Proofs for file C:\Escher\Customers\prang-cpp\prang.cpp

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Escher Verification Studio file versions

EscherTool 7.00
ecv 7.00.00.00
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Proved 65 of 72 verification conditions.

Proof of verification condition: Precondition of 'div' satisfied

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (60,18)

Condition defined at: C:\Escher\ecv\standard\stdlib.h (94,10)

To prove: $0 <$ **asType$<$integer$>$(static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))**

Given:

$\$$heap$_{init}$.LIMIT == (**int**)80

$\$$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

Proof:

[Take goal term]

[1.0] $0 <$ **asType$<$integer$>$(static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))**

$\rightarrow$ *[const static or extern object]*

[1.1] $0 < \textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{init}.\text{a1}))$

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[1.2] $0 < \textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}((\textbf{int})177))$

$\rightarrow$ *[simplify]*

[1.6] **true**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(61,48)

To prove: $(\textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}) \leq$
$\textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs }\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) =>$
$!(0 == \textbf{asType}\textbf{<integer>}(\text{div1.quot}))$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

$\text{div1} == \text{div}(\textbf{heapIs }\$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs }\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}),$
$\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))$

$(\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) \ /$
$\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) ==$

asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$\text{heap}_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] (**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a1) ≤
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

→ *[const static or extern object]*

[1.1] (**asType<integer>**($\$\text{heap}_{init}$.a1) ≤
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[1.2] (**asType**<**integer**>((**int**)177) $\leq$ **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) => !(0 == **asType**<**integer**>(div1.quot))

$\rightarrow$ *[simplify]*

[1.4] (177 $\leq$ **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) => !(0 == **asType**<**integer**>(div1.quot))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.5] (177 $\leq$ **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) => !(0 == **asType**<**integer**>(div1.quot))

$\rightarrow$ *[simplify]*

[1.8] (176 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) => !(0 == **asType**<**integer**>(div1.quot))

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[1.9] (176 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) => !(0 == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))

$\rightarrow$ *[simplify]*

[1.13] !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) $\lor$ (-177 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[negate goal and search for contradiction]*

[1.14] (0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) $\land$!(-177 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[simplify]*

[1.17] (0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) $\land$ (176 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[separate conjunction and work on first sub-term]*

[1.18] 0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(**(int)**30269))

$\rightarrow$ *[simplify]*

[7.10] $(-30269 < -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) $\wedge$ $(0 <$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[9.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) /
asType<**integer**>(177)) == **asType**<**integer**>(div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot)

$\rightarrow$ *[simplify]*

[9.2] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 / 177) ==
asType<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[9.3] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) <
0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) /
177), []: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) /
177) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[9.4] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) <
0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) /
177), [!(**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) <
0)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) /
177) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.7] ([0 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1]:
−(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
177) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[from term 8.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[9.7.0]* -2 < (0 + 0)
>
> $\rightarrow$ *[simplify]*
>
> *[9.7.2]* **true**

[9.8] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot)

$\rightarrow$ *[simplify]*

[9.11] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(0 < −**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot)

$\rightarrow$ *[from term 8.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[9.11.0]* -2 < (0 + 0)
>
> $\rightarrow$ *[simplify]*
>
> *[9.11.2]* **true**

[9.12] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!**false**]:
asType<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / 177)
== **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[9.17] $0 == (-\text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot} + (\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p1} / 177))$

→ *[from term 1.18, div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot is equal to 0]*

[9.18] $0 == (-0 + (\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1} / 177))$

→ *[simplify]*

[9.20] $0 == (\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1} / 177)$

[Work on sub-term 2 of conjunction in term 1.17]

[16.0] $176 < \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}$

[Create new term from term 9.20 using rule: condition for equality of division]

[17.0] $((0 * 177) < (1 + \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1})) \wedge$ $(\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1} < (177 * (0 + 1)))$

→ *[simplify]*

[17.3] $(-1 < \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}) \wedge$ $(\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1} < (177 * (0 + 1)))$

→ *[from term 16.0, literala < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is true whenever (-1 + literala) < 176]*

Proof of rule precondition:

[17.3.0] $(-1 + -1) < 176$

→ *[simplify]*

[17.3.2] **true**

[17.4] $\textbf{true} \wedge (\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1} < (177 * (0 + 1)))$

→ *[simplify]*

[17.9] $\textbf{true} \wedge (-177 < -\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1})$

→ *[from term 16.0, literala < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (176 + literala)]*

Proof of rule precondition:

[17.9.0] $-2 < (-177 + 176)$

→ *[simplify]*

[17.9.2] **true**

[17.10] $\textbf{true} \wedge \textbf{false}$

→ *[simplify]*

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[17.11] **false**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (61,20)

To prove: $(\textbf{asType<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < \textbf{asType<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1})) => (\textbf{asType<integer>}(\text{div1.rem}) == \textbf{asType<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}))$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

$\text{div1} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{static\_cast<int>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}), \textbf{static\_cast<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))$

$(\textbf{asType<integer>}(\textbf{static\_cast<int>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) / \textbf{asType<integer>}(\textbf{static\_cast<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) == \textbf{asType<integer>}(\text{div1.quot})$

$(\textbf{asType<integer>}(\textbf{static\_cast<int>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) \% \textbf{asType<integer>}(\textbf{static\_cast<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) == \textbf{asType<integer>}(\text{div1.rem})$

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] (**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)
< **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.1] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

→ *[simplify]*

[1.2] (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

→ *[const static or extern object]*

[1.3] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>(heap_{init}.a1)) => (**asType**<**integer**>(div1.rem) ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[1.4] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)177)) => (**asType**<**integer**>(div1.rem) ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1))

→ *[simplify]*

[1.9] (-177 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.$r.**value**($heap_{funcstart_1032,1}$).p1, 177)]*

[1.10] (-177 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) =>
(**asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1))

→ *[simplify]*

[1.11] (-177 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.12] (-177 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem ==
asType<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1))

→ *[simplify]*

[1.18] (0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).rem)) ∨ (176 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

→ *[negate goal and search for contradiction]*

[1.19] !(0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).rem)) ∧ !(176 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

→ *[simplify]*

[1.21] !(0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).rem)) ∧ (-177 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

→ *[separate conjunction and work on first sub-term]*

[1.22] -177 $<$ $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] $(0 <$ **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $<$ **asType**$<$**integer**$>$($heap.**class** WHPrang $\in$ M1))

→ *[simplify]*

[7.2] $(0 <$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 $<$ **asType**$<$**integer**$>$($heap.**class** WHPrang $\in$ M1))

→ *[const static or extern object]*

[7.3] $(0 <$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 $<$ **asType**$<$**integer**$>$(heap_{init}.**class** WHPrang $\in$ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 $<$ **asType**$<$**integer**$>$((**int**)30269))

→ *[simplify]*

[7.10] (-30269 $<$ $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 $<$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 $<$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[10.0] (**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) % **asType**$<$**integer**$>$(177)) == **asType**$<$**integer**$>$(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

→ *[simplify]*

[10.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 % 177) == **asType**$<$**integer**$>$(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

→ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[10.3] ([**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $<$ 0]: $-$($-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) % 177), []: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) % 177) == **asType**$<$**integer**$>$(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[10.4] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <
0]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) %
177), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) %
177) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

→ *[simplify]*

[10.7] ([0 < −**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1]:
−(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) %
177), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) %
177) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

→ *[from term 8.0, literala < −**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[10.7.0] -2 < (0 + 0)

→ *[simplify]*

[10.7.2] **true**

[10.8] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) % 177), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).rem)

→ *[simplify]*

[10.11] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) % 177), [!(0 < −**this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).rem)

→ *[from term 8.0, literala < −**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[10.11.0] -2 < (0 + 0)

→ *[simplify]*

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[10.11.2] **true**

[10.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) % 177), [!**false**]:
asType<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) % 177)
== **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.17] $0 == (-$div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem + (**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1 % 177))

[Work on sub-term 2 of conjunction in term 1.21]

[15.0] !(0 == ($-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).rem))

[Copy term 15.0]

[16.0] !(0 == ($-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).rem))

$\rightarrow$ *[from term 10.17, div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem is equal to **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1 % 177]*

[16.1] !(0 == ($-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 +
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 % 177)))

$\rightarrow$ *[remainder with larger divisor]*

Proof of rule precondition 1:

[16.1.0.0] literald $< -$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

$\rightarrow$ *[unify with term 1.22]*

[16.1.0.1] **true**

Proof of rule precondition 2:

[16.1.1.0] literalc $<$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

$\rightarrow$ *[unify with term 8.0]*

[16.1.1.1] **true**

Proof of rule precondition 3:

[16.1.2.0] $-$-177 $\leq$ 177

$\rightarrow$ *[simplify]*

[16.1.2.2] **true**

Proof of rule precondition 4:

[16.1.3.0] -2 < 0

$\rightarrow$ *[simplify]*

[16.1.3.1] **true**

[16.2] !(0 == ($-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 + **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1))

$\rightarrow$ *[simplify]*

[16.5] **false**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (62,26)

To prove: !(0 == **asType**<**integer**>(div1.rem)) || !(0 == **asType**<**integer**>(div1.quot))

Given:

\$heap$_{init}$.LIMIT == (**int**)80

\$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

\$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

\$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

\$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

\$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

\$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

\$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

\$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

\$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

\$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

\$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

\$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1)) /

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**asType<integer>(static_cast<int>($heap$_{funcstart_1032,1}$.a1))) ==
asType<integer>(div1.quot)**

**(asType<integer>(static_cast<int>(operator*(heapIs
$heap$_{funcstart_1032,1}$, this).p1)) %
asType<integer>(static_cast<int>($heap$_{funcstart_1032,1}$.a1))) ==
asType<integer>(div1.rem)**

**(asType<integer>(operator*(heapIs $heap$_{funcstart_1032,1}$, this).p1) <
asType<integer>($heap$_{funcstart_1032,1}$.a1)) =>
(asType<integer>(div1.rem) == asType<integer>(operator*(heapIs
$heap$_{funcstart_1032,1}$, this).p1))**

**(asType<integer>($heap$_{funcstart_1032,1}$.a1) ≤
asType<integer>(operator*(heapIs $heap$_{funcstart_1032,1}$, this).p1)) =>
!(0 == asType<integer>(div1.quot))**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))**

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast<int>($heap$_{funcstart\_1032,1}$.a1))**

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast<int>($heap$_{init}$.a1))**

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast<int>((int)177))**

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, 177)**

[Take goal term]

[1.0] !(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$,*

this.$r.value(*heapIs $heap$*$_{funcstart\_1032,1}$*).p1, 177)]*

[1.1] !(0 == **asType<integer>**(div(**heapIs** $heap$$_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem)) || !(0 ==
asType<integer>(div1.quot))

→ *[simplify]*

[1.2] !(0 == div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap$$_{funcstart_1032,1}$).p1, 177).rem) || !(0 == **asType<integer>**(div1.quot))

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$$_{funcstart_1032,1}$,*
this.$r.value(*heapIs $heap$*$_{funcstart\_1032,1}$*).p1, 177)]*

[1.3] !(0 == div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap$$_{funcstart_1032,1}$).p1, 177).rem) || !(0 == **asType<integer>**(div(**heapIs**
$heap$$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap$$_{funcstart_1032,1}$).p1,
177).quot))

→ *[simplify]*

[1.5] !(0 == div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap$$_{funcstart_1032,1}$).p1, 177).quot) ∨ !(0 == div(**heapIs**
$heap$$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap$$_{funcstart_1032,1}$).p1,
177).rem)

→ *[negate goal and search for contradiction]*

[1.6] (0 == div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap$$_{funcstart_1032,1}$).p1, 177).quot) ∧ (0 == div(**heapIs** $heap$$_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem)

→ *[separate conjunction and work on first sub-term]*

[1.7] 0 == div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap$$_{funcstart_1032,1}$).p1, 177).quot

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this.$r.value**(**heapIs**
$heap$$_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this.$r.value**(**heapIs**
$heap$$_{funcstart_1032,1}$).p1) < **asType<integer>**($heap.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this.$r.value**(**heapIs** $heap$$_{funcstart\_1032,1}$).p1) &&
(**this.$r.value**(**heapIs** $heap$$_{funcstart_1032,1}$).p1 <
asType<integer>($heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this.$r.value**(**heapIs** $heap$$_{funcstart\_1032,1}$).p1) &&
(**this.$r.value**(**heapIs** $heap$$_{funcstart_1032,1}$).p1 <
asType<integer>($heap$_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) ∧ (0 <
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1

[Work on sub-term 2 of conjunction in term 1.6]

[17.0] 0 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem

[Take given term]

[15.0] (**asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1)
< **asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[15.1] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) <
asType<**integer**>(\$heap$_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p1))

→ *[simplify]*

[15.2] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap$_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p1))

→ *[const static or extern object]*

[15.3] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap$_{init}$.a1)) => (**asType**<**integer**>(div1.rem) ==
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[15.4] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)177)) => (**asType**<**integer**>(div1.rem) ==
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1))

→ *[simplify]*

[15.9] (-177 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[15.10] (-177 $<$ $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) =>
(**asType**$<$**integer**$>$(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) ==
asType$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1))

$\rightarrow$ *[simplify]*

[15.11] (-177 $<$ $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem ==
asType$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[15.12] (-177 $<$ $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem ==
asType$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1))

$\rightarrow$ *[simplify]*

[15.18] (0 == ($-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).rem)) $\vee$ (176 $<$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[from term 17.0, div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem is equal to 0]*

[15.19] (0 == ($-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 + 0)) $\vee$ (176
$<$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[simplify]*

[15.20] (0 == $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $\vee$ (176 $<$
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[from term 8.0, $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 ==
literala is false whenever -1 $<$ (0 + literala)]*

Proof of rule precondition:

[15.20.0] -1 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[15.20.2] **true**

[15.21] **false** $\vee$ (176 $<$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[simplify]*

[15.22] 176 $<$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Take given term]

[16.0] (**asType\<integer\>**($\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType\<integer\>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

$\rightarrow$ *[const static or extern object]*

[16.1] (**asType\<integer\>**(heap_{init}.a1) $\leq$
asType\<integer\>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[16.2] (**asType\<integer\>**((**int**)177) $\leq$
asType\<integer\>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

$\rightarrow$ *[simplify]*

[16.4] (177 $\leq$ **asType\<integer\>**(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this).p1)) => !(0 == **asType\<integer\>**(div1.quot))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[16.5] (177 $\leq$ **asType\<integer\>**(**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)) => !(0 == **asType\<integer\>**(div1.quot))

$\rightarrow$ *[simplify]*

[16.8] (176 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) => !(0 ==
asType\<integer\>(div1.quot))

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[16.9] (176 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) => !(0 ==
asType\<integer\>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot))

$\rightarrow$ *[simplify]*

[16.13] !(0 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) $\vee$ (-177 < $-$**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)

$\rightarrow$ *[from term 15.22, literala < $-$**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1 is false whenever -2 < (176 + literala)]*

Proof of rule precondition:

[16.13.0] -2 < (-177 + 176)

$\rightarrow$ *[simplify]*

[16.13.2] **true**

[16.14] **false** $\vee$!(0 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[from term 1.7, div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot is equal to 0]*

[16.15] **false** $\lor$!(0 == 0)

$\rightarrow$ *[simplify]*

[16.18] **false**

Proof of verification condition: Precondition of 'div' satisfied

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (64,18)

Condition defined at: C:\Escher\ecv\standard\stdlib.h (94,10)

To prove: $0 <$
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==

asType\<integer\>(div1.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType\<integer\>(div1.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType\<integer\>**(div1.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType\<integer\>**($\$\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

!(0 == **asType\<integer\>**(div1.rem)) || !(0 ==
asType\<integer\>(div1.quot))

Proof:

[Take goal term]

[1.0] 0 < **asType\<integer\>**(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[1.1] 0 < **asType\<integer\>**(**static_cast\<int\>**($\$\text{heap}_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[1.2] 0 < **asType\<integer\>**(**static_cast\<int\>**((**int**)176))

$\rightarrow$ *[simplify]*

[1.6] **true**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(65,48)

To prove: (**asType\<integer\>**($\$\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType\<integer\>**(div2.quot))

Given:

$\$\text{heap}_{init}$.LIMIT == (**int**)80

$\$\text{heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$\text{heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ a1 == (**int**)177

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ b1 == (**int**)2

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ M2 == (**int**)30307

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ r2 == (**int**)172

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ a2 == (**int**)176

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ b2 == (**int**)35

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ M3 == (**int**)30323

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ r3 == (**int**)170

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ a3 == (**int**)178

$\$\mathrm{heap}_{init}.$**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$\mathrm{heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$\mathrm{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$\mathrm{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$\mathrm{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$\mathrm{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$\mathrm{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$\mathrm{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

Proof:

[Take given term]

[18.0] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(heap_{init}.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Take goal term]

[1.0] (**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

$\rightarrow$ *[const static or extern object]*

[1.1] (**asType**<**integer**>(heap_{init}.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[1.2] (**asType**<**integer**>((**int**)176) ≤ **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) => !(0 == **asType**<**integer**>(div2.quot))

→ *[simplify]*

[1.4] (176 ≤ **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) => !(0 == **asType**<**integer**>(div2.quot))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.5] (176 ≤ **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)) => !(0 == **asType**<**integer**>(div2.quot))

→ *[simplify]*

[1.8] (175 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) => !(0 == **asType**<**integer**>(div2.quot))

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[1.9] (175 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) => !(0 == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))

→ *[simplify]*

[1.13] !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) ∨ (-176 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

→ *[negate goal and search for contradiction]*

[1.14] (0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) ∧ !(-176 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

→ *[simplify]*

[1.17] (0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) ∧ (175 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

→ *[separate conjunction and work on first sub-term]*

[1.18] 0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($heap.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 $< -$**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[25.0] (**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) /
asType<**integer**>(176)) == **asType**<**integer**>(div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot)

$\rightarrow$ *[simplify]*

[25.2] (**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 / 176) ==
asType<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[25.3] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) /
176), []: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) /
176) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[25.4] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) /
176), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) /
176) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.7] ([$0 < -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2]: $-(-$**asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(**asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $<$ 0)]: **asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>$(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala $< -$**this**.\$r.**value**(\$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.7.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[25.7.2] **true**

[25.8] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(**asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $<$ 0)]: **asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>$(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.11] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(0 $< -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)]: **asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>$(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala $< -$**this**.\$r.**value**(\$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.11.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[25.11.2] **true**

[25.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!**false**]: **asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>$(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.17] $0 == (-\text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{quot} + (\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}\ /\ 176))$

$\rightarrow$ *[from term 1.18, div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot is equal to 0]*

[25.18] $0 == (-0 + (\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2}\ /\ 176))$

$\rightarrow$ *[simplify]*

[25.20] $0 == (\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2}\ /\ 176)$

[Work on sub-term 2 of conjunction in term 1.17]

[32.0] $175 < \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2}$

[Create new term from term 25.20 using rule: condition for equality of division]

[36.0] $((0\ \text{*}\ 176) < (1 + \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2})) \wedge$ $(\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2} < (176\ \text{*}\ (0 + 1)))$

$\rightarrow$ *[simplify]*

[36.3] $(\text{-}1 < \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2}) \wedge$ $(\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2} < (176\ \text{*}\ (0 + 1)))$

$\rightarrow$ *[from term 32.0, literala < **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 is true whenever (-1 + literala) < 175]*

Proof of rule precondition:

[36.3.0] $(\text{-}1 + \text{-}1) < 175$

$\rightarrow$ *[simplify]*

[36.3.2] **true**

[36.4] $\textbf{true} \wedge (\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2} < (176\ \text{*}\ (0 + 1)))$

$\rightarrow$ *[simplify]*

[36.9] $\textbf{true} \wedge (\text{-}176 < -\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2})$

$\rightarrow$ *[from term 32.0, literala < −**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (175 + literala)]*

Proof of rule precondition:

[36.9.0] $\text{-}2 < (\text{-}176 + 175)$

$\rightarrow$ *[simplify]*

[36.9.2] **true**

[36.10] $\textbf{true} \wedge \textbf{false}$

$\rightarrow$ *[simplify]*

[36.11] **false**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(65,20)

To prove: $(\textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{this}).\text{p2}) < \textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}\textbf{<integer>}(\text{div2.rem}) == \textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}))$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

$\text{div1} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}),$
$\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))$

$(\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) /$
$\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) ==$
$\textbf{asType}\textbf{<integer>}(\text{div1.quot})$

$(\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) \%$
$\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) ==$
$\textbf{asType}\textbf{<integer>}(\text{div1.rem})$

$(\textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) <$
$\textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1})) =>$
$(\textbf{asType}\textbf{<integer>}(\text{div1.rem}) == \textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs}$

$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($heap_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

Proof:

[Take given term]

[18.0] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2),
static_cast<**int**>($heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($heap_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176)

[Take goal term]

[1.0] (**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)
< **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.1] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[simplify]*

[1.2] (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[const static or extern object]*

[1.3] (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap_{init}$.a2)) => (**asType**<**integer**>(div2.rem) ==
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[1.4] (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)176)) => (**asType**<**integer**>(div2.rem) ==
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[simplify]*

[1.9] (-176 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[1.10] (-176 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) =>
(**asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) ==
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[simplify]*

[1.11] (-176 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) =>
(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem ==
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.12] (-176 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) => (div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem == **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2))

→ *[simplify]*

[1.18] (0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 + div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) ∨ (175 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

→ *[negate goal and search for contradiction]*

[1.19] !(0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 + div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) ∧ !(175 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

→ *[simplify]*

[1.21] !(0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 + div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) ∧ (-176 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

→ *[separate conjunction and work on first sub-term]*

[1.22] -176 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($heap.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($heap.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(heap_{init}.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) ∧ (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[26.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) % **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.2] (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 % 176) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[26.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) $<$ 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) % 176), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[26.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) $<$ 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) $<$ 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.7] ([$0 < -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) $<$ 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[from term 24.0, literala $< -$**this**.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 is false whenever -2 $< (0 + literala)]*

Proof of rule precondition:

[26.7.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[26.7.2] **true**

[26.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).rem)

$\rightarrow$ *[simplify]*

[26.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2) % 176), [!(0 < $-$**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).rem)

$\rightarrow$ *[from term 24.0, literala < $-$**this**.$r.**value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p2*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[26.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[26.11.2] **true**

[26.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2) % 176), [!**false**]:
asType<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) % 176)
== **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.17] 0 == ($-$div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem + (**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2 % 176))

[Work on sub-term 2 of conjunction in term 1.21]

[31.0] !(0 == ($-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 + div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).rem))

[Copy term 31.0]

[35.0] !(0 == ($-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 + div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).rem))

$\rightarrow$ *[from term 26.17, div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem is equal to **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2 % 176]*

[35.1] !(0 == ($-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 +

($\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2 } \% \text{ 176})))$

$\rightarrow$ *[remainder with larger divisor]*

Proof of rule precondition 1:

[35.1.0.0] $\text{literald} < -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}$

$\rightarrow$ *[unify with term 1.22]*

[35.1.0.1] **true**

Proof of rule precondition 2:

[35.1.1.0] $\text{literalc} < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}$

$\rightarrow$ *[unify with term 24.0]*

[35.1.1.1] **true**

Proof of rule precondition 3:

[35.1.2.0] $--176 \leq 176$

$\rightarrow$ *[simplify]*

[35.1.2.2] **true**

Proof of rule precondition 4:

[35.1.3.0] -2 < 0

$\rightarrow$ *[simplify]*

[35.1.3.1] **true**

[35.2] $!(0 == (-\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2} +$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}))$

$\rightarrow$ *[simplify]*

[35.5] **false**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(66,26)

To prove: $!(0 == \textbf{asType}<\textbf{integer}>(\text{div2.rem})) \text{ } || \text{ } !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.quot}))$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class } \text{WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class } \text{WHPrang} \in \text{r1} == (\textbf{int})171$

$\$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$heap_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$heap_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

Proof:

[Take given term]

[18.0] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(heap_{init}.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Take goal term]

[1.0] !(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]*

[1.1] !(0 == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) || !(0 ==

asType<**integer**>(div2.quot))

→ *[simplify]*

[1.2] !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) || !(0 == **asType**<**integer**>(div2.quot))

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[1.3] !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) || !(0 == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))

→ *[simplify]*

[1.5] !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) ∨ !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[negate goal and search for contradiction]*

[1.6] (0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) ∧ (0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[separate conjunction and work on first sub-term]*

[1.7] 0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <

asType<integer>((int)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) ∧ (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Work on sub-term 2 of conjunction in term 1.6]

[33.0] 0 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem

[Take given term]

[31.0] (**asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2) < **asType<integer>**(\$heap$_{funcstart\_1032,1}$.a2)) => (**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[31.1] (**asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) < **asType<integer>**(\$heap$_{funcstart\_1032,1}$.a2)) => (**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[simplify]*

[31.2] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType<integer>**(\$heap$_{funcstart\_1032,1}$.a2)) => (**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[const static or extern object]*

[31.3] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType<integer>**(\$heap$_{init}$.a2)) => (**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[31.4] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType<integer>**((int)176)) => (**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[simplify]*

[31.9] (-176 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) => (**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[from term 18.6, div2 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176)]*

[31.10] (-176 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) =>
(**asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem) ==
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[simplify]*

[31.11] (-176 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) =>
(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem ==
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[31.12] (-176 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) =>
(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem ==
asType<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2))

→ *[simplify]*

[31.18] (0 == (−**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 + div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,
176).rem)) ∨ (175 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

→ *[from term 33.0, div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem is equal to 0]*

[31.19] (0 == (−**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 + 0)) ∨ (175
< **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

→ *[simplify]*

[31.20] (0 == −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) ∨ (175 <
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

→ *[from term 24.0, −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 ==
literala is false whenever -1 < (0 + literala)]*

Proof of rule precondition:

[31.20.0] -1 < (0 + 0)

→ *[simplify]*

[31.20.2] **true**

[31.21] **false** ∨ (175 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

→ *[simplify]*

[31.22] 175 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Take given term]

[32.0] (**asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2)) =>

!(0 == **asType**<**integer**>(div2.quot))

→ *[const static or extern object]*

[32.1] (**asType**<**integer**>($heap$_{init}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[32.2] (**asType**<**integer**>((**int**)176) ≤
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

→ *[simplify]*

[32.4] (176 ≤ **asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$,
this).p2)) => !(0 == **asType**<**integer**>(div2.quot))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[32.5] (176 ≤ **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2)) => !(0 == **asType**<**integer**>(div2.quot))

→ *[simplify]*

[32.8] (175 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) => !(0 ==
asType<**integer**>(div2.quot))

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176)]*

[32.9] (175 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) => !(0 ==
asType<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).quot))

→ *[simplify]*

[32.13] !(0 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).quot) ∨ (-176 < −**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2)

→ *[from term 31.22, literala < −**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2 is false whenever -2 < (175 + literala)]*

> **Proof of rule precondition:**
>
> *[32.13.0]* -2 < (-176 + 175)
>
> → *[simplify]*
>
> *[32.13.2]* **true**

[32.14] **false** ∨ !(0 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).quot)

→ *[from term 1.7, div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).quot is equal to 0]*

[32.15] **false** $\vee$!(0 == 0)

$\rightarrow$ *[simplify]*

[32.18] **false**

Proof of verification condition: Precondition of 'div' satisfied

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(68,18)

Condition defined at: C:\Escher\ecv\standard\stdlib.h (94,10)

To prove: $0 <$
asType$<$integer$>$(static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a3))

Given:

$\$$heap$_{init}$.LIMIT == (**int**)80

$\$$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
static_cast$<$int$>$(operator*(heapIs $\$$heap$_{funcstart\_1032,1}$, **this**).p1),
static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))

(**asType$<$integer$>$(static_cast$<$int$>$(operator*(heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1)) /
asType$<$integer$>$(static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))) ==
asType$<$integer$>$(div1.quot)

(**asType$<$integer$>$(static_cast$<$int$>$(operator*(heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1)) %
asType$<$integer$>$(static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))) ==

asType<integer>(div1.rem)

(asType<integer>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a1)) =>
(asType<integer>(div1.rem) == **asType<integer>(operator*(heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(asType<integer>($\$heap_{funcstart\_1032,1}$.a1) ≤
asType<integer>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a2))

(asType<integer>(static_cast<int>(operator*(heapIs
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(static_cast<int>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(asType<integer>(static_cast<int>(operator*(heapIs
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(static_cast<int>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(asType<integer>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a2)) =>
(asType<integer>(div2.rem) == **asType<integer>(operator*(heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(asType<integer>($\$heap_{funcstart\_1032,1}$.a2) ≤
asType<integer>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

Proof:

[Take goal term]

[1.0] 0 < **asType<integer>(static_cast<int>**($\$heap_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[1.1] 0 < **asType<integer>(static_cast<int>**($\$heap_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[1.2] 0 < **asType<integer>(static_cast<int>**((**int**)178))

→ *[simplify]*

[1.6] **true**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(69,48)

To prove: $(\textbf{asType}\langle\textbf{integer}\rangle(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$
$\textbf{asType}\langle\textbf{integer}\rangle(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) =>$
$!(0 == \textbf{asType}\langle\textbf{integer}\rangle(\text{div3.quot}))$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

$\text{div1} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\langle\textbf{int}\rangle(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}),$
$\textbf{static\_cast}\langle\textbf{int}\rangle(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))$

$(\textbf{asType}\langle\textbf{integer}\rangle(\textbf{static\_cast}\langle\textbf{int}\rangle(\textbf{operator*}(\textbf{heapIs }$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) /$
$\textbf{asType}\langle\textbf{integer}\rangle(\textbf{static\_cast}\langle\textbf{int}\rangle(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) ==$
$\textbf{asType}\langle\textbf{integer}\rangle(\text{div1.quot})$

$(\textbf{asType}\langle\textbf{integer}\rangle(\textbf{static\_cast}\langle\textbf{int}\rangle(\textbf{operator*}(\textbf{heapIs }$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) \%$
$\textbf{asType}\langle\textbf{integer}\rangle(\textbf{static\_cast}\langle\textbf{int}\rangle(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) ==$
$\textbf{asType}\langle\textbf{integer}\rangle(\text{div1.rem})$

$(\textbf{asType}\langle\textbf{integer}\rangle(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) <$

asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a3)) =>

(**asType<integer>**(div3.rem) == **asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

Proof:

[Take given term]

[34.0] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$\text{heap}_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, 178)

[Take goal term]

[1.0] (**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a3) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

$\rightarrow$ *[const static or extern object]*

[1.1] (**asType<integer>**($\$\text{heap}_{init}$.a3) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[1.2] (**asType<integer>**((**int**)178) $\leq$ **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType<integer>**(div3.quot))

$\rightarrow$ *[simplify]*

[1.4] (178 $\leq$ **asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this).p3)) => !(0 == **asType<integer>**(div3.quot))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.5] $(178 \leq$ **asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)) $=>$!$(0 ==$ **asType**$<$**integer**$>$(div3.quot))

$\rightarrow$ *[simplify]*

[1.8] $(177 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) $=>$!$(0 ==$ **asType**$<$**integer**$>$(div3.quot))

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178)]*

[1.9] $(177 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) $=>$!$(0 ==$ **asType**$<$**integer**$>$(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot))

$\rightarrow$ *[simplify]*

[1.13] !$(0 ==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) $\vee$ (-178 $< -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

$\rightarrow$ *[negate goal and search for contradiction]*

[1.14] $(0 ==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) $\wedge$!(-178 $< -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

$\rightarrow$ *[simplify]*

[1.17] $(0 ==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) $\wedge$ $(177 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

$\rightarrow$ *[separate conjunction and work on first sub-term]*

[1.18] $0 ==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] $(0 <$ **asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)) && (**asType**$<$**integer**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) $<$ **asType**$<$**integer**$>$(\$heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[simplify]*

[39.2] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 $<$ **asType**$<$**integer**$>$(\$heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 $<$

asType<integer>($heap$_{init}$.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) &&
(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 <
asType<integer>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) ∧ (0 <
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[41.0] (**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) /
asType<integer>(178)) == **asType<integer>**(div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3,
178).quot)

→ *[simplify]*

[41.2] (**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 / 178) ==
asType<integer>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, 178).quot)

→ *[expand definition of operator './' in class 'int' at built in declaration]*

[41.3] ([**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) <
0]: −(−**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) /
178), []: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) /
178) == **asType<integer>**(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[41.4] ([**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) <
0]: −(−**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) /
178), [!(**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) <
0)]: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) /
178) == **asType<integer>**(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot)

→ *[simplify]*

[41.7] ([0 < −**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3]:
−(−**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) /
178), [!(**asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) <
0)]: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) /
178) == **asType<integer>**(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot)

→ *[from term 40.0, literala < −***this.***$r.***value***(***heapIs** $\$heap_{funcstart\_1032,1}$)*.p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.7.0] -2 < (0 + 0)

→ *[simplify]*

[41.7.2] **true**

[41.8] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

→ *[simplify]*

[41.11] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178), [!(0 < −**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

→ *[from term 40.0, literala < −***this.***$r.***value***(***heapIs** $\$heap_{funcstart\_1032,1}$)*.p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.11.0] -2 < (0 + 0)

→ *[simplify]*

[41.11.2] **true**

[41.12] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178), [!**false**]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

→ *[simplify]*

[41.17] 0 == (−div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot + (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 / 178))

→ *[from term 1.18, div(***heapIs** $\$heap_{funcstart\_1032,1}$*, ***this.***$r.***value***(***heapIs** $\$heap_{funcstart\_1032,1}$)*.p3, 178).quot is equal to 0]*

[41.18] 0 == (−0 + (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 / 178))

→ *[simplify]*

[41.20] 0 == (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 / 178)

[Work on sub-term 2 of conjunction in term 1.17]

[48.0] 177 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3

[Create new term from term 41.20 using rule: condition for equality of division]

[55.0] ((0 * 178) < (1 + **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)) ∧ (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < (178 * (0 + 1)))

→ *[simplify]*

[55.3] (-1 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) ∧ (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < (178 * (0 + 1)))

→ *[from term 48.0, literala < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 is true whenever (-1 + literala) < 177]*

Proof of rule precondition:

[55.3.0] (-1 + -1) < 177

→ *[simplify]*

[55.3.2] **true**

[55.4] **true** ∧ (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < (178 * (0 + 1)))

→ *[simplify]*

[55.9] **true** ∧ (-178 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)

→ *[from term 48.0, literala < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (177 + literala)]*

Proof of rule precondition:

[55.9.0] -2 < (-178 + 177)

→ *[simplify]*

[55.9.2] **true**

[55.10] **true** ∧ **false**

→ *[simplify]*

[55.11] **false**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (69,20)

To prove: (**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$,

this).p3) $<$ **asType**$<$**integer**$>$($\$$heap$_{funcstart\_1032,1}$.a3)) =>
(**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p3))

Given:

$\$$heap$_{init}$.LIMIT == (**int**)80

$\$$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**).p1),
static_cast$<$**int**$>$($\$$heap$_{funcstart\_1032,1}$.a1))

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1)) /
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\$$heap$_{funcstart\_1032,1}$.a1))) ==
asType$<$**integer**$>$(div1.quot)

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1)) %
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\$$heap$_{funcstart\_1032,1}$.a1))) ==
asType$<$**integer**$>$(div1.rem)

(**asType**$<$**integer**$>$(**operator***(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**).p1) $<$
asType$<$**integer**$>$($\$$heap$_{funcstart\_1032,1}$.a1)) =>
(**asType**$<$**integer**$>$(div1.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1))

(**asType**$<$**integer**$>$($\$$heap$_{funcstart\_1032,1}$.a1) $\leq$
asType$<$**integer**$>$(**operator***(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**$<$**integer**$>$(div1.quot))

!(0 == **asType**$<$**integer**$>$(div1.rem)) || !(0 ==
asType$<$**integer**$>$(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\$heap_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

Proof:

[Take given term]

[34.0] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178)

[Take goal term]

[1.0] (**asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.1] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) < **asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[simplify]*

[1.2] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 < **asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[const static or extern object]*

[1.3] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 < **asType**<**integer**>(\$heap$_{init}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[1.4] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 < **asType**<**integer**>((**int**)178)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[simplify]*

[1.9] (-178 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

→ *[from term 34.6, div3 is equal to div(***heapIs** $heap_{funcstart\_1032,1}$,* **this**.$r.**value**(***heapIs** $heap_{funcstart\_1032,1}$*).p3, 178)]*

[1.10] (-178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) =>
(**asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

→ *[simplify]*

[1.11] (-178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.12] (-178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem ==
asType<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3))

→ *[simplify]*

[1.18] (0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem)) ∨ (177 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

→ *[negate goal and search for contradiction]*

[1.19] !(0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem)) ∧ !(177 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

→ *[simplify]*

[1.21] !(0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem)) ∧ (-178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

→ *[separate conjunction and work on first sub-term]*

[1.22] -178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($heap.**class** WHPrang ∈
M3))

→ *[simplify]*

[39.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&

(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>($heap.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>(heap_{init}.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) ∧ (0 <
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[42.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) %
asType<**integer**>(178)) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem)

→ *[simplify]*

[42.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 % 178) ==
asType<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

→ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[42.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <
0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) %
178), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)
% 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[42.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <
0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) %
178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) %
178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

→ *[simplify]*

[42.7] ([0 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3]:
−(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) %
178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) %
178) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).rem)

→ *[from term 40.0, literala < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[42.7.0] -2 < (0 + 0)

→ *[simplify]*

[42.7.2] **true**

[42.8] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) % 178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3,
178).rem)

→ *[simplify]*

[42.11] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) % 178), [!(0 < −**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3,
178).rem)

→ *[from term 40.0, literala < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[42.11.0] -2 < (0 + 0)

→ *[simplify]*

[42.11.2] **true**

[42.12] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) % 178), [!**false**]:
asType<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) % 178)
== **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).rem)

→ *[simplify]*

[42.17] 0 == (−div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, 178).rem + (**this**.$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p3 % 178))

[Work on sub-term 2 of conjunction in term 1.21]

[47.0] !(0 == (−**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 + div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))

[Copy term 47.0]

[54.0] !(0 == (−**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 + div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))

→ *[from term 42.17, div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem is equal to **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 % 178]*

[54.1] !(0 == (−**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 + (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 % 178)))

→ *[remainder with larger divisor]*

Proof of rule precondition 1:

[54.1.0.0] literald < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

→ *[unify with term 1.22]*

[54.1.0.1] **true**

Proof of rule precondition 2:

[54.1.1.0] literalc < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

→ *[unify with term 40.0]*

[54.1.1.1] **true**

Proof of rule precondition 3:

[54.1.2.0] −-178 ≤ 178

→ *[simplify]*

[54.1.2.2] **true**

Proof of rule precondition 4:

[54.1.3.0] -2 < 0

→ *[simplify]*

[54.1.3.1] **true**

[54.2] !(0 == (−**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 + **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3))

→ *[simplify]*

[54.5] **false**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(70,26)

To prove: !(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

Given:

$heap_{init}$.LIMIT == (**int**)80

$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$heap_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$heap_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($heap_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p1))

$(\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}) \leq$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) =>$
$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div1.quot}))$

$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div1.rem})) \mathbin{||} !(0 ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div1.quot}))$

$\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \mathbin{/}$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div2.quot})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \mathbin{\%}$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div2.rem})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}) <$
$\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}{<}\textbf{integer}{>}(\text{div2.rem}) == \textbf{asType}{<}\textbf{integer}{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div2.quot}))$

$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div2.rem})) \mathbin{||} !(0 ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \mathbin{/}$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div3.quot})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \mathbin{\%}$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div3.rem})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}) <$
$\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) =>$
$(\textbf{asType}{<}\textbf{integer}{>}(\text{div3.rem}) == \textbf{asType}{<}\textbf{integer}{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$

asType<integer>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this).p3)) =>
!(0 == asType<integer>**(div3.quot))

Proof:

[Take given term]

[34.0] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator*(heapIs** $\$heap_{funcstart\_1032,1}$, **this).p3),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$heap_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast<int>**(**(int)**178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178)

[Take goal term]

[1.0] !(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[1.1] !(0 == **asType<integer>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) || !(0 ==
asType<integer>(div3.quot))

$\rightarrow$ *[simplify]*

[1.2] !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem) || !(0 == **asType<integer>**(div3.quot))

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[1.3] !(0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p3, 178).rem) || !(0 == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot))

$\rightarrow$ *[simplify]*

[1.5] !(0 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) $\vee$!(0 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[negate goal and search for contradiction]*

[1.6] (0 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) $\wedge$ (0 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[separate conjunction and work on first sub-term]*

[1.7] 0 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[simplify]*

[39.2] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($heap_{init}.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 < $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

[Work on sub-term 2 of conjunction in term 1.6]

[49.0] 0 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem

[Take given term]

[47.0] (**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[47.1] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[simplify]*

[47.2] (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[const static or extern object]*

[47.3] (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($\$heap_{init}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[47.4] (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>((**int**)178)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[simplify]*

[47.9] (-178 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[47.10] (-178 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) => (**asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[simplify]*

[47.11] (-178 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) => (div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem ==

asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[47.12] (-178 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) =>
(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem ==
asType<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3))

→ *[simplify]*

[47.18] (0 == (−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).rem)) ∨ (177 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)

→ *[from term 49.0, div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem is equal to 0]*

[47.19] (0 == (−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 + 0)) ∨ (177
< **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)

→ *[simplify]*

[47.20] (0 == −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) ∨ (177 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)

→ *[from term 40.0, −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 ==
literala is false whenever -1 < (0 + literala)]*

Proof of rule precondition:

[47.20.0] -1 < (0 + 0)

→ *[simplify]*

[47.20.2] **true**

[47.21] **false** ∨ (177 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)

→ *[simplify]*

[47.22] 177 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3

[Take given term]

[48.0] (**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

→ *[const static or extern object]*

[48.1] (**asType**<**integer**>($\$heap_{init}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[48.2] (**asType**<**integer**>((**int**)178) ≤

asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$**, this).p3)) =>**
!(0 == asType<integer>(div3.quot))

→ *[simplify]*

[48.4] (178 ≤ **asType<integer>(operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this).p3)) => **!(0 == asType<integer>**(div3.quot))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[48.5] (178 ≤ **asType<integer>(this.**$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3)) => **!(0 == asType<integer>**(div3.quot))

→ *[simplify]*

[48.8] (177 < **this.**$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) => **!(0 ==**
asType<integer>(div3.quot))

→ *[from term 34.6, div3 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178)]*

[48.9] (177 < **this.**$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) => **!(0 ==**
asType<integer>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot))

→ *[simplify]*

[48.13] **!(0 ==** div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) ∨ (-178 < −**this.**$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3)

→ *[from term 47.22, literala < −**this.**$r.**value(heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p3 is false whenever -2 < (177 + literala)]

Proof of rule precondition:

[48.13.0] -2 < (-178 + 177)

→ *[simplify]*

[48.13.2] **true**

[48.14] **false** ∨ **!(0 ==** div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot)

→ *[from term 1.7, div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot is equal to 0]

[48.15] **false** ∨ **!(0 ==** 0)

→ *[simplify]*

[48.18] **false**

Proof of verification condition: Arithmetic result of operator '*' is within
limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (74,30)

Condition defined at:

To prove: minof(signed int) $\leq$ ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem))

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}) \leq$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{operator*}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p1})) =>$
$!(0 == \textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div1.quot}))$

$!(0 == \textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div1.rem})) \ || \ !(0 ==$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div1.quot}))$

$\text{div2} == \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\textbf{operator*}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p2}),$
$\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p2})) \ /$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div2.quot})$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p2})) \ \%$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div2.rem})$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{operator*}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p2}) <$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div2.rem}) == \textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p2}))$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{operator*}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div2.quot}))$

$!(0 == \textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div2.rem})) \ || \ !(0 ==$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\textbf{operator*}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p3}),$
$\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p3})) \ /$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div3.quot})$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p3})) \ \%$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{static\_cast}\textbf{<}\textbf{int}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div3.rem})$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{operator*}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p3}) <$
$\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) =>$
$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\text{div3.rem}) == \textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1},\ \textbf{this}).\text{p3}))$

$(\textbf{asType}\textbf{<}\textbf{integer}\textbf{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$

asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] **minof**(**signed int**) $\leq$ ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed
int**>(div1.rem))

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq$ ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem))

$\rightarrow$ *[const static or extern object]*

[1.2] -32768 $\leq$ ($\text{\$heap}_{init}$.r1 * **static_cast**<**signed int**>(div1.rem))

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[1.3] -32768 $\leq$ ((**int**)171 * **static_cast**<**signed int**>(div1.rem))

$\rightarrow$ *[simplify]*

[1.4] -32768 $\leq$ (171 * **static_cast**<**signed int**>(div1.rem))

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177)]*

[1.5] -32768 $\leq$ (171 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

$\rightarrow$ *[simplify]*

[1.8] -32769 < (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[literal comparison of product]*

[1.9] ([171 < 0]: (-32769 / -171) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem, [0 < 171]: (-32769 / 171) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem, [0 == 171]: -32769 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] ([171 < 0]: (-32769 / -171) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem, [(0 < 171) $\wedge$!(171 < 0)]: (-32769 / 171) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem, [(0 == 171) $\wedge$!(0 < 171) $\wedge$!(171 < 0)]: -32769 < 0)

$\rightarrow$ *[simplify]*

[1.18] -192 < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem

$\rightarrow$ *[negate goal and search for contradiction]*

[1.19] !(-192 < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[1.21] 191 < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 $<$ $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) $\wedge$ (0 $<$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 $<$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[10.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) %
asType<**integer**>(177)) == **asType**<**integer**>(div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).rem)

$\rightarrow$ *[simplify]*

[10.2] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 % 177) ==
asType<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[10.3] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) $<$
0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) %
177), []: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)
% 177) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[10.4] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) $<$
0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) %
177), [!(**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) $<$
0)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) %
177) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.7] ([0 $<$ $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1]:
$-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) %
177), [!(**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) $<$
0)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) %

177) == **asType<integer>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[from term 8.0, literala $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 $< (0 +$ literala)]*

Proof of rule precondition:

[10.7.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[10.7.2] **true**

[10.8] ([**false**]: $-(-$**asType<integer>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), [!(**asType<integer>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < 0)]: **asType<integer>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType<integer>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.11] ([**false**]: $-(-$**asType<integer>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), [!(0 $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)]: **asType<integer>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType<integer>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[from term 8.0, literala $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 $< (0 +$ literala)]*

Proof of rule precondition:

[10.11.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[10.11.2] **true**

[10.12] ([**false**]: $-(-$**asType<integer>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), [!**false**]: **asType<integer>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType<integer>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.17] 0 == ($-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem + (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 % 177))

[Create new term from terms 1.21, 10.17 using rule: transitivity 15]

[60.0] $(0 + 191) < -($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 % 177)

$\rightarrow$ *[simplify]*

[60.2] **false**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (74,30)

Condition defined at:

To prove: ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $\leq$ **maxof**(**signed int**)

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) / **asType**<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) == **asType**<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) % **asType**<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==

asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a3) $\leq$ **asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1), **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$\text{heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[const static or extern object]*

[1.1] ($\$\text{heap}_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[1.2] ((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.3] (171 * **static_cast**<**signed int**>(div1.rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$*).p1, 177)]*

[1.4] (171 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.15] -32768 < (-171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[literal comparison of product]*

[1.16] ([-171 < 0]: (-32768 / 171) < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem, [0 < -171]: (-32768 / -171) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem, [-171 == 0]: -32768 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.17] ([-171 < 0]: (-32768 / 171) < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem, [(0 < -171) $\land$!(-171 < 0)]: (-32768 / -171) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem, [(-171 == 0) $\land$!(-171 < 0) $\land$!(0 < -171)]: -32768 < 0)

$\rightarrow$ *[simplify]*

[1.21] -192 < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem

$\rightarrow$ *[negate goal and search for contradiction]*

[1.22] !(-192 < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[1.25] 191 < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 $< -$**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[10.0] (**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) %
asType<**integer**>(177)) == **asType**<**integer**>(div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).rem)

$\rightarrow$ *[simplify]*

[10.2] (**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 % 177) ==
asType<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[10.3] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) %
177), []: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)
% 177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[10.4] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) %
177), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) %
177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)

→ [simplify]

[10.7] ([0 < −**this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1]:
−(−**asType<integer>(this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1) %
177), [!(**asType<integer>(this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1) <
0)]: **asType<integer>(this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1) %
177) == **asType<integer>**(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem)

*→ [from term 8.0, literala < −**this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[10.7.0]* -2 < (0 + 0)
>
> *→ [simplify]*
>
> *[10.7.2]* **true**

[10.8] ([**false**]: −(−**asType<integer>(this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1) % 177), [!(**asType<integer>(this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1) < 0)]: **asType<integer>(this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1) % 177) == **asType<integer>**(div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).rem)

→ [simplify]

[10.11] ([**false**]: −(−**asType<integer>(this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1) % 177), [!(0 < −**this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1)]: **asType<integer>(this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1) % 177) == **asType<integer>**(div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).rem)

*→ [from term 8.0, literala < −**this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[10.11.0]* -2 < (0 + 0)
>
> *→ [simplify]*
>
> *[10.11.2]* **true**

[10.12] ([**false**]: −(−**asType<integer>(this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1) % 177), [!**false**]:
asType<integer>(this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1) % 177)
== **asType<integer>**(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem)

→ [simplify]

[10.17] 0 == (−div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem + (**this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1 % 177))

→ *[remainder is less than divisor]*

    Proof of rule precondition:

    [10.17.0] (177 + −div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) ≤ 0

    → *[simplify]*

    [10.17.11] 176 < div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem

    → *[from term 1.25, literala < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem is true whenever (-1 + literala) < 191]*

        Proof of rule precondition:

        [10.17.11.0] (-1 + 176) < 191

        → *[simplify]*

        [10.17.11.2] **true**

    [10.17.12] **true**

[10.18] **false**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (74,57)

Condition defined at:

To prove: minof(signed int) ≤ ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

Given:

$\$\text{heap}_{init}$.LIMIT == (**int**)80

$\$\text{heap}_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$\$\text{heap}_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$\$\text{heap}_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$\$\text{heap}_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$\$\text{heap}_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$heap_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$heap_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) <

asType<**integer**>($heap$_{funcstart_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p2))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a3) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$\text{heap}_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] **minof**(**signed int**) $\leq$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed
int**>(div1.quot))

→ *[simplify]*

[1.1] -32768 $\leq$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed
int**>(div1.quot))

→ *[const static or extern object]*

[1.2] -32768 $\leq$ ($\$\text{heap}_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[1.3] -32768 $\leq$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))

→ *[simplify]*

[1.4] -32768 $\leq$ (2 * **static_cast**<**signed int**>(div1.quot))

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[1.5] -32768 $\leq$ (2 * **static_cast**<**signed int**>(div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot))

→ *[simplify]*

[1.8] -32769 < (2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[literal comparison of product]*

[1.9] ([2 < 0]: (-32769 / -2) < −div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot, [0 < 2]: (-32769 /
2) < div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot, [0 == 2]: -32769 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] ([2 < 0]: (-32769 / -2) < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot, [(0 < 2) ∧ !(2 < 0)]: (-32769 / 2) < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot, [(0 == 2) ∧ !(0 < 2) ∧ !(2 < 0)]: -32769 < 0)

→ *[simplify]*

[1.18] -16385 < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot

→ *[negate goal and search for contradiction]*

[1.19] !(-16385 < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[1.21] 16384 < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < **asType<integer>**($heap.**class** WHPrang ∈ M1))

→ *[simplify]*

[7.2] (0 < **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType<integer>**($heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType<integer>**(heap_{init}.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType<integer>**((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) ∧ (0 < **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[9.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / **asType**<**integer**>(177)) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.2] (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 / 177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[9.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[9.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.7] ([0 < $-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[from term 8.0, literala < $-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[9.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[9.7.2] **true**

[9.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) / 177), [!(0 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[from term 8.0, literala < $-$**this**.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[9.11.0]* -2 < (0 + 0)
>
> $\rightarrow$ *[simplify]*
>
> *[9.11.2]* **true**

[9.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) / 177), [!**false**]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.17] 0 == ($-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot + (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 / 177))

[Create new term from terms 1.21, 9.17 using rule: transitivity 15]

[59.0] (0 + 16384) < $-$(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 / 177)

$\rightarrow$ *[simplify]*

[59.7] 2899968 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

$\rightarrow$ *[from term 8.0, literala < $-$**this**.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[59.7.0]* -2 < (0 + 2899968)
>
> $\rightarrow$ *[simplify]*
>
> *[59.7.2]* **true**

[59.8] **false**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at:

C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (74,57)

Condition defined at:

To prove: ($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)) $\leq$ **maxof**(**signed int**)

Given:

$heap$_{init}$.LIMIT == (**int**)80

$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a1) $\leq$

asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>(\$heap$_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>(\$heap$_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3)) =>

!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(heap_{init}.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)) $\leq$ **maxof(signed int)**

$\rightarrow$ *[const static or extern object]*

[1.1] (heap_{init}.b1 * **static_cast**<**signed int**>(div1.quot)) $\leq$ **maxof(signed int)**

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[1.2] ((**int**)2 * **static_cast**<**signed int**>(div1.quot)) $\leq$ **maxof(signed int)**

$\rightarrow$ *[simplify]*

[1.3] (2 * **static_cast**<**signed int**>(div1.quot)) $\leq$ **maxof(signed int)**

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[1.4] (2 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.15] -32768 < (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)

→ *[literal comparison of product]*

[1.16] ([-2 < 0]: (-32768 / 2) < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [0 < -2]: (-32768 / -2) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [-2 == 0]: -32768 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.17] ([-2 < 0]: (-32768 / 2) < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [(0 < -2) ∧ !(-2 < 0)]: (-32768 / -2) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [(-2 == 0) ∧ !(-2 < 0) ∧ !(0 < -2)]: -32768 < 0)

→ *[simplify]*

[1.21] -16384 < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot

→ *[negate goal and search for contradiction]*

[1.22] !(-16384 < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[1.25] 16383 < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($heap.**class** WHPrang ∈ M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 <

asType\<integer\>(heap_{init}.**class** WHPrang $\in$ M1))

$\to$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType\<integer\>((**int**)30269))

$\to$ *[simplify]*

[7.10] (-30269 < $-$**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

$\to$ *[separate conjunction and work on first sub-term]*

[7.11] -30269 < $-$**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[9.0] (**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
asType\<integer\>(177)) == **asType\<integer\>**(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot)

$\to$ *[simplify]*

[9.2] (**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 / 177) ==
asType\<integer\>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\to$ *[expand definition of operator './' in class 'int' at built in declaration]*

[9.3] ([**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <
0]: $-$($-$**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
177), []: **asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
177) == **asType\<integer\>**(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[9.4] ([**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <
0]: $-$($-$**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
177), [!(**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <
0)]: **asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
177) == **asType\<integer\>**(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\to$ *[simplify]*

[9.7] ([0 < $-$**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1]:
$-$($-$**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) /
177), [!(**asType\<integer\>**(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) <

0)]: **asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) / 177) == **asType<integer>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot)

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[9.7.0] -2 < (0 + 0)

→ *[simplify]*

[9.7.2] **true**

[9.8] ([**false**]: −(−**asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) / 177), [!(**asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) < 0)]: **asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) / 177) == **asType<integer>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[9.11] ([**false**]: −(−**asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) / 177), [!(0 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)]: **asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) / 177) == **asType<integer>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot)

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[9.11.0] -2 < (0 + 0)

→ *[simplify]*

[9.11.2] **true**

[9.12] ([**false**]: −(−**asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) / 177), [!**false**]: **asType<integer>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) / 177) == **asType<integer>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[9.17] 0 == (−div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot + (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 / 177))

[Create new term from terms 1.25, 9.17 using rule: transitivity 16]

[59.0] $(0 + 16383) < ($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 / 177)

$\rightarrow$ *[simplify]*

[59.8] $2899967 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.11] $-30269 < -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1

$\rightarrow$ *[from term 59.8, literala $< -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 is false whenever -2 < (2899967 + literala)]*

Proof of rule precondition:

[7.11.0] $-2 < (-30269 + 2899967)$

$\rightarrow$ *[simplify]*

[7.11.2] **true**

[7.12] **false**

Proof of verification condition: Arithmetic result of operator '-' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (74,52)

Condition defined at:

To prove: minof(signed int) $\leq$ ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

Given:

\$heap$_{init}$.LIMIT == (**int**)80

\$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

\$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

\$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

\$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

\$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

\$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

\$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

\$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

\$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast\<int\>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType\<integer\>(div1.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType\<integer\>(div1.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType\<integer\>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType\<integer\>**(div1.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a1) ≤
asType\<integer\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

!(0 == **asType\<integer\>**(div1.rem)) || !(0 ==
asType\<integer\>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast\<int\>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType\<integer\>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType\<integer\>**(div2.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a2) ≤
asType\<integer\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>

!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 == **asType**<**integer**>(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) / **asType**<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) % **asType**<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a3) ≤ **asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] **minof**(**signed int**) $\leq$ (($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq$ (($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[const static or extern object]*

[1.2] -32768 $\leq$ (($\text{\$heap}_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[1.3] -32768 $\leq$ ((((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[simplify]*

[1.4] -32768 $\leq$ ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)]*

[1.5] -32768 $\leq$ ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[simplify]*

[1.6] -32768 $\leq$ ((171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[const static or extern object]*

[1.7] -32768 $\leq$ ((171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\text{\$heap}_{init}$.b1 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[1.8] -32768 $\leq$ ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[simplify]*

[1.9] -32768 $\leq$ ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot)))

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)]*

[1.10] -32768 $\leq$ ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot)))

$\rightarrow$ *[simplify]*

[1.15] -32769 < ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))

$\rightarrow$ *[negate goal and search for contradiction]*

[1.16] !(-32769 < ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))

$\rightarrow$ *[simplify]*

[1.21] 32768 < ((2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (-171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&

(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ [expand definition of constant 'M1' at prang.cpp (28,26)]

[7.4] (0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ [simplify]

[7.10] (-30269 < $-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

$\rightarrow$ [separate conjunction and work on first sub-term]

[7.11] -30269 < $-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[9.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) /
asType<**integer**>(177)) == **asType**<**integer**>(div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot)

$\rightarrow$ [simplify]

[9.2] (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 / 177) ==
asType<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ [expand definition of operator './' in class 'int' at built in declaration]

[9.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) <
0]: $-$($-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) /
177), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) /
177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ [explicitly assert falsehood of skipped guards in subsequent guards]

[9.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) <
0]: $-$($-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) /
177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) /
177) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ [simplify]

[9.7] ([0 < $-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1]:
$-$($-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) /

177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[from term 8.0, literala < −***this**.$r.**value***(***heapIs** $\$\text{heap}_{funcstart\_1032,1}$*).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[9.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[9.7.2] **true**

[9.8] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.11] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(0 < −**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[from term 8.0, literala < −***this**.$r.**value***(***heapIs** $\$\text{heap}_{funcstart\_1032,1}$*).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[9.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[9.11.2] **true**

[9.12] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!**false**]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.17] 0 == (−div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot + (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1 / 177))

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[10.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % **asType**<**integer**>(177)) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.2] (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1 % 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[10.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[10.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.7] ([0 < $-$**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[from term 8.0, literala < $-$**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[10.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[10.7.2] **true**

[10.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.11] ([**false**]: $-(-$**asType**<**integer**>(**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) % 177), [!(0 < $-$**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)]: **asType**<**integer**>(**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[from term 8.0, literala < $-$**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[10.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[10.11.2] **true**

[10.12] ([**false**]: $-(-$**asType**<**integer**>(**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) % 177), [!**false**]: **asType**<**integer**>(**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.17] 0 == ($-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem + (**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 % 177))

[Copy term 1.21]

[66.0] 32768 < ((-171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) + (2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot))

$\rightarrow$ *[from term 10.17, div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem is equal to **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 % 177]*

[66.1] 32768 < ((-171 * (**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 % 177)) + (2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot))

[Create new term from term 9.17 using rule: condition for equality of division]

[69.0] ((177 * (0 + $-(-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot))) < (1 + **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)) $\wedge$ (**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 < (177 * (0 + 1 + $-(-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**

$heap_{funcstart\_1032,1}$).p1, 177).quot))))

→ *[simplify]*

[69.15] (-1 < ((-177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)) ∧ (-177 < (−**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 + (177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)))

[Work on sub-term 2 of conjunction in term 69.15]

[70.0] -1 < ((-177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)

[Create new term from terms 70.0, 7.11 using rule: transitivity 2]

[109.0] (-30269 + -1 + 1) < (-177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[109.1] -30269 < (-177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)

→ *[literal comparison of product]*

[109.2] ([-177 < 0]: (-30269 / 177) < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [0 < -177]: (-30269 / -177) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [-177 == 0]: -30269 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[109.3] ([-177 < 0]: (-30269 / 177) < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [(0 < -177) ∧ !(-177 < 0)]: (-30269 / -177) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [(-177 == 0) ∧ !(-177 < 0) ∧ !(0 < -177)]: -30269 < 0)

→ *[simplify]*

[109.7] -172 < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot

[Create new term from terms 109.7, 66.1 using rule: transitivity 5]

[131.0] 32768 < ((-171 * (**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 % 177)) + (2 * −(-172 + 1)))

→ *[simplify]*

[131.5] 32426 < (-171 * (**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 % 177))

→ *[literal comparison of product]*

[131.6] ([-171 < 0]: (32426 / 171) < −(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1 % 177), [0 < -171]: (32426 / -171) <
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 % 177), [-171 == 0]: 32426 <
0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[131.7] ([-171 < 0]: (32426 / 171) < −(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1 % 177), [(0 < -171) ∧ !(-171 < 0)]: (32426 / -171) <
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 % 177), [(-171 == 0) ∧ !(-171
< 0) ∧ !(0 < -171)]: 32426 < 0)

→ *[simplify]*

[131.12] **false**

Proof of verification condition: Arithmetic result of operator '-' is within
limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(74,52)

Condition defined at:

To prove: (($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem))
− ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤
maxof(**signed int**)

Given:

heap_{init}.LIMIT == (**int**)80

heap_{init}.**class** WHPrang ∈ M1 == (**int**)30269

heap_{init}.**class** WHPrang ∈ r1 == (**int**)171

heap_{init}.**class** WHPrang ∈ a1 == (**int**)177

heap_{init}.**class** WHPrang ∈ b1 == (**int**)2

heap_{init}.**class** WHPrang ∈ M2 == (**int**)30307

heap_{init}.**class** WHPrang ∈ r2 == (**int**)172

heap_{init}.**class** WHPrang ∈ a2 == (**int**)176

heap_{init}.**class** WHPrang ∈ b2 == (**int**)35

heap_{init}.**class** WHPrang ∈ M3 == (**int**)30323

heap_{init}.**class** WHPrang ∈ r3 == (**int**)170

heap_{init}.**class** WHPrang ∈ a3 == (**int**)178

heap_{init}.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a1) ≤
asType<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,

static_cast<int>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this).p3),
static_cast<int>(**$\text{\$heap}_{funcstart\_1032,1}$.a3))

(asType<integer>(static_cast<int>(operator*(heapIs
$\text{\$heap}_{funcstart\_1032,1}$, **this).p3)) /
asType<integer>(static_cast<int>(**$\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(asType<integer>(static_cast<int>(operator*(heapIs
$\text{\$heap}_{funcstart\_1032,1}$, **this).p3)) %
asType<integer>(static_cast<int>(**$\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this).p3) <
asType<integer>(**$\text{\$heap}_{funcstart\_1032,1}$.a3)) =>
(asType<integer>(div3.rem) == **asType<integer>(operator*(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this).p3))

(asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a3) ≤
asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this).p1),
static_cast<int>(**$\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>(**$\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>(**$\text{\$heap}_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>((int)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)

[Take goal term]

[1.0] (($heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.1] (($heap_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[1.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) − ($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − ($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[1.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) − ($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.5] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) − ($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.6] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) − ($heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[1.7] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.8] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed**

int>(div1.quot))) ≤ **maxof(signed int)**

→ *[from term 2.6, div1 is equal to div(***heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[1.9] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed**
int>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot))) ≤ **maxof(signed int)**

→ *[simplify]*

[1.26] -32768 < ((-171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) + (2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot))

→ *[negate goal and search for contradiction]*

[1.27] !(-32768 < ((-171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) + (2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot)))

→ *[simplify]*

[1.32] 32767 < ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem) + (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot))

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>(this.**$r.**value(heapIs**
$heap_{funcstart\_1032,1}$).p1)) && (**asType<integer>(this.**$r.**value(heapIs**
$heap_{funcstart\_1032,1}$).p1) < **asType<integer>**($heap.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1) &&
(**this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1 <
asType<integer>($heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1) &&
(**this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1 <
asType<integer>($heap_{init}.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1) &&
(**this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1 <
asType<integer>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) ∧ (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[9.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / **asType**<**integer**>(177)) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[9.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 / 177) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[expand definition of operator './' in class 'int' at built in declaration]*

[9.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / 177), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[9.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[simplify]*

[9.7] ([0 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) / 177) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

→ *[from term 8.0, literala < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[9.7.0] -2 < (0 + 0)

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$\rightarrow$ *[simplify]*

[9.7.2] **true**

[9.8] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1) < 0)]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1) / 177) $==$ **asType**$<$**integer**$>$(div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot)

$\rightarrow$ *[simplify]*

[9.11] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!(0 $< -$**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1)]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1) / 177) $==$ **asType**$<$**integer**$>$(div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot)

$\rightarrow$ *[from term 8.0, literala $< -$**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1*
is false whenever -2 $< (0 + literala)$]

Proof of rule precondition:

[9.11.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[9.11.2] **true**

[9.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1) / 177), [!**false**]:
asType$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) / 177)
$==$ **asType**$<$**integer**$>$(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[9.17] 0 $==$ ($-$div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot $+$ (**this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1 / 177))

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[10.0] (**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) %
asType$<$**integer**$>$(177)) $==$ **asType**$<$**integer**$>$(div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).rem)

$\rightarrow$ *[simplify]*

[10.2] (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1 % 177) $==$
asType$<$**integer**$>$(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[10.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $<$ 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[10.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $<$ 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $<$ 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.7] ([0 $<$ $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $<$ 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[from term 8.0, literala $<$ $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[10.7.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[10.7.2] **true**

[10.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $<$ 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177), [!(0 $<$ $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)

$\rightarrow$ *[from term 8.0, literala $<$ $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1*

is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[10.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[10.11.2] **true**

[10.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) % 177), [!**false**]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) % 177) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)

$\rightarrow$ *[simplify]*

[10.17] 0 == ($-$div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem + (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 % 177))

[Take given term]

[15.0] (**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < **asType**<**integer**>($heap$_{funcstart\_1032,1}$.a1)) => (**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[15.1] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) < **asType**<**integer**>($heap$_{funcstart\_1032,1}$.a1)) => (**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1))

$\rightarrow$ *[simplify]*

[15.2] (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 < **asType**<**integer**>($heap$_{funcstart\_1032,1}$.a1)) => (**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1))

$\rightarrow$ *[const static or extern object]*

[15.3] (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 < **asType**<**integer**>($heap$_{init}$.a1)) => (**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[15.4] (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 < **asType**<**integer**>((**int**)177)) => (**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1))

$\rightarrow$ *[simplify]*

[15.9] (-177 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[15.10] (-177 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) =>
(**asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) ==
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1))

→ *[simplify]*

[15.11] (-177 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) =>
(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem ==
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[15.12] (-177 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) =>
(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem ==
asType<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))

→ *[simplify]*

[15.18] (0 == (−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).rem)) ∨ (176 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Branch on disjunction or conditional in term 15.18]

[50.0] (0 == (−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).rem)) ∨ (176 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∨ !(0 ==
(−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).rem))

[Copy term 1.32]

[51.0] (32767 < ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))) ∨ (176 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∨ !(0 ==
(−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).rem))

→ *[from term 50.0, div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem is equal to **this**.$r.**value**(**heapIs***

$\$heap_{funcstart\_1032,1}$).p1]

[51.1] (32767 < ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) ∨ ...

[Copy term 10.17]

[52.0] (0 == (−div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem + (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 % 177))) ∨ (176 < **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∨ !(0 == (−**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

*→ [from term 50.0, div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem is equal to **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1]*

[52.1] (0 == (−**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 % 177))) ∨ ...

[Assume known post-assertion, class invariant or type constraint for term 52.1]

[53.0] (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < 177) ∨ (176 < **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∨ !(0 == (−**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

→ [simplify]

[53.3] (-177 < −**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∨ ...

[Create new term from terms 51.1, 53.3 using rule: transitivity 5r]

[60.0] (32767 < ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * −(-177 + 1)))) ∨ (176 < **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∨ !(0 == (−**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 + div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

→ [simplify]

[60.5] (2671 < (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot)) ∨ ...

→ [literal comparison of product]

[60.6] ([-2 < 0]: (2671 / 2) < −div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot, [0 < -2]: (2671 / -2) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot, [-2 == 0]: 2671 < 0) ∨ ...

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[60.7] ([-2 < 0]: (2671 / 2) < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [(0 < -2) $\wedge$!(-2 < 0)]: (2671 / -2) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot, [(-2 == 0) $\wedge$!(-2 < 0) $\wedge$!(0 < -2)]: 2671 < 0) $\vee$ ...

$\rightarrow$ *[simplify]*

[60.11] (1335 < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) $\vee$ ...

[Create new term from terms 60.11, 9.17 using rule: transitivity 15]

[62.0] ((0 + 1335) < $-$(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 / 177)) $\vee$ (176 < **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) $\vee$!(0 == ($-$**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 + div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))

$\rightarrow$ *[simplify]*

[62.1] (1335 < $-$(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 / 177)) $\vee$ ...

$\rightarrow$ *[division by larger divisor]*

Proof of rule precondition 1:

[62.1.0.0] literald < $-$**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1

$\rightarrow$ *[unify with term 53.3]*

[62.1.0.1] **true**

Proof of rule precondition 2:

[62.1.1.0] literalc < **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1

$\rightarrow$ *[unify with term 8.0]*

[62.1.1.1] **true**

Proof of rule precondition 3:

[62.1.2.0] $-$-177 $\leq$ 177

$\rightarrow$ *[simplify]*

[62.1.2.2] **true**

Proof of rule precondition 4:

[62.1.3.0] -2 < 0

$\rightarrow$ *[simplify]*

[62.1.3.1] **true**

[62.2] (1335 < $-$**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) $\vee$ ...

→ *[from term 8.0, literala* < −**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 *is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[62.2.0] -2 < (0 + 1335)

→ *[simplify]*

[62.2.2] **true**

[62.3] **false** ∨ ...

[Remove 'false' term 62.3 and fetch new term from containing clause]

[63.0] 176 < **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1

[Copy term 1.32]

[66.0] 32767 < ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))

→ *[from term 10.17, div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem is equal to **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 % 177]*

[66.1] 32767 < ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * (**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 % 177)))

[Create new term from term 9.17 using rule: condition for equality of division]

[69.0] ((177 * (0 + −(−div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot))) < (1 + **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)) ∧ (**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 < (177 * (0 + 1 + −(−div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot))))

→ *[simplify]*

[69.15] (-1 < ((-177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)) ∧ (-177 < (−**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 + (177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)))

→ *[separate conjunction and work on first sub-term]*

[69.16] -177 < (−**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 + (177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot))

[Create new term from terms 63.0, 69.16 using rule: transitivity 3]

[71.0] (-177 + 1 + 176) < (177 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot)

$\rightarrow$ *[simplify]*

[71.1] $0 < (177 * \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot})$

$\rightarrow$ *[product is positive]*

[71.2] $((0 < 177) \wedge (0 < \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot})) \vee ((177 < 0) \wedge (\text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot} < 0))$

$\rightarrow$ *[simplify]*

[71.7] $0 < \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}$

[Create new term from terms 71.7, 66.1 using rule: transitivity 11]

[76.0] $(1 + 32767 + (0 * 2)) < (171 * (\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}\ \%\ 177))$

$\rightarrow$ *[simplify]*

[76.2] $32768 < (171 * (\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}\ \%\ 177))$

$\rightarrow$ *[literal comparison of product]*

[76.3] $([171 < 0]: (32768 / -171) < -(\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}\ \%\ 177), [0 < 171]: (32768 / 171) < (\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}\ \%\ 177), [0 == 171]: 32768 < 0)$

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[76.4] $([171 < 0]: (32768 / -171) < -(\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}\ \%\ 177), [(0 < 171) \wedge !(171 < 0)]: (32768 / 171) < (\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}\ \%\ 177), [(0 == 171) \wedge !(0 < 171) \wedge !(171 < 0)]: 32768 < 0)$

$\rightarrow$ *[simplify]*

[76.13] **false**

Proof of verification condition: Type constraint satisfied in explicit conversion from 'integer' to 'int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (75,18)

Condition defined at:

To prove: minof(int) $\leq$ static_cast<integer>(static_cast<signed

int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang ∈ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang ∈ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang ∈ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang ∈ r3 == (**int**)170

$\$heap_{init}$.**class** WHPrang ∈ a3 == (**int**)178

$\$heap_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a1) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),

static_cast<int>($heap$_{funcstart_1032,1}$.a2))

(asType<integer>(static_cast<int>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p2)) /
asType<integer>(static_cast<int>($heap$_{funcstart_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(asType<integer>(static_cast<int>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p2)) %
asType<integer>(static_cast<int>($heap$_{funcstart_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(asType<integer>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p2) <
asType<integer>($heap$_{funcstart_1032,1}$.a2)) =>
(asType<integer>(div2.rem) == **asType<integer>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this**).p2))

(asType<integer>($heap$_{funcstart_1032,1}$.a2) ≤
asType<integer>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p3),
static_cast<int>($heap$_{funcstart_1032,1}$.a3))

(asType<integer>(static_cast<int>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p3)) /
asType<integer>(static_cast<int>($heap$_{funcstart_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(asType<integer>(static_cast<int>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p3)) %
asType<integer>(static_cast<int>($heap$_{funcstart_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(asType<integer>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p3) <
asType<integer>($heap$_{funcstart_1032,1}$.a3)) =>
(asType<integer>(div3.rem) == **asType<integer>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this**).p3))

(asType<integer>($heap$_{funcstart_1032,1}$.a3) ≤
asType<integer>(operator*(heapIs $heap$_{funcstart_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType<integer>**($\text{\$heap}$.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>($\text{\$heap}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] $(-30269 < -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1) $\wedge$ $(0 <$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1

[Take goal term]

[1.0] **minof**(**int**) $\leq$ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0)

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq$ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0)

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.2] -32768 $\leq$ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1) < (**int**)0)

$\rightarrow$ *[simplify]*

[1.6] -32768 $\leq$ **static_cast**<**integer**>(0 < $-$**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1})$.p1)

$\rightarrow$ *[from term 8.0, literala $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[1.6.0]* -2 < (0 + 0)
>
> $\rightarrow$ *[simplify]*
>
> *[1.6.2]* **true**

[1.7] -32768 $\leq$ **static_cast**<**integer**>(**false**)

$\rightarrow$ *[simplify]*

[1.8] -32768 $\leq$ ([**false**]: 1, []: 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.9] -32768 $\leq$ ([**false**]: 1, [**true**]: 0)

$\rightarrow$ *[simplify]*

[1.11] **true**

Proof of verification condition: Type constraint satisfied in explicit

conversion from 'integer' to 'int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(75,18)

Condition defined at:

To prove: static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, this).p1) < (int)0) $\leq$ maxof(int)

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$heap_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$heap_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

(asType<integer>(static_cast<int>(operator*(heapIs
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(asType<integer>(static_cast<int>(operator*(heapIs
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(asType<integer>(operator*(heapIs $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a1)) =>

(asType\<integer\>(div1.rem) **== asType\<integer\>(operator*(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType\<integer\>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) **=>**
!(0 **== asType\<integer\>**(div1.quot))

!(0 **== asType\<integer\>**(div1.rem)) **||** !(0 **==**
asType\<integer\>(div1.quot))

div2 **==** div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(asType\<integer\>(static_cast\<int\>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) **/**
asType\<integer\>(static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a2))) **==**
asType\<integer\>(div2.quot)

(asType\<integer\>(static_cast\<int\>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType\<integer\>(static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a2))) **==**
asType\<integer\>(div2.rem)

(asType\<integer\>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) **<**
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a2)) **=>**
(asType\<integer\>(div2.rem) **== asType\<integer\>(operator*(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType\<integer\>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) **=>**
!(0 **== asType\<integer\>**(div2.quot))

!(0 **== asType\<integer\>**(div2.rem)) **||** !(0 **==**
asType\<integer\>(div2.quot))

div3 **==** div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(asType\<integer\>(static_cast\<int\>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) **/**
asType\<integer\>(static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a3))) **==**
asType\<integer\>(div3.quot)

(asType\<integer\>(static_cast\<int\>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType\<integer\>(static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a3))) **==**
asType\<integer\>(div3.rem)

(asType\<integer\>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) **<**
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a3)) **=>**
(asType\<integer\>(div3.rem) **== asType\<integer\>(operator*(heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a3) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(heap_{init}.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(heap.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1$)$ &&
$($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1 $<$
asType<**integer**>($\$heap$.**class** WHPrang $\in$ M1$))$

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1$)$ &&
$($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1 $<$
asType<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1$))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1$)$ &&
$($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1 $<$
asType<**integer**>$(($**int**$)30269))$

$\rightarrow$ *[simplify]*

[7.10] $(\text{-}30269 < -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1$) \wedge (0 <$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1$)$

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1

[Take goal term]

[1.0] **static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0) $\leq$ **maxof**(**int**)

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.1] **static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1})$.p1) $<$ (**int**)0) $\leq$ **maxof**(**int**)

$\rightarrow$ *[simplify]*

[1.5] **static_cast**<**integer**>(0 $< -$**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1})$.p1) $\leq$ **maxof**(**int**)

$\rightarrow$ *[from term 8.0, literala $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p1
is false whenever -2 $< (0 + literala)]$*

    Proof of rule precondition:

    [1.5.0] -2 $< (0 + 0)$

    $\rightarrow$ *[simplify]*

    [1.5.2] **true**

[1.6] **static_cast**<**integer**>(**false**) $\leq$ **maxof**(**int**)

$\rightarrow$ *[simplify]*

[1.7] ([**false**]: 1, []: 0) $\leq$ **maxof**(**int**)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.8] ([**false**]: 1, [**true**]: 0) $\leq$ **maxof**(**int**)

$\rightarrow$ [simplify]

[1.11] **true**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (75,32)

Condition defined at:

To prove: minof(signed int) $\leq$ ($\$\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0)))

Given:

$\$\text{heap}_{init}$.LIMIT == (**int**)80

$\$\text{heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$\text{heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$\text{heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$\text{heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$\text{heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$\text{heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$\text{heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$\text{heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$\text{heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$\text{heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$\text{heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$\text{heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) / **asType**<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))) == **asType**<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %

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asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p1))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p2))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==

asType<integer>(div3.rem)

(**asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(**asType<integer>**(div3.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a3) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) $-$
($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$\text{heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType$<$integer$>$**(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) $<$ **asType$<$integer$>$**(\$heap.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 $<$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 $<$
asType$<$integer$>$(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 $<$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 $<$
asType$<$integer$>$($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 $<$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 $<$
asType$<$integer$>$((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 $<$ $-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 $<$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 $<$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take goal term]

[1.0] **minof**(**signed int**) $\leq$ ($\text{\$heap}_{funcstart\_1032,1}$.M1 *
asType$<$int$>$(**static_cast$<$integer$>$**(**static_cast$<$signed
int$>$**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0)))

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq$ ($\text{\$heap}_{funcstart\_1032,1}$.M1 *
asType$<$int$>$(**static_cast$<$integer$>$**(**static_cast$<$signed
int$>$**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0)))

$\rightarrow$ *[const static or extern object]*

[1.2] -32768 $\leq$ ($\text{\$heap}_{init}$.M1 *
asType$<$int$>$(**static_cast$<$integer$>$**(**static_cast$<$signed
int$>$**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[1.3] -32768 $\leq$ ((**int**)30269 *
asType$<$int$>$(**static_cast$<$integer$>$**(**static_cast$<$signed
int$>$**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0)))

$\rightarrow$ *[simplify]*

[1.4] -32768 ≤ (30269 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $heap_{funcstart\_1032,1}$**, this**).p1) < (**int**)0)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.5] -32768 ≤ (30269 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1) < (**int**)0)))

→ *[simplify]*

[1.9] -32768 ≤ (30269 * **asType<int>(static_cast<integer>**(0 <
−**this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1)))

→ *[from term 8.0, literala < −***this.**$r.**value(heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]

> **Proof of rule precondition:**
>
> *[1.9.0]* -2 < (0 + 0)
>
> → *[simplify]*
>
> *[1.9.2]* **true**

[1.10] -32768 ≤ (30269 * **asType<int>(static_cast<integer>(false)))**

→ *[simplify]*

[1.11] -32768 ≤ (30269 * **asType<int>**(([**false**]: 1, []: 0)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.12] -32768 ≤ (30269 * **asType<int>**(([**false**]: 1, [**true**]: 0)))

→ *[simplify]*

[1.16] **true**

Proof of verification condition: Arithmetic result of operator '*' is within
limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(75,32)

Condition defined at:

To prove: ($heap_{funcstart\_1032,1}$.M1 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $heap_{funcstart\_1032,1}$**, this**).p1) < (**int**)0))) ≤
maxof(signed int)

Given:

$\$heap_{init}$.LIMIT $==$ (**int**)80

$\$heap_{init}$.**class** WHPrang $\in$ M1 $==$ (**int**)30269

$\$heap_{init}$.**class** WHPrang $\in$ r1 $==$ (**int**)171

$\$heap_{init}$.**class** WHPrang $\in$ a1 $==$ (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 $==$ (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 $==$ (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 $==$ (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 $==$ (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 $==$ (**int**)35

$\$heap_{init}$.**class** WHPrang $\in$ M3 $==$ (**int**)30323

$\$heap_{init}$.**class** WHPrang $\in$ r3 $==$ (**int**)170

$\$heap_{init}$.**class** WHPrang $\in$ a3 $==$ (**int**)178

$\$heap_{init}$.**class** WHPrang $\in$ b3 $==$ (**int**)63

div1 $==$ div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) $==$
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) $==$
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) $=>$
(**asType**<**integer**>(div1.rem) $==$ **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) $=>$
!(0 $==$ **asType**<**integer**>(div1.quot))

!(0 $==$ **asType**<**integer**>(div1.rem)) || !(0 $==$
asType<**integer**>(div1.quot))

div2 $==$ div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a2) ≤
asType<integer>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(**asType<integer>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a3)) =>
(**asType<integer>**(div3.rem) == **asType<integer>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a3) ≤
asType<integer>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) −
($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <

asType<integer>((int)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) ∧ (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Take goal term]

[1.0] ($\text{heap}_{funcstart\_1032,1}$.M1 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.1] (heap_{init}.M1 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) ≤ **maxof**(**signed int**)

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[1.2] ((**int**)30269 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.3] (30269 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) ≤ **maxof**(**signed int**)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.4] (30269 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < (**int**)0))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.8] (30269 * **asType<int>**(**static_cast<integer>**(0 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1))) ≤ **maxof**(**signed int**)

→ *[from term 8.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.8.0] -2 < (0 + 0)

→ *[simplify]*

[1.8.2] **true**

[1.9] (30269 * **asType<int>(static_cast<integer>(false)))** ≤ **maxof(signed int**)

→ *[simplify]*

[1.10] (30269 * **asType<int>**(([**false**]: 1, []: 0))) ≤ **maxof(signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.11] (30269 * **asType<int>**(([**false**]: 1, [**true**]: 0))) ≤ **maxof(signed int**)

→ *[simplify]*

[1.16] **true**

Proof of verification condition: Arithmetic result of operator '+' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (75,16)

Condition defined at:

To prove: minof(signed int) ≤ (($\text{heap}_{funcstart\_1032,1}$.M1 * **asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

Given:

heap_{init}.LIMIT == (**int**)80

heap_{init}.**class** WHPrang ∈ M1 == (**int**)30269

heap_{init}.**class** WHPrang ∈ r1 == (**int**)171

heap_{init}.**class** WHPrang ∈ a1 == (**int**)177

heap_{init}.**class** WHPrang ∈ b1 == (**int**)2

heap_{init}.**class** WHPrang ∈ M2 == (**int**)30307

heap_{init}.**class** WHPrang ∈ r2 == (**int**)172

heap_{init}.**class** WHPrang ∈ a2 == (**int**)176

heap_{init}.**class** WHPrang ∈ b2 == (**int**)35

heap_{init}.**class** WHPrang ∈ M3 == (**int**)30323

heap_{init}.**class** WHPrang ∈ r3 == (**int**)170

heap_{init}.**class** WHPrang ∈ a3 == (**int**)178

heap_{init}.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast\<int\>($\$heap_{funcstart\_1032,1}$.a1))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType\<integer\>(**static_cast\<int\>**($\$heap_{funcstart\_1032,1}$.a1))) ==
asType\<integer\>(div1.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType\<integer\>(**static_cast\<int\>**($\$heap_{funcstart\_1032,1}$.a1))) ==
asType\<integer\>(div1.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType\<integer\>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType\<integer\>**(div1.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType\<integer\>**($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType\<integer\>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

!(0 == **asType\<integer\>**(div1.rem)) || !(0 ==
asType\<integer\>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast\<int\>($\$heap_{funcstart\_1032,1}$.a2))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType\<integer\>(**static_cast\<int\>**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType\<integer\>(**static_cast\<int\>**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) <
asType\<integer\>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType\<integer\>**(div2.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType\<integer\>**($\$heap_{funcstart\_1032,1}$.a2) $\leq$
asType\<integer\>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType\<integer\>**(div2.quot))

!(0 == **asType\<integer\>**(div2.rem)) || !(0 ==
asType\<integer\>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,

static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(**asType<integer>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType<integer>**(div3.rem) == **asType<integer>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType<integer>**($\$heap_{funcstart\_1032,1}$.a3) $\leq$
asType<integer>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) $-$
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($heap_{init}.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[50.0] (($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$heap_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ (heap_{init}.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[51.0] **minof**(**signed int**) $\leq$ temp1

$\rightarrow$ *[simplify]*

[51.3] -32769 < temp1

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ** div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[51.4] -32769 < ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take goal term]

[1.0] **minof(signed int)** ≤ (($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

→ *[simplify]*

[1.1] -32768 ≤ (($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

→ *[const static or extern object]*

[1.2] -32768 ≤ (($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[1.3] -32768 ≤ (((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

→ *[simplify]*

[1.4] -32768 ≤ ((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.5] -32768 ≤ ((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)

→ *[simplify]*

[1.9] -32768 ≤ ((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)

→ *[from term 8.0, literala < −**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

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[1.9.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.9.2] **true**

[1.10] -32768 $\leq$ ((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)

$\rightarrow$ *[simplify]*

[1.11] -32768 $\leq$ ((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.12] -32768 $\leq$ ((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)

$\rightarrow$ *[simplify]*

[1.15] -32768 $\leq$ (0 + temp1)

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *\$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 ** div(**heapIs** *\$heap$_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *\$heap$_{funcstart\_1032,1}$).p1, 177).rem)]*

[1.16] -32768 $\leq$ (0 + ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))

$\rightarrow$ *[simplify]*

[1.20] -32769 < ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))

$\rightarrow$ *[from term 51.4, literala < ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *\$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 ** div(**heapIs** *\$heap$_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *\$heap$_{funcstart\_1032,1}$).p1, 177).rem)) is true whenever (-1 + literala) < -32769]*

Proof of rule precondition:

[1.20.0] (-32769 + -1) < -32769

$\rightarrow$ *[simplify]*

[1.20.2] **true**

[1.21] **true**

Proof of verification condition: Arithmetic result of operator '+' is within limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (75,16)

Condition defined at:

To prove: $((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$ **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1) $\le$ **maxof**(**signed int**)

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) / **asType**<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))) == **asType**<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) % **asType**<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))) == **asType**<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < **asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a1)) => (**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a1) $\le$

asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>

!(0 == **asType**\<**integer**\>(div3.quot))

!(0 == **asType**\<**integer**\>(div3.rem)) || !(0 == **asType**\<**integer**\>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast**\<**signed int**\>(div1.rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**\<**signed int**\>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **static_cast**\<**int**\>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1), **static_cast**\<**int**\>($heap$_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **static_cast**\<**int**\>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1), **static_cast**\<**int**\>($heap$_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, **static_cast**\<**int**\>($heap$_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, **static_cast**\<**int**\>($heap$_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, **static_cast**\<**int**\>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**\<**integer**\>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1)) && (**asType**\<**integer**\>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) < **asType**\<**integer**\>($heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 < **asType**\<**integer**\>($heap.**class** WHPrang $\in$ M1))

→ *[const static or extern object]*

[7.3] $(0 <$ **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1)$ &&
$(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1 <$
asType<**integer**>($heap_{init}.**class** WHPrang \in M1))$

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1)$ &&
$(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1 <$
asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] $(-30269 < -$**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1) \wedge (0 <$
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1)$

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1$

[Take given term]

[50.0] $(($heap_{funcstart_1032,1}.r1$ * **static_cast**<**signed int**>(div1.rem)) -$
$($heap_{funcstart_1032,1}.b1$ * **static_cast**<**signed int**>(div1.quot))) == $ temp1

→ *[const static or extern object]*

[50.1] $(($heap_{init}.r1$ * **static_cast**<**signed int**>(div1.rem)) -$
$($heap_{funcstart_1032,1}.b1$ * **static_cast**<**signed int**>(div1.quot))) == $ temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] $((($**int**$)171$ * **static_cast**<**signed int**>(div1.rem)) -$
$($heap_{funcstart_1032,1}.b1$ * **static_cast**<**signed int**>(div1.quot))) == $ temp1

→ *[simplify]*

[50.3] $((171$ * **static_cast**<**signed int**>(div1.rem)) - ($heap_{funcstart\_1032,1}.b1$
* **static_cast**<**signed int**>(div1.quot))) == $ temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1},$
this.$r.**value**(**heapIs** $heap_{funcstart_1032,1}).p1, 177)]*

[50.4] $((171$ * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1},$
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}).p1, 177).rem)) -$
$($heap_{funcstart_1032,1}.b1$ * **static_cast**<**signed int**>(div1.quot))) == $ temp1

→ *[simplify]*

[50.5] $((171$ * div(**heapIs** $heap_{funcstart\_1032,1},$ **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem) - ($heap_{funcstart_1032,1}.b1$ *
static_cast<**signed int**>(div1.quot))) == $ temp1

→ *[const static or extern object]*

[50.6] $((171$ * div(**heapIs** $heap_{funcstart\_1032,1},$ **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem) - ($heap_{init}.b1$ * **static_cast**<**signed**

int>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[52.0] temp1 ≤ **maxof**(**signed int**)

→ *[simplify]*

[52.9] -32768 < −temp1

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[52.10] -32768 < −((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

→ *[simplify]*

[52.13] -32768 < ((2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (-171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take goal term]

[1.0] (($heap$_{funcstart_1032,1}$.M1 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this).p1) < (int)0))) + temp1)
≤ maxof(signed int)**

→ *[const static or extern object]*

[1.1] (($heap$_{init}$.M1 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this).p1) < (int)0))) + temp1)
≤ maxof(signed int)**

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[1.2] (((int)30269 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this).p1) < (int)0))) + temp1)
≤ maxof(signed int)**

→ *[simplify]*

[1.3] ((30269 * **asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this).p1) < (int)0))) + temp1)
≤ maxof(signed int)**

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.4] ((30269 * **asType<int>(static_cast<integer>(static_cast<signed
int>(this.$r.value(heapIs** $heap$_{funcstart_1032,1}$**).p1) < (int)0))) + temp1) ≤
maxof(signed int)**

→ *[simplify]*

[1.8] ((30269 * **asType<int>(static_cast<integer>(0 <
−this.$r.value(heapIs** $heap$_{funcstart_1032,1}$**).p1))) + temp1) ≤
maxof(signed int)**

→ *[from term 8.0, literala < −**this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[1.8.0]* -2 < (0 + 0)
>
> → *[simplify]*
>
> *[1.8.2]* **true**

[1.9] ((30269 * **asType<int>(static_cast<integer>(false)))) + temp1) ≤
maxof(signed int)**

→ *[simplify]*

[1.10] ((30269 * **asType<int>(([false]: 1, []: 0))) + temp1) ≤ maxof(signed
int)**

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.11] $((30269 * \textbf{asType}<\textbf{int}>(([\textbf{false}]: 1, [\textbf{true}]: 0))) + \text{temp1}) \leq$ **maxof(signed int**)

$\rightarrow$ *[simplify]*

[1.14] $(0 + \text{temp1}) \leq$ **maxof(signed int**)

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 ** *div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).rem)]*

[1.15] $(0 + ((-2 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) $+ (171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))) $\leq$ **maxof(signed int**)

$\rightarrow$ *[simplify]*

[1.31] $-32768 < ((-171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $+ (2 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))

$\rightarrow$ *[from term 52.13, literala < ((-171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).rem) + (2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).quot)) is true whenever (-1 + literala) < -32768]*

Proof of rule precondition:

[1.31.0] $(-32768 + -1) < -32768$

$\rightarrow$ *[simplify]*

[1.31.2] **true**

[1.32] **true**

Proof of verification condition: Type constraint satisfied in implicit conversion from 'signed int' to 'P1Type'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (75,16)

Condition defined at:

To prove: minof(signed int) $\leq ((\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0))) + temp1)

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a1))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType\<integer\>(div1.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType\<integer\>(div1.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType\<integer\>**(div1.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType\<integer\>**($\$\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

!(0 == **asType\<integer\>**(div1.rem)) || !(0 ==
asType\<integer\>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType\<integer\>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType\<integer\>**(div2.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a2) ≤
asType\<integer\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType\<integer\>**(div2.quot))

!(0 == **asType\<integer\>**(div2.rem)) || !(0 ==
asType\<integer\>(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast\<int\>($\text{\$heap}_{funcstart\_1032,1}$.a3))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3) <
asType\<integer\>($\text{\$heap}_{funcstart\_1032,1}$.a3)) =>
(**asType\<integer\>**(div3.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a3) ≤
asType\<integer\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType\<integer\>**(div3.quot))

!(0 == **asType\<integer\>**(div3.rem)) || !(0 ==
asType\<integer\>(div3.quot))

temp1 == ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast\<signed int\>**(div1.rem)) −
($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast\<signed int\>**(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <

asType<integer>((int)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) ∧ (0 <
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Take given term]

[50.0] (($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] ((heap_{init}.r1 * **static_cast<signed int>**(div1.rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast<signed int>**(div1.rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast<signed int>**(div1.rem)) − ($\text{heap}_{funcstart\_1032,1}$.b1
* **static_cast<signed int>**(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast<signed int>**(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\text{heap}_{funcstart\_1032,1}$.b1 *
static_cast<signed int>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\text{heap}_{init}$.b1 * **static_cast<signed
int>**(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast<signed
int>**(div1.quot))) == temp1

→ *[simplify]*

[50.8] $((171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $- (2 *$ **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] $((171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $- (2 *$ **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] $0 == (-$temp1 $+ (-2 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) $+ (171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[51.0] **minof**(**signed int**) $\leq$ temp1

$\rightarrow$ *[simplify]*

[51.3] -32769 $<$ temp1

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[51.4] -32769 $< ((-2 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) $+ (171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take goal term]

[1.0] **minof**(**signed int**) $\leq ((\$heap_{funcstart\_1032,1}$.M1 $*$ **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) $< ($**int**$)0))) +$ temp1)

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq ((\$heap_{funcstart\_1032,1}$.M1 $*$ **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) $< ($**int**$)0))) +$ temp1)

$\rightarrow$ *[const static or extern object]*

[1.2] -32768 $\leq ((\$heap_{init}$.M1 $*$ **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) $< ($**int**$)0))) +$ temp1)

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[1.3] -32768 ≤ (((**int**)30269 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

→ *[simplify]*

[1.4] -32768 ≤ ((30269 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.5] -32768 ≤ ((30269 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(this.**$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)

→ *[simplify]*

[1.9] -32768 ≤ ((30269 * **asType<int>(static_cast<integer>**(0 <
−**this.**$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1))) + temp1)

→ *[from term 8.0, literala < −**this.**$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.9.0] -2 < (0 + 0)

→ *[simplify]*

[1.9.2] **true**

[1.10] -32768 ≤ ((30269 * **asType<int>(static_cast<integer>(false)**)) +
temp1)

→ *[simplify]*

[1.11] -32768 ≤ ((30269 * **asType<int>**(([**false**]: 1, []: 0))) + temp1)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.12] -32768 ≤ ((30269 * **asType<int>**(([**false**]: 1, [**true**]: 0))) + temp1)

→ *[simplify]*

[1.15] -32768 ≤ (0 + temp1)

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)]*

[1.16] -32768 ≤ (0 + ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))

→ *[simplify]*

[1.20] -32769 < ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

$\rightarrow$ *[from term 51.4, literala < ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) is true whenever (-1 + literala) < -32769]*

Proof of rule precondition:

[1.20.0] (-32769 + -1) < -32769

$\rightarrow$ *[simplify]*

[1.20.2] **true**

[1.21] **true**

Proof of verification condition: Type constraint satisfied in implicit conversion from 'signed int' to 'P1Type'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (75,16)

Condition defined at:

To prove: (($\$heap_{funcstart\_1032,1}$.M1 * **asType\<int\>**(**static_cast\<integer\>**(**static_cast\<signed int\>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1) $\leq$ **maxof**(**signed int**)

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}.$**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}.$**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<integer>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[50.0] (($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$heap_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] $(((\textbf{int})171 * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.rem})) - (\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{b1} * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[simplify]*

[50.3] $((171 * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.rem})) - (\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{b1} * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[from term 2.6, div1 is equal to div(***heapIs*** $\$heap_{funcstart\_1032,1}$, ***this**.$r.***value**(***heapIs*** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] $((171 * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem})) - (\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{b1} * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[simplify]*

[50.5] $((171 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - (\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{b1} * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[const static or extern object]*

[50.6] $((171 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - (\$\mathrm{heap}_{init}.\mathrm{b1} * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] $((171 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - ((\textbf{int})2 * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[simplify]*

[50.8] $((171 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - (2 * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[from term 2.6, div1 is equal to div(***heapIs*** $\$heap_{funcstart\_1032,1}$, ***this**.$r.***value**(***heapIs*** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] $((171 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - (2 * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{quot}))) == \mathrm{temp1}$

$\rightarrow$ *[simplify]*

[50.14] $0 == (-\mathrm{temp1} + (\text{-}2 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{quot}) + (171 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}))$

[Take given term]

[52.0] temp1 $\leq$ **maxof(signed int)**

$\rightarrow$ *[simplify]*

[52.9] -32768 $< -$temp1

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(***heapIs** $heap_{funcstart\_1032,1}$*,* **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(***heapIs** $heap_{funcstart\_1032,1}$*,* **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).rem)]*

[52.10] -32768 $< -$((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))

$\rightarrow$ *[simplify]*

[52.13] -32768 $<$ ((2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (-171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take goal term]

[1.0] (($heap_{funcstart\_1032,1}$.M1 * **asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0))) + temp1) $\leq$ **maxof(signed int)**

$\rightarrow$ *[const static or extern object]*

[1.1] (($heap_{init}$.M1 * **asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0))) + temp1) $\leq$ **maxof(signed int)**

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[1.2] (((**int**)30269 * **asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0))) + temp1) $\leq$ **maxof(signed int)**

$\rightarrow$ *[simplify]*

[1.3] ((30269 * **asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0))) + temp1) $\leq$ **maxof(signed int)**

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.4] ((30269 * **asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed**

int>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.8] ((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1))) + temp1) ≤ **maxof**(**signed int**)

→ *[from term 8.0, literala < −***this***.$r.***value***(***heapIs*** $heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

   Proof of rule precondition:

   [1.8.0] -2 < (0 + 0)

   → *[simplify]*

   [1.8.2] **true**

[1.9] ((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.10] ((30269 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp1) ≤ **maxof**(**signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.11] ((30269 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) + temp1) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.14] (0 + temp1) ≤ **maxof**(**signed int**)

→ *[from term 50.14, temp1 is equal to (-2 * div(***heapIs*** $heap_{funcstart\_1032,1}$, ***this***.$r.***value***(***heapIs*** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs*** $heap_{funcstart\_1032,1}$, ***this***.$r.***value***(***heapIs*** $heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[1.15] (0 + ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.31] -32768 < ((-171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) + (2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot))

→ *[from term 52.13, literala < ((-171 * div(***heapIs*** $heap_{funcstart\_1032,1}$, ***this***.$r.***value***(***heapIs*** $heap_{funcstart\_1032,1}$).p1, 177).rem) + (2 * div(***heapIs*** $heap_{funcstart\_1032,1}$, ***this***.$r.***value***(***heapIs*** $heap_{funcstart\_1032,1}$).p1,*

177).quot)) is true whenever (-1 + literala) < -32768]

Proof of rule precondition:

[1.31.0] (-32768 + -1) < -32768

$\rightarrow$ *[simplify]*

[1.31.2] **true**

[1.32] **true**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (77,30)

Condition defined at:

To prove: minof(signed int) $\leq$ ($heap$_{1032,1;1051,8}$.r2 * **static_cast<signed int>**(div2.rem))

Given:

$heap$_{init}$.LIMIT == (**int**)80

$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p1)) /

asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}.\text{a1}$))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}.\text{a1}$))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}.\text{a1}$)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}.\text{a1}$) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}.\text{a2}$))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}.\text{a2}$))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}.\text{a2}$))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}.\text{a2}$)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}.\text{a2}$) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}.\text{a3}$))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}.\text{a3}$))) ==

asType<integer>(div3.quot)

(asType<integer>(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(asType<integer>(div3.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3) ≤
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) −
($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) ≤ temp1

temp1 ≤ **maxof(signed int)**

$\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
operator*(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 →
asType<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(heap_{init}.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(heap.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>(heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>(heap_{init}.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) ∧ (0 <
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[26.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) % **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[26.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[26.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.7] ([0 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[from term 24.0, literala < $-$**this**.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[26.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[26.7.2] **true**

[26.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.11] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(0 $< -$**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2)]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**$<$**integer**$>$(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[from term 24.0, literala $< -$**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[26.11.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[26.11.2] **true**

[26.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!**false**: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**$<$**integer**$>$(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.17] 0 == ($-$div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem + (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 % 176))

[Take given term]

[50.0] (($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$\text{heap}_{init}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($\textbf{int}$)171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**$<$**signed int**$>$(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

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$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.**$\$r \rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.**$\$r \rightarrow$ **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.\$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**replace(p1 →**
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**replace(p1 →**
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**replace(p1 →**
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**replace(p1 →**
asType<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.value(heapIs *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**replace(p1 →**
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**replace(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] **minof(signed int)** ≤ ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed**
int>(div2.rem))

→ *[simplify]*

[1.1] -32768 ≤ ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$ **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.2] -32768 $\leq$ ($\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$ **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed**
int>(div2.rem))

$\rightarrow$ *[const member of object with modified fields]*

[1.3] -32768 $\leq$ ($\$heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem))

$\rightarrow$ *[const static or extern object]*

[1.4] -32768 $\leq$ ($\$heap_{init}$.r2 * **static_cast**<**signed int**>(div2.rem))

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[1.5] -32768 $\leq$ ((**int**)172 * **static_cast**<**signed int**>(div2.rem))

$\rightarrow$ *[simplify]*

[1.6] -32768 $\leq$ (172 * **static_cast**<**signed int**>(div2.rem))

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[1.7] -32768 $\leq$ (172 * **static_cast**<**signed int**>(div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).rem))

$\rightarrow$ *[simplify]*

[1.10] -32769 < (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[literal comparison of product]*

[1.11] ([172 < 0]: (-32769 / -172) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem, [0 < 172]: (-32769 /
172) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem, [0 == 172]: -32769 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.12] ([172 < 0]: (-32769 / -172) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem, [(0 < 172) $\wedge$!(172 <
0)]: (-32769 / 172) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem, [(0 == 172) $\wedge$!(0 < 172) $\wedge$!(172 < 0)]:

167

-32769 < 0)

→ *[simplify]*

[1.20] -191 < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem

→ *[negate goal and search for contradiction]*

[1.21] !(-191 < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[simplify]*

[1.23] $190 < -$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem

[Create new term from terms 1.23, 26.17 using rule: transitivity 15]

[68.0] $(0 + 190) < -($**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 % 176)

→ *[simplify]*

[68.2] **false**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (77,30)

Condition defined at:

To prove: ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) ≤ **maxof**(**signed int**)

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r3 $==$ (**int**)170

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a3 $==$ (**int**)178

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b3 $==$ (**int**)63

div1 $==$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) $==$
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) $==$
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1)) $=>$
(**asType**<**integer**>(div1.rem) $==$ **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) $=>$
!(0 $==$ **asType**<**integer**>(div1.quot))

!(0 $==$ **asType**<**integer**>(div1.rem)) || !(0 $==$
asType<**integer**>(div1.quot))

div2 $==$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) $==$
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) $==$
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2)) $=>$
(**asType**<**integer**>(div2.rem) $==$ **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) $=>$

!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 == **asType**<**integer**>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) / **asType**<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) % **asType**<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤ **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$\$$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

170

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType<integer>**($\$heap$.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>($\$heap$.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>($\$heap_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∧ (0 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$\text{heap}_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\$\text{heap}$.**class** WHPrang ∈
M2))

→ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$\text{heap}$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$\text{heap}_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) ∧ (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

[Take given term]

[50.0] (($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$heap_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((**(int)**171 * **static_cast**<**signed int**>(div1.rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (**(int)**2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed**

173

int>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$*).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed**
int>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0)))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala < $-$**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.15] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.\$r.**value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.\$r.**value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] ($\$\text{heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) ≤ **maxof**(**signed int**)

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace***(**this**.\$r → **this**.\$r.**value***(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace***(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.\$r.**value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.\$r.**value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.1] ($\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed int**>(div2.rem)) ≤ **maxof**(**signed int**)

→ *[const member of object with modified fields]*

[1.2] ($\$\text{heap}_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.3] ($\$\text{heap}_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) ≤ **maxof**(**signed int**)

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[1.4] ((**int**)172 * **static_cast**<**signed int**>(div2.rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.5] (172 * **static_cast**<**signed int**>(div2.rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[from term 18.6, div2 is equal to div(***heapIs** $\$heap_{funcstart\_1032,1}$*,* **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$*).p2, 176)]*

[1.6] (172 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.17] -32768 < (-172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[literal comparison of product]*

[1.18] ([-172 < 0]: (-32768 / 172) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem, [0 < -172]: (-32768 / -172) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem, [-172 == 0]: -32768 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.19] ([-172 < 0]: (-32768 / 172) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem, [(0 < -172) $\wedge$!(-172 < 0)]: (-32768 / -172) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem, [(-172 == 0) $\wedge$!(-172 < 0) $\wedge$!(0 < -172)]: -32768 < 0)

$\rightarrow$ *[simplify]*

[1.23] -191 < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem

$\rightarrow$ *[negate goal and search for contradiction]*

[1.24] !(-191 < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[1.27] 190 < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[26.0] (**asType**<**integer**>(**this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2) % **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.2] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 % 176) ==
asType<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[26.3] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) <
0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) %
176), []: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)
% 176) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[26.4] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) <
0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) %
176), [!(**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) <
0)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) %
176) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.7] ([0 < $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2]:
$-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) %
176), [!(**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) <
0)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) %
176) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[from term 24.0, literala < $-$**this**.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[26.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[26.7.2] **true**

[26.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,
176).rem)

$\rightarrow$ *[simplify]*

[26.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2) % 176), [!(0 < $-$**this**.\$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p2)]: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176) == **asType<integer>**(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[from term 24.0, literala < −***this.***$r.***value***(heapIs $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[26.11.0]* -2 < (0 + 0)
>
> → *[simplify]*
>
> *[26.11.2]* **true**

[26.12] ([**false**]: −(−**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176), [!**false**]: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176) == **asType<integer>**(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[simplify]*

[26.17] 0 == (−div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem + (**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 % 176))

→ *[remainder is less than divisor]*

> **Proof of rule precondition:**
>
> *[26.17.0]* (176 + −div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) ≤ 0
>
> → *[simplify]*
>
> *[26.17.11]* 175 < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem
>
> → *[from term 1.27, literala < div(***heapIs** *$heap_{funcstart\_1032,1}$, ***this.***$r.***value***(heapIs $heap_{funcstart\_1032,1}$).p2, 176).rem is true whenever (-1 + literala) < 190]*
>
> > **Proof of rule precondition:**
> >
> > *[26.17.11.0]* (-1 + 175) < 190
> >
> > → *[simplify]*
> >
> > *[26.17.11.2]* **true**
>
> *[26.17.12]* **true**

[26.18] **false**

Proof of verification condition: Arithmetic result of operator '*' is within

limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(77,57)

Condition defined at:

To prove: minof(signed int) $\leq$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$heap_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$heap_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**

$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

($\mathbf{asType}\mathbf{<integer>}$($\$\mathrm{heap}_{funcstart\_1032,1}$.a3) $\leq$
$\mathbf{asType}\mathbf{<integer>}$($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p3)) =>
!(0 == $\mathbf{asType}\mathbf{<integer>}$(div3.quot))

!(0 == $\mathbf{asType}\mathbf{<integer>}$(div3.rem)) || !(0 ==
$\mathbf{asType}\mathbf{<integer>}$(div3.quot))

temp1 == ($\$\mathrm{heap}_{funcstart\_1032,1}$.r1 * $\mathbf{static\_cast}\mathbf{<signed\ int>}$(div1.rem)) $-$
($\$\mathrm{heap}_{funcstart\_1032,1}$.b1 * $\mathbf{static\_cast}\mathbf{<signed\ int>}$(div1.quot))

$\mathbf{minof}(\mathbf{signed\ int}) \leq$ temp1

temp1 $\leq \mathbf{maxof}(\mathbf{signed\ int})$

$\$\mathrm{heap}_{1032,1;1051,8}$ == $\$\mathrm{heap}_{funcstart\_1032,1}$.$\mathbf{\_replace}$(this.$r $\rightarrow$
$\mathbf{operator}$*($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).$\mathbf{\_replace}$(p1 $\rightarrow$
$\mathbf{asType}\mathbf{<P1Type>}$(($\$\mathrm{heap}_{funcstart\_1032,1}$.M1 *
$\mathbf{asType}\mathbf{<int>}$($\mathbf{static\_cast}\mathbf{<integer>}$($\mathbf{static\_cast}\mathbf{<signed}$
$\mathbf{int>}$($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p1) $<$ $(\mathbf{int})$0))) +
temp1)))

Proof:

[Take given term]

[2.0] div1 == div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$,
$\mathbf{static\_cast}\mathbf{<int>}$($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p1),
$\mathbf{static\_cast}\mathbf{<int>}$($\$\mathrm{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$,
$\mathbf{static\_cast}\mathbf{<int>}$($\mathbf{this}$.$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p1),
$\mathbf{static\_cast}\mathbf{<int>}$($\$\mathrm{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$).p1, $\mathbf{static\_cast}\mathbf{<int>}$($\$\mathrm{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$).p1, $\mathbf{static\_cast}\mathbf{<int>}$($\$\mathrm{heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$).p1, $\mathbf{static\_cast}\mathbf{<int>}$(($\mathbf{int}$)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

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[7.0] $(0 < \textbf{asType}\langle\textbf{integer}\rangle(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).p1)) \&\& (\textbf{asType}\langle\textbf{integer}\rangle(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).p1) < \textbf{asType}\langle\textbf{integer}\rangle(\$\text{heap}.\textbf{class WHPrang} \in$
$\text{M1}))$

$\rightarrow$ *[simplify]*

[7.2] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1) \&\&$
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1 <$
$\textbf{asType}\langle\textbf{integer}\rangle(\$\text{heap}.\textbf{class WHPrang} \in \text{M1}))$

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1) \&\&$
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1 <$
$\textbf{asType}\langle\textbf{integer}\rangle(\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1}))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1) \&\&$
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1 <$
$\textbf{asType}\langle\textbf{integer}\rangle((\textbf{int})30269))$

$\rightarrow$ *[simplify]*

[7.10] $(-30269 < -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1) \wedge (0 <$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1)$

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p1$

[Take given term]

[18.0] $\text{div2} == \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\langle\textbf{int}\rangle(\textbf{operator}*(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).p2),$
$\textbf{static\_cast}\langle\textbf{int}\rangle(\$\text{heap}_{funcstart\_1032,1}.a2))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] $\text{div2} == \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\langle\textbf{int}\rangle(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).p2),$
$\textbf{static\_cast}\langle\textbf{int}\rangle(\$\text{heap}_{funcstart\_1032,1}.a2))$

$\rightarrow$ *[simplify]*

[18.2] $\text{div2} == \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).p2, \textbf{static\_cast}\langle\textbf{int}\rangle(\$\text{heap}_{funcstart\_1032,1}.a2))$

$\rightarrow$ *[const static or extern object]*

[18.3] $\text{div2} == \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).p2, \textbf{static\_cast}\langle\textbf{int}\rangle(\$\text{heap}_{init}.a2))$

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] $\text{div2} == \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$

$\text{\$heap}_{funcstart\_1032,1}).\text{p2}$, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2})$) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2})$ < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$ < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$ < **asType**<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$ < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[25.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$) / **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$, 176).quot)

$\rightarrow$ *[simplify]*

[25.2] (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$ / 176) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$, 176).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[25.3] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$) <

0]: $-(-$**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), []: **asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>($div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[25.4] ([**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $<$ 0]: $-(-$**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $<$ 0)]: **asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>($div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.7] ([0 $<$ $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2]: $-(-$**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $<$ 0)]: **asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>($div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala $<$ $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[25.7.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[25.7.2] **true**

[25.8] ([**false**]: $-(-$**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $<$ 0)]: **asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>($div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.11] ([**false**]: $-(-$**asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(0 $<$ $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)]: **asType**$<$**integer**$>($**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>($div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala $<$ $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[25.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[25.11.2] **true**

[25.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) / 176), [!**false**]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) / 176) == **asType**$<$**integer**$>$(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.17] 0 == ($-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot + (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 / 176))

[Take given term]

[50.0] (($heap_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($heap_{init}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($ \textbf{int}$)171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**$<$**signed int**$>$(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($heap_{init}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow$
$\textbf{asType}<P1Type>(((\textbf{int})30269\ *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}*(\textbf{heapIs}\ \$heap_{funcstart\_1032,1},\ \textbf{this}).p1) < (\textbf{int})0))) +$
temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow$
$\textbf{asType}<P1Type>((30269\ *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}*(\textbf{heapIs}\ \$heap_{funcstart\_1032,1},\ \textbf{this}).p1) < (\textbf{int})0))) +$
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow$
$\textbf{asType}<P1Type>((30269\ *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1) < (\textbf{int})0))) + temp1)))$

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow$
$\textbf{asType}<P1Type>((30269\ *\ \textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(0 <$
$-\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1))) + temp1)))$

$\rightarrow$ *[from term 8.0, literala $< -$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p1$
is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow$
$\textbf{asType}<P1Type>((30269\ *\ \textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{false})))$
$+ temp1)))$

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow$
$\textbf{asType}<P1Type>((30269\ *\ \textbf{asType}<\textbf{int}>((([\textbf{false}]:\ 1,\ []:\ 0))) + temp1)))$

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(((**[false]**: 1, **[true]**: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

→ *[simplify]*

[1.1] -32768 ≤ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.2] -32768 ≤ ($\$heap_{funcstart\_1032,1}$.**replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**

$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))

$\rightarrow$ *[const member of object with modified fields]*

[1.3] -32768 ≤ ($heap_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))

$\rightarrow$ *[const static or extern object]*

[1.4] -32768 ≤ ($heap_{init}$.b2 * **static_cast<signed int>**(div2.quot))

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[1.5] -32768 ≤ ((**int**)35 * **static_cast<signed int>**(div2.quot))

$\rightarrow$ *[simplify]*

[1.6] -32768 ≤ (35 * **static_cast<signed int>**(div2.quot))

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]*

[1.7] -32768 ≤ (35 * **static_cast<signed int>**(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))

$\rightarrow$ *[simplify]*

[1.10] -32769 < (35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[literal comparison of product]*

[1.11] ([35 < 0]: (-32769 / -35) < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [0 < 35]: (-32769 / 35) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [0 == 35]: -32769 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.12] ([35 < 0]: (-32769 / -35) < −div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [(0 < 35) ∧ !(35 < 0)]: (-32769 / 35) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [(0 == 35) ∧ !(0 < 35) ∧ !(35 < 0)]: -32769 < 0)

$\rightarrow$ *[simplify]*

[1.20] -937 < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot

$\rightarrow$ *[negate goal and search for contradiction]*

[1.21] !(-937 < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[1.23] $936 < -\mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p2}, 176).\mathrm{quot}$

[Create new term from terms 1.23, 25.17 using rule: transitivity 15]

[67.0] $(0 + 936) < -(\textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p2} / 176)$

$\rightarrow$ *[simplify]*

[67.7] $164736 < -\textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p2}$

$\rightarrow$ *[from term 24.0, literala $< -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2$ is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[67.7.0] $-2 < (0 + 164736)$

$\rightarrow$ *[simplify]*

[67.7.2] **true**

[67.8] **false**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (77,57)

Condition defined at:

To prove: $(\$\mathrm{heap}_{1032,1;1051,8}.\mathrm{b2} * \textbf{static\_cast}<\textbf{signed int}>(\mathrm{div2.quot})) \leq$ **maxof**(**signed int**)

Given:

$\$\mathrm{heap}_{init}.\mathrm{LIMIT} == (\textbf{int})80$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{M1} == (\textbf{int})30269$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{r1} == (\textbf{int})171$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{a1} == (\textbf{int})177$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{b1} == (\textbf{int})2$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{M2} == (\textbf{int})30307$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{r2} == (\textbf{int})172$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{a2} == (\textbf{int})176$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{b2} == (\textbf{int})35$

$\$\mathrm{heap}_{init}.\textbf{class } \mathrm{WHPrang} \in \mathrm{M3} == (\textbf{int})30323$

$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$heap_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$heap_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<int>(**operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($heap_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator*(heapIs**
$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator*(heapIs**
$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($heap_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator*(heapIs**
$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($heap_{funcstart\_1032,1}$.a1) $\leq$
asType<integer>(**operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<int>(**operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($heap_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator*(heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator*(heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($heap_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator*(heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($heap_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(**operator*(heapIs** $heap_{funcstart\_1032,1}$, **this**).p2)) =>

!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 == **asType**<**integer**>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) / **asType**<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) % **asType**<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a3) ≤ **asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(this.$r → **operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 → **asType**<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\text{\$heap}$.**class** WHPrang $\in$
M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\text{\$heap}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) $\land$ (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)

$\rightarrow$ *[separate conjunction and work on first sub-term]*

[23.11] -30307 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[25.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.2] (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 / 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[25.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[25.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.7] ([0 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.7.0] -2 < (0 + 0)

→ *[simplify]*

[25.7.2] **true**

[25.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

→ *[simplify]*

[25.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!(0 < $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

→ *[from term 24.0, literala < $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.11.0] -2 < (0 + 0)

→ *[simplify]*

[25.11.2] **true**

[25.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176), [!**false**]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

→ *[simplify]*

[25.17] 0 == ($-$div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot + (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 / 176))

[Take given term]

[50.0] ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] ((\$heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] $(((\mathbf{int})171 * \mathbf{static\_cast}{<}\mathbf{signed\ int}{>}(\text{div1.rem})) -$
$(\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \mathbf{static\_cast}{<}\mathbf{signed\ int}{>}(\text{div1.quot}))) ==$ temp1

$\rightarrow$ *[simplify]*

[50.3] $((171 * \mathbf{static\_cast}{<}\mathbf{signed\ int}{>}(\text{div1.rem})) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1}$
$* \mathbf{static\_cast}{<}\mathbf{signed\ int}{>}(\text{div1.quot}))) ==$ temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] $((171 * \mathbf{static\_cast}{<}\mathbf{signed\ int}{>}(\text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$
$\mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})) -$
$(\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \mathbf{static\_cast}{<}\mathbf{signed\ int}{>}(\text{div1.quot}))) ==$ temp1

$\rightarrow$ *[simplify]*

[50.5] $((171 * \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} *$
$\mathbf{static\_cast}{<}\mathbf{signed\ int}{>}(\text{div1.quot}))) ==$ temp1

$\rightarrow$ *[const static or extern object]*

[50.6] $((171 * \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (\$\text{heap}_{init}.\text{b1} * \mathbf{static\_cast}{<}\mathbf{signed}$
$\mathbf{int}{>}(\text{div1.quot}))) ==$ temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] $((171 * \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - ((\mathbf{int})2 * \mathbf{static\_cast}{<}\mathbf{signed}$
$\mathbf{int}{>}(\text{div1.quot}))) ==$ temp1

$\rightarrow$ *[simplify]*

[50.8] $((171 * \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (2 * \mathbf{static\_cast}{<}\mathbf{signed}$
$\mathbf{int}{>}(\text{div1.quot}))) ==$ temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] $((171 * \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (2 * \mathbf{static\_cast}{<}\mathbf{signed}$
$\mathbf{int}{>}(\text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}))) ==$ temp1

$\rightarrow$ *[simplify]*

[50.14] $0 == (-\text{temp1} + (\text{-2} * \text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$
$\mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$
$\text{div}(\mathbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \mathbf{this}.\$\text{r}.\mathbf{value}(\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))$

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(this.\$r →
__operator__*(__heapIs__ $\$heap_{funcstart\_1032,1}$, __this__).__replace__(p1 →
__asType__<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
__asType__<__int__>(__static_cast__<__integer__>(__static_cast__<__signed__
__int__>(__operator__*(__heapIs__ $\$heap_{funcstart\_1032,1}$, __this__).p1) < (__int__)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(this.\$r →
__this__.\$r.__value__(__heapIs__ $\$heap_{funcstart\_1032,1}$).__replace__(p1 →
__asType__<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
__asType__<__int__>(__static_cast__<__integer__>(__static_cast__<__signed__
__int__>(__operator__*(__heapIs__ $\$heap_{funcstart\_1032,1}$, __this__).p1) < (__int__)0))) +
temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(this.\$r →
__this__.\$r.__value__(__heapIs__ $\$heap_{funcstart\_1032,1}$).__replace__(p1 →
__asType__<P1Type>(($\$heap_{init}$.M1 *
__asType__<__int__>(__static_cast__<__integer__>(__static_cast__<__signed__
__int__>(__operator__*(__heapIs__ $\$heap_{funcstart\_1032,1}$, __this__).p1) < (__int__)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(this.\$r →
__this__.\$r.__value__(__heapIs__ $\$heap_{funcstart\_1032,1}$).__replace__(p1 →
__asType__<P1Type>(((__int__)30269 *
__asType__<__int__>(__static_cast__<__integer__>(__static_cast__<__signed__
__int__>(__operator__*(__heapIs__ $\$heap_{funcstart\_1032,1}$, __this__).p1) < (__int__)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(this.\$r →
__this__.\$r.__value__(__heapIs__ $\$heap_{funcstart\_1032,1}$).__replace__(p1 →
__asType__<P1Type>((30269 *
__asType__<__int__>(__static_cast__<__integer__>(__static_cast__<__signed__
__int__>(__operator__*(__heapIs__ $\$heap_{funcstart\_1032,1}$, __this__).p1) < (__int__)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(this.\$r →
__this__.\$r.__value__(__heapIs__ $\$heap_{funcstart\_1032,1}$).__replace__(p1 →
__asType__<P1Type>((30269 *
__asType__<__int__>(__static_cast__<__integer__>(__static_cast__<__signed__
__int__>(__this__.\$r.__value__(__heapIs__ $\$heap_{funcstart\_1032,1}$).p1) < (__int__)0))) + temp1)))

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→ *[simplify]*

[53.9] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala* < −**this**.*\$r.***value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)))

→ *[simplify]*

[53.11] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(***heapIs** *$\$heap_{funcstart\_1032,1}$,* **this**.*\$r.***value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** *$\$heap_{funcstart\_1032,1}$,* **this**.*\$r.***value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot)) ≤ **maxof**(**signed int**)

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.1] ($\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot)) ≤ **maxof**(**signed int**)

→ *[const member of object with modified fields]*

[1.2] ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot)) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.3] ($\$heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot)) ≤ **maxof**(**signed int**)

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[1.4] ((**int**)35 * **static_cast**<**signed int**>(div2.quot)) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.5] (35 * **static_cast**<**signed int**>(div2.quot)) ≤ **maxof**(**signed int**)

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[1.6] (35 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot)) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.17] -32768 < (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[literal comparison of product]*

[1.18] ([-35 < 0]: (-32768 / 35) < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [0 < -35]: (-32768 / -35) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [-35 == 0]: -32768 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.19] ([-35 < 0]: (-32768 / 35) < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [(0 < -35) $\wedge$!(-35 < 0)]: (-32768 / -35) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot, [(-35 == 0) $\wedge$!(-35 < 0) $\wedge$!(0 < -35)]: -32768 < 0)

$\rightarrow$ *[simplify]*

[1.23] -937 < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot

$\rightarrow$ *[negate goal and search for contradiction]*

[1.24] !(-937 < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[1.27] 936 < div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot

[Create new term from terms 1.27, 25.17 using rule: transitivity 16]

[67.0] (0 + 936) < (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 / 176)

$\rightarrow$ *[simplify]*

[67.8] 164911 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.11] -30307 < $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2

$\rightarrow$ *[from term 67.8, literala < $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (164911 + literala)]*

Proof of rule precondition:

[23.11.0] -2 < (-30307 + 164911)

$\rightarrow$ *[simplify]*

[23.11.2] **true**

[23.12] **false**

Proof of verification condition: Arithmetic result of operator '-' is within limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(77,52)

Condition defined at:

To prove: minof(signed int) $\leq$ (($\text{\$heap}_{1032,1;1051,8}$.r2 *
static_cast<signed int>(div2.rem)) $-$ ($\text{\$heap}_{1032,1;1051,8}$.b2 *
static_cast<signed int>(div2.quot)))

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

$(\textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}) \leq$
$\textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) =>$
$!(0 == \textbf{asType}\textbf{<integer>}(\text{div1.quot}))$

$!(0 == \textbf{asType}\textbf{<integer>}(\text{div1.rem})) \;||\; !(0 ==$
$\textbf{asType}\textbf{<integer>}(\text{div1.quot}))$

$\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}),$
$\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$(\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \;/$
$\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}\textbf{<integer>}(\text{div2.quot})$

$(\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \;\%$
$\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}\textbf{<integer>}(\text{div2.rem})$

$(\textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}) <$
$\textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}\textbf{<integer>}(\text{div2.rem}) == \textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}))$

$(\textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}\textbf{<integer>}(\text{div2.quot}))$

$!(0 == \textbf{asType}\textbf{<integer>}(\text{div2.rem})) \;||\; !(0 ==$
$\textbf{asType}\textbf{<integer>}(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}),$
$\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \;/$
$\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}\textbf{<integer>}(\text{div3.quot})$

$(\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \;\%$
$\textbf{asType}\textbf{<integer>}(\textbf{static\_cast}\textbf{<int>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}\textbf{<integer>}(\text{div3.rem})$

$(\textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}) <$
$\textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) =>$
$(\textbf{asType}\textbf{<integer>}(\text{div3.rem}) == \textbf{asType}\textbf{<integer>}(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}))$

$(\textbf{asType}\textbf{<integer>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$

asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang ∈
M1))

→ [simplify]

[7.2] (0 < **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap.**class** WHPrang ∈ M1))

→ [const static or extern object]

[7.3] (0 < **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang ∈ M1))

→ [expand definition of constant 'M1' at prang.cpp (28,26)]

[7.4] (0 < **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ [simplify]

[7.10] (-30269 < −**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1) ∧ (0 <
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

→ [expand definition of operator '*' in class 'pointer' at built in declaration]

[18.1] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

→ [simplify]

[18.2] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

→ [const static or extern object]

[18.3] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{init}$.a2))

→ [expand definition of constant 'a2' at prang.cpp (35,26)]

[18.4] div2 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(\$heap.**class** WHPrang ∈ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap.**class** WHPrang ∈ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap$_{init}$.**class** WHPrang ∈ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) ∧ (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

$\rightarrow$ *[separate conjunction and work on first sub-term]*

[23.11] -30307 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[25.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) / **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.2] (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 / 176) == **asType**<**integer**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[25.3] ([**asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0]: $-(-$**asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176), []: **asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176) == **asType<integer>**(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[25.4] ([**asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0]: $-(-$**asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176), [!(**asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0)]: **asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176) == **asType<integer>**(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.7] ([0 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2]:
$-(-$**asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176), [!(**asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0)]: **asType<integer>**(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176) == **asType<integer>**(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[25.7.2] **true**

[25.8] ([**false**]: $-(-$**asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) / 176), [!(**asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) / 176) == **asType<integer>**(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot)

$\rightarrow$ *[simplify]*

[25.11] ([**false**]: $-(-$**asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) / 176), [!(0 < $-$**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2)]: **asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) / 176) == **asType<integer>**(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot)

$\rightarrow$ *[from term 24.0, literala < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.11.0] -2 < (0 + 0)

→ *[simplify]*

[25.11.2] **true**

[25.12] ([**false**]: −(−**asType**<**integer**>(this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176), [!**false**]: **asType**<**integer**>(this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot)

→ *[simplify]*

[25.17] 0 == (−div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot + (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 / 176))

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[26.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) % **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)

→ *[simplify]*

[26.2] (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 % 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)

→ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[26.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) % 176), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[26.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)

→ *[simplify]*

[26.7] ([0 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) <

0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[from term 24.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[26.7.0] -2 < (0 + 0)

→ *[simplify]*

[26.7.2] **true**

[26.8] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[simplify]*

[26.11] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176), [!(0 < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[from term 24.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[26.11.0] -2 < (0 + 0)

→ *[simplify]*

[26.11.2] **true**

[26.12] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176), [!**false**]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)

→ *[simplify]*

[26.17] 0 == (−div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem + (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 % 176))

[Take given term]

[50.0] (($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] ((heap_{init}.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($\textbf{int}$)171 * **static_cast**<**signed int**>(div1.rem)) − ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) − ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\text{heap}_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − (($\textbf{int}$)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] $0 == (-\text{temp1} + (\text{-2} * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$ $\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$ $\text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))$

[Take given term]

[53.0] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\text{r} \rightarrow$ $\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\_\textbf{replace}(\text{p1} \rightarrow$ $\textbf{asType}<\text{P1Type}>((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$ $\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$ $\text{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\text{r} \rightarrow$ $\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$ $\textbf{asType}<\text{P1Type}>((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$ $\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$ $\text{temp1})))$

$\rightarrow$ *[const static or extern object]*

[53.2] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\text{r} \rightarrow$ $\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$ $\textbf{asType}<\text{P1Type}>((\$\text{heap}_{init}.\text{M1} *$ $\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$ $\text{temp1})))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\text{r} \rightarrow$ $\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$ $\textbf{asType}<\text{P1Type}>(((\textbf{int})30269 *$ $\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$ $\text{temp1})))$

$\rightarrow$ *[simplify]*

[53.4] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\text{r} \rightarrow$ $\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$ $\textbf{asType}<\text{P1Type}>((30269 *$ $\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$ $\text{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_$**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_$**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −***this**.*$r.***value***(***heapIs** *$heap_{funcstart_1032,1}).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_$**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_$**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_$**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_$**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(***heapIs** *$heap_{funcstart\_1032,1},* **this**.*$r.***value***(***heapIs** *$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 * div(***heapIs** *$heap_{funcstart_1032,1},* **this**.*$r.***value***(***heapIs** *$heap_{funcstart_1032,1}).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_$**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →

asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] **minof**(**signed int**) $\leq$ (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed
int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot)))

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq$ (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to
$\$heap_{funcstart\_1032,1}$._replace(**this.\$r** $\rightarrow$ **this.\$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$)._replace(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.2] -32768 $\leq$ (($\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed
int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot)))

$\rightarrow$ *[const member of object with modified fields]*

[1.3] -32768 $\leq$ (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed
int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot)))

$\rightarrow$ *[const static or extern object]*

[1.4] -32768 $\leq$ (($\$heap_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[1.5] -32768 $\leq$ ((((**int**)172 * **static_cast**<**signed int**>(div2.rem)) $-$
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[simplify]*

[1.6] -32768 $\leq$ ((172 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[1.7] -32768 $\leq$ ((172 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[simplify]*

[1.8] -32768 $\leq$ ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.__replace(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.9] -32768 $\leq$ ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$heap_{funcstart\_1032,1}$.__replace(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[const member of object with modified fields]*

[1.10] -32768 $\leq$ ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[const static or extern object]*

[1.11] -32768 $\leq$ ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[1.12] -32768 $\leq$ ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ((**int**)35 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[simplify]*

[1.13] -32768 $\leq$ ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ (35 * **static_cast**<**signed int**>(div2.quot)))

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.**$r.**value***(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]*

[1.14] -32768 $\leq$ ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ (35 *
static_cast<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot)))

$\rightarrow$ *[simplify]*

[1.19] -32769 $<$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))

$\rightarrow$ *[negate goal and search for contradiction]*

[1.20] !(-32769 $<$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))

$\rightarrow$ *[simplify]*

[1.25] 32768 $<$ ((35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (-172 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).rem))

[Copy term 1.25]

[75.0] 32768 $<$ ((-172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) + (35 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))

$\rightarrow$ *[from term 26.17, div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.**$r.**value***(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem is equal to* **this.**$r.**value***(**heapIs**
$heap_{funcstart\_1032,1}$).p2 % 176]*

[75.1] 32768 $<$ ((-172 * (**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 %
176)) + (35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot))

[Create new term from term 25.17 using rule: condition for equality of division]

[101.0] ((176 * (0 + $-$($-$div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))) $<$ (1 +
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2)) $\wedge$ (**this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2 $<$ (176 * (0 + 1 + $-$($-$div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot))))

→ *[simplify]*

[101.15] (-1 < ((-176 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)) ∧ (-176 < (−**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 + (176 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)))

[Work on sub-term 2 of conjunction in term 101.15]

[102.0] -1 < ((-176 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

[Create new term from terms 102.0, 23.11 using rule: transitivity 2]

[129.0] (-30307 + -1 + 1) < (-176 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

→ *[simplify]*

[129.1] -30307 < (-176 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

→ *[literal comparison of product]*

[129.2] ([-176 < 0]: (-30307 / 176) < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot, [0 < -176]: (-30307 / -176) < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot, [-176 == 0]: -30307 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[129.3] ([-176 < 0]: (-30307 / 176) < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot, [(0 < -176) ∧ !(-176 < 0)]: (-30307 / -176) < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot, [(-176 == 0) ∧ !(-176 < 0) ∧ !(0 < -176)]: -30307 < 0)

→ *[simplify]*

[129.7] -173 < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot

[Create new term from terms 129.7, 75.1 using rule: transitivity 5]

[131.0] 32768 < ((-172 * (**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 % 176)) + (35 * −(-173 + 1)))

→ *[simplify]*

[131.5] 26748 < (-172 * (**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 % 176))

→ *[literal comparison of product]*

[131.6] ([-172 < 0]: (26748 / 172) < −(**this.**$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p2 % 176), [0 < -172]: (26748 / -172) < (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 % 176), [-172 == 0]: 26748 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[131.7] ([-172 < 0]: (26748 / 172) < −(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 % 176), [(0 < -172) ∧ !(-172 < 0)]: (26748 / -172) < (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 % 176), [(-172 == 0) ∧ !(-172 < 0) ∧ !(0 < -172)]: 26748 < 0)

→ *[simplify]*

[131.12] **false**

Proof of verification condition: Arithmetic result of operator '-' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (77,52)

Condition defined at:

To prove: ((\$heap$_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) ≤ **maxof**(**signed int**)

Given:

\$heap$_{init}$.LIMIT == (**int**)80

\$heap$_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

\$heap$_{init}$.**class** WHPrang ∈ r1 == (**int**)171

\$heap$_{init}$.**class** WHPrang ∈ a1 == (**int**)177

\$heap$_{init}$.**class** WHPrang ∈ b1 == (**int**)2

\$heap$_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

\$heap$_{init}$.**class** WHPrang ∈ r2 == (**int**)172

\$heap$_{init}$.**class** WHPrang ∈ a2 == (**int**)176

\$heap$_{init}$.**class** WHPrang ∈ b2 == (**int**)35

\$heap$_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

\$heap$_{init}$.**class** WHPrang ∈ r3 == (**int**)170

\$heap$_{init}$.**class** WHPrang ∈ a3 == (**int**)178

\$heap$_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,

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static_cast<int>(**operator*****(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator*****(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator*****(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator*****(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator*****(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a1) ≤
asType<integer>(**operator*****(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator*****(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator*****(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator*****(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator*****(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator*****(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a2) ≤
asType<integer>(**operator*****(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator*****(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3),

static_cast<int>($heap$_{funcstart_1032,1}$.a3))

(asType<integer>(**static_cast<int>**(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($heap$_{funcstart_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(asType<integer>(**static_cast<int>**(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($heap$_{funcstart_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(asType<integer>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3) <
asType<integer>($heap$_{funcstart_1032,1}$.a3)) =>
(asType<integer>(div3.rem) == **asType<integer>**(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3))

(asType<integer>($heap$_{funcstart_1032,1}$.a3) ≤
asType<integer>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) ≤ temp1

temp1 ≤ **maxof(signed int)**

$heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(this.$r →
operator*(**heapIs** $heap$_{funcstart_1032,1}$, **this**).**_replace**(p1 →
asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < **(int)**0))) +
temp1)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**

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$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**$<$**int**$>$($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**$<$**int**$>$((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 $<$ **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $<$ **asType**$<$**integer**$>$($\text{\$heap}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 $<$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 $<$ **asType**$<$**integer**$>$($\text{\$heap}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 $<$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 $<$ **asType**$<$**integer**$>$($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 $<$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 $<$ **asType**$<$**integer**$>$((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 $<$ $-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 $<$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 $<$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**$<$**int**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2), **static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast<int>**($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast<int>**($\$heap_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast<int>**((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType<integer>**(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2)) && (**asType<integer>**(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2) < **asType<integer>**($\$heap$.**class** WHPrang $\in$
M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<integer>($\$heap$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<integer>($\$heap_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<integer>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) $\wedge$ (0 <
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[25.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
asType<**integer**>(176)) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot)

$\rightarrow$ *[simplify]*

[25.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 / 176) ==
asType<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[25.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0]: $-($−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[25.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0]: $-($−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.7] ([0 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2]:
$-($−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) /
176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala < −**this**.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[25.7.2] **true**

[25.8] ([**false**]: $-($−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) / 176), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) / 176), [!(0 < $-$**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[from term 24.0, literala < $-$**this**.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[25.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[25.11.2] **true**

[25.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) / 176), [!**false**]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) / 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

$\rightarrow$ *[simplify]*

[25.17] 0 == ($-$div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot + (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 / 176))

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[26.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % **asType**<**integer**>(176)) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.2] (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[26.3] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), []: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[26.4] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

→ *[simplify]*

[26.7] ([0 < −**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

→ *[from term 24.0, literala < −**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[26.7.0] -2 < (0 + 0)

→ *[simplify]*

[26.7.2] **true**

[26.8] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < 0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

→ *[simplify]*

[26.11] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!(0 < −**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

→ *[from term 24.0, literala < −**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[26.11.0] -2 < (0 + 0)

→ *[simplify]*

[26.11.2] **true**

[26.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) % 176), [!**false**]:
asType<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) % 176)
== **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)

$\rightarrow$ *[simplify]*

[26.17] 0 == ($-$div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem + (**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2 % 176))

[Take given term]

[31.0] (**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)
< **asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[31.1] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[simplify]*

[31.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[const static or extern object]*

[31.3] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>(heap_{init}.a2)) => (**asType**<**integer**>(div2.rem) ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[31.4] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)176)) => (**asType**<**integer**>(div2.rem) ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[simplify]*

[31.9] (-176 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176)]*

[31.10] (-176 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) =>

($\mathbf{asType}$<$\mathbf{integer}$>(div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p2, 176).rem) ==
$\mathbf{asType}$<$\mathbf{integer}$>($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p2))

$\rightarrow$ *[simplify]*

[31.11] (-176 < $-\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p2) =>
(div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$).p2, 176).rem ==
$\mathbf{asType}$<$\mathbf{integer}$>($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[31.12] (-176 < $-\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p2) =>
(div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$).p2, 176).rem ==
$\mathbf{asType}$<$\mathbf{integer}$>($\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p2))

$\rightarrow$ *[simplify]*

[31.18] (0 == ($-\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p2 + div($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p2,
176).rem)) $\vee$ (175 < $\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p2)

[Take given term]

[50.0] (($\$\mathrm{heap}_{funcstart\_1032,1}$.r1 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.rem}$)) $-$
($\$\mathrm{heap}_{funcstart\_1032,1}$.b1 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.quot}$))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$\mathrm{heap}_{init}$.r1 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.rem}$)) $-$
($\$\mathrm{heap}_{funcstart\_1032,1}$.b1 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.quot}$))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($\mathbf{int}$)171 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.rem}$)) $-$
($\$\mathrm{heap}_{funcstart\_1032,1}$.b1 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.quot}$))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.rem}$)) $-$ ($\$\mathrm{heap}_{funcstart\_1032,1}$.b1
* $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.quot}$))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,*
$\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177)]

[50.4] ((171 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>(div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$,
$\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$
($\$\mathrm{heap}_{funcstart\_1032,1}$.b1 * $\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.quot}$))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div($\mathbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.$\$$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\mathrm{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$\mathrm{heap}_{funcstart\_1032,1}$.b1 *
$\mathbf{static\_cast}$<$\mathbf{signed\ int}$>($\mathrm{div1.quot}$))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\$\text{heap}_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 → **asType**<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →

this.\$r.value(heapIs \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((\$heap$_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType**<P1Type>(0 + temp1)))

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.**$\$r$.**value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ** *div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.**$\$r$.**value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) ≤ **maxof**(**signed int**)

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$\$r$ $\rightarrow$ **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.**$\$r$.**value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ** *div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.**$\$r$.**value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.1] (($\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ this.\$r.**value**(**heapIs**

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$\text{\$heap}_{funcstart\_1032,1})._\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1},$
$\textbf{this.\$r.value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$
$\text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\text{r2} * \textbf{static\_cast}\text{<}\textbf{signed}$
$\textbf{int}\text{>}(\text{div2.rem})) - (\text{\$heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\text{<}\textbf{signed}$
$\textbf{int}\text{>}(\text{div2.quot}))) \leq \textbf{maxof}(\textbf{signed int})$

$\rightarrow$ *[const member of object with modified fields]*

[1.2] $((\text{\$heap}_{funcstart\_1032,1}.\text{r2} * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.rem})) -$
$(\text{\$heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.quot}))) \leq$
$\textbf{maxof}(\textbf{signed int})$

$\rightarrow$ *[const static or extern object]*

[1.3] $((\text{\$heap}_{init}.\text{r2} * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.rem})) -$
$(\text{\$heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.quot}))) \leq$
$\textbf{maxof}(\textbf{signed int})$

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[1.4] $(((\textbf{int})172 * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.rem})) - (\text{\$heap}_{1032,1;1051,8}.\text{b2}$
$* \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.quot}))) \leq \textbf{maxof}(\textbf{signed int})$

$\rightarrow$ *[simplify]*

[1.5] $((172 * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.rem})) - (\text{\$heap}_{1032,1;1051,8}.\text{b2} *$
$\textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.quot}))) \leq \textbf{maxof}(\textbf{signed int})$

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,*
*this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176)]*

[1.6] $((172 * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1},$
$\textbf{this.\$r.value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem})) -$
$(\text{\$heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.quot}))) \leq$
$\textbf{maxof}(\textbf{signed int})$

$\rightarrow$ *[simplify]*

[1.7] $((172 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\text{\$heap}_{1032,1;1051,8}.\text{b2} *$
$\textbf{static\_cast}\text{<}\textbf{signed int}\text{>}(\text{div2.quot}))) \leq \textbf{maxof}(\textbf{signed int})$

$\rightarrow$ *[from term 53.19, \$heap$_{1032,1;1051,8}$ is equal to*
*\$heap$_{funcstart\_1032,1}$._replace(this.\$r $\rightarrow$ this.\$r.value(**heapIs***
*\$heap$_{funcstart\_1032,1}$)._replace(p1 $\rightarrow$ (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,*
*this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.value(**heapIs***
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))]

[1.8] $((172 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\text{\$heap}_{funcstart\_1032,1}._\textbf{replace}(\textbf{this.\$r}$
$\rightarrow \textbf{this.\$r.value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1})._\textbf{replace}(\text{p1} \rightarrow ((\text{-2} *$
$\text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$

$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) ≤ **maxof**(**signed int**)

→ *[const member of object with modified fields]*

[1.9] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.10] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot))) ≤ **maxof**(**signed int**)

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[1.11] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed int**>(div2.quot))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.12] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) ≤ **maxof**(**signed int**)

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]*

[1.13] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.30] -32768 < ((-172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) + (35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))

→ *[negate goal and search for contradiction]*

[1.31] !(-32768 < ((-172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) + (35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot)))

→ *[simplify]*

[1.36] 32767 < ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) + (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))

[Branch on disjunction or conditional in term 31.18]

[61.0] $(0 == (-\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 + \text{div}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2,$ $176).\text{rem})) \vee (175 < \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2) \vee !(0 ==$ $(-\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 + \text{div}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2,$ $176).\text{rem}))$

[Copy term 1.36]

[62.0] $(32767 < ((-35 * \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}).p2, 176).\text{quot}) + (172 * \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$ $\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2, 176).\text{rem}))) \vee (175 <$ $\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2) \vee !(0 ==$ $(-\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 + \text{div}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2,$ $176).\text{rem}))$

$\rightarrow$ *[from term 61.0, div(*$\textbf{heapIs }$ *$\$heap_{funcstart\_1032,1}$, this.$r.*$\textbf{value}$*(*$\textbf{heapIs}$ *$\$heap_{funcstart\_1032,1}$).p2, 176).rem is equal to* $\textbf{this.}\$r.\textbf{value}$*(*$\textbf{heapIs}$ *$\$heap_{funcstart\_1032,1}$).p2]*

[62.1] $(32767 < ((-35 * \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}).p2, 176).\text{quot}) + (172 * \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}).p2))) \vee ...$

[Copy term 26.17]

[63.0] $(0 == (-\text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}).p2, 176).\text{rem} + (\textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}).p2 \% 176))) \vee (175 < \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}).p2) \vee !(0 == (-\textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}).p2 + \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$ $\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2, 176).\text{rem}))$

$\rightarrow$ *[from term 61.0, div(*$\textbf{heapIs }$ *$\$heap_{funcstart\_1032,1}$, this.$r.*$\textbf{value}$*(*$\textbf{heapIs}$ *$\$heap_{funcstart\_1032,1}$).p2, 176).rem is equal to* $\textbf{this.}\$r.\textbf{value}$*(*$\textbf{heapIs}$ *$\$heap_{funcstart\_1032,1}$).p2]*

[63.1] $(0 == (-\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 +$ $(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 \% 176))) \vee ...$

[Assume known post-assertion, class invariant or type constraint for term 63.1]

[64.0] $(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 < 176) \vee (175 <$ $\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2) \vee !(0 ==$ $(-\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 + \text{div}(\textbf{heapIs }$ $\$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2,$ $176).\text{rem}))$

$\rightarrow$ *[simplify]*

[64.3] (-176 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) ∨ ...

[Copy term 62.1]

[70.0] (32767 < ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) ∨ (175 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) ∨ !(0 == (−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 + div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

→ *[from term 25.17, div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot is equal to **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 / 176]*

[70.1] (32767 < ((-35 * (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 / 176)) + (172 * **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) ∨ ...

→ *[division by larger divisor]*

Proof of rule precondition 1:

[70.1.0.0] literald < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

→ *[unify with term 64.3]*

[70.1.0.1] **true**

Proof of rule precondition 2:

[70.1.1.0] literalc < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

→ *[unify with term 24.0]*

[70.1.1.1] **true**

Proof of rule precondition 3:

[70.1.2.0] −-176 ≤ 176

→ *[simplify]*

[70.1.2.2] **true**

Proof of rule precondition 4:

[70.1.3.0] -2 < 0

→ *[simplify]*

[70.1.3.1] **true**

[70.2] (32767 < ((-35 * **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) + (172 * **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) ∨ ...

→ *[simplify]*

[70.4] (32767 < (137 * **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)) ∨ ...

→ *[literal comparison of product]*

[70.5] ([137 < 0]: (32767 / -137) < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, [0 < 137]: (32767 / 137) < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, [0 == 137]: 32767 < 0) ∨ ...

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[70.6] ([137 < 0]: (32767 / -137) < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, [(0 < 137) ∧ !(137 < 0)]: (32767 / 137) < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, [(0 == 137) ∧ !(0 < 137) ∧ !(137 < 0)]: 32767 < 0) ∨ ...

→ *[simplify]*

[70.13] (**true** ∧ (239 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)) ∨ ...

→ *[from term 64.3, literala < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 < (-176 + literala)]*

Proof of rule precondition:

[70.13.0] -2 < (-176 + 239)

→ *[simplify]*

[70.13.2] **true**

[70.14] (**true** ∧ **false**) ∨ ...

→ *[simplify]*

[70.15] **false** ∨ ...

[Remove 'false' term 70.15 and fetch new term from containing clause]

[71.0] 175 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Copy term 1.36]

[74.0] 32767 < ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem))

→ *[from term 26.17, div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem is equal to **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 % 176]*

[74.1] 32767 < ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 % 176)))

[Create new term from term 25.17 using rule: condition for equality of division]

[101.0] ((176 * (0 + −(−div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot))) < (1 + **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)) ∧ (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < (176 * (0 + 1 + −(−div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,

176).quot))))

→ *[simplify]*

[101.15] (-1 < ((-176 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2)) ∧ (-176 < (−**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 + (176 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)))

→ *[separate conjunction and work on first sub-term]*

[101.16] -176 < (−**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 + (176 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot))

[Create new term from terms 101.16, 71.0 using rule: transitivity 2]

[126.0] (-176 + 1 + 175) < (176 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

→ *[simplify]*

[126.1] 0 < (176 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)

→ *[product is positive]*

[126.2] ((0 < 176) ∧ (0 < div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot)) ∨ ((176 < 0) ∧ (div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot < 0))

→ *[simplify]*

[126.7] 0 < div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot

[Create new term from terms 126.7, 74.1 using rule: transitivity 11]

[129.0] (1 + 32767 + (0 * 35)) < (172 * (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 % 176))

→ *[simplify]*

[129.2] 32768 < (172 * (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 % 176))

→ *[literal comparison of product]*

[129.3] ([172 < 0]: (32768 / -172) < −(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 % 176), [0 < 172]: (32768 / 172) < (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 % 176), [0 == 172]: 32768 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[129.4] ([172 < 0]: (32768 / -172) < −(**this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1})$.p2 % 176), [(0 < 172) ∧ !(172 < 0)]: (32768 / 172) < (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 % 176), [(0 == 172) ∧ !(0 < 172) ∧ !(172 < 0)]: 32768 < 0)

→ *[simplify]*

[129.13] **false**

Proof of verification condition: Type constraint satisfied in explicit conversion from 'integer' to 'int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (78,18)

Condition defined at:

To prove: minof(int) ≤ static_cast<integer>(static_cast<signed int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0)

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang ∈ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang ∈ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang ∈ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang ∈ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang ∈ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator*****(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator*****(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator*****(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a1) ≤
asType<integer>(**operator*****(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator*****(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator*****(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator*****(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator*****(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator*****(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a2) ≤
asType<integer>(**operator*****(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator*****(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator*****(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(**asType<integer>**(**static_cast<int>**(**operator*****(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
operator*(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**)._**replace**(p1 →
asType<P1Type>(($\text{\$heap}_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\text{\$heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

239

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∧ (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,

static_cast<int>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2),
static_cast<int>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**(heap_{init}.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) < **asType<integer>**(heap.**class** WHPrang $\in$
M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>(heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>(heap_{init}.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) $\land$ (0 <
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2

[Take given term]

[50.0] (($heap$_{funcstart_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] (($heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($**int**$)171 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (($**int**$)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] $0 == (-\mathrm{temp1} + (\text{-2} * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},$ $\textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1},\ 177).\mathrm{quot}) + (171 *$ $\mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},\ \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1},\ 177).\mathrm{rem}))$

[Take given term]

[53.0] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\mathrm{r} \rightarrow$ $\textbf{operator}^*(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},\ \textbf{this}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}((\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{M1} *$ $\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},\ \textbf{this}).\mathrm{p1}) < (\textbf{int})0))) +$ $\mathrm{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\mathrm{r} \rightarrow$ $\textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}((\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{M1} *$ $\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},\ \textbf{this}).\mathrm{p1}) < (\textbf{int})0))) +$ $\mathrm{temp1})))$

$\rightarrow$ *[const static or extern object]*

[53.2] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\mathrm{r} \rightarrow$ $\textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}((\$\mathrm{heap}_{init}.\mathrm{M1} *$ $\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},\ \textbf{this}).\mathrm{p1}) < (\textbf{int})0))) +$ $\mathrm{temp1})))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\mathrm{r} \rightarrow$ $\textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}(((\textbf{int})30269 *$ $\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},\ \textbf{this}).\mathrm{p1}) < (\textbf{int})0))) +$ $\mathrm{temp1})))$

$\rightarrow$ *[simplify]*

[53.4] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\mathrm{r} \rightarrow$ $\textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}((30269 *$ $\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1},\ \textbf{this}).\mathrm{p1}) < (\textbf{int})0))) +$ $\mathrm{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r →
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r →
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r →
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r →
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r →
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r →
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r →
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →

asType<P1Type>(0 + ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] **minof(int)** $\leq$ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0)

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq$ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0)

$\rightarrow$ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to
$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.2] -32768 $\leq$ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0)

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.3] -32768 $\leq$ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0)

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[1.4] -32768 $\leq$ **static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r** ==
this.\$r]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.5] -32768 $\leq$ **static_cast<integer>**(**static_cast<signed int>**((([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 $\rightarrow$ (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0)

$\rightarrow$ *[simplify]*

[1.12] -32768 $\leq$ **static_cast<integer>**(0 < $-$**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2)

$\rightarrow$ *[from term 24.0, literala < $-$**this**.$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[1.12.0]* -2 < (0 + 0)
>
> $\rightarrow$ *[simplify]*
>
> *[1.12.2]* **true**

[1.13] -32768 $\leq$ **static_cast<integer>**(**false**)

$\rightarrow$ *[simplify]*

[1.14] -32768 $\leq$ ([**false**]: 1, []: 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.15] -32768 $\leq$ ([**false**]: 1, [**true**]: 0)

$\rightarrow$ *[simplify]*

[1.17] **true**

Proof of verification condition: Type constraint satisfied in explicit
conversion from 'integer' to 'int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(78,18)

Condition defined at:

To prove: static_cast<integer>(**static_cast<signed
int>**(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0) $\leq$ **maxof**(**int**)

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M1 == $(\textbf{int})30269$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r1 == $(\textbf{int})171$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a1 == $(\textbf{int})177$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b1 == $(\textbf{int})2$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M2 == $(\textbf{int})30307$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r2 == $(\textbf{int})172$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a2 == $(\textbf{int})176$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b2 == $(\textbf{int})35$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M3 == $(\textbf{int})30323$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r3 == $(\textbf{int})170$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a3 == $(\textbf{int})178$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b3 == $(\textbf{int})63$

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType$<$**integer**$>$(div1.quot)

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType$<$**integer**$>$(div1.rem)

(**asType**$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$
asType$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**$<$**integer**$>$(div1.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**$<$**integer**$>$(div1.quot))

!(0 == **asType**$<$**integer**$>$(div1.rem)) || !(0 ==
asType$<$**integer**$>$(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==

asType<integer>(div2.quot)

(asType<integer>(**static_cast<int>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(asType<integer>(div2.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(asType<integer>(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(asType<integer>(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(asType<integer>(div3.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) −
($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

$\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(this.$r →
operator*(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 →

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asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($heap$_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast**<**int**>($heap$_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast**<**int**>($heap$_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1) < **asType**<**integer**>($heap$.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <

asType<**integer**>($heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <
asType<**integer**>($heap$_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) ∧ (0 <
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2

[Take given term]

[50.0] (($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\text{\$heap}_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>((((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 $\rightarrow$ **asType**<P1Type>(0 + temp1)))

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(***heapIs** *$heap_{funcstart\_1032,1}$,* **this.$r.value***(***heapIs** *$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** *$heap_{funcstart_1032,1}$,* **this.$r.value***(***heapIs** *$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 $\rightarrow$ **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] **static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0) $\leq$ **maxof**(**int**)

$\rightarrow$ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}.\_$***replace***(***this.$r** $\rightarrow$ **this.$r.value***(***heapIs** *$heap_{funcstart_1032,1}$).$_$***replace***(p1 $\rightarrow$ (-2 * div(***heapIs** *$heap_{funcstart\_1032,1}$,*

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[1.1] **static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0) ≤ **maxof**(**int**)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.2] **static_cast**<**integer**>(**static_cast**<**signed int**>(**this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0) ≤ **maxof**(**int**)

→ *[evaluate dereferenced pointer into modified heap]*

[1.3] **static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r** == **this.$r**]:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0) ≤ **maxof**(**int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.4] **static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r** == **this.$r**]:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r** == **this.$r**)]:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0) ≤ **maxof**(**int**)

→ *[simplify]*

[1.11] **static_cast**<**integer**>(0 < −**this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2) ≤ **maxof**(**int**)

→ *[from term 24.0, literala < −**this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.11.0] -2 < (0 + 0)

→ *[simplify]*

[1.11.2] **true**

[1.12] **static_cast<integer>(false) ≤ maxof(int)**

→ *[simplify]*

[1.13] (**[false]**: 1, **[]**: 0) ≤ **maxof(int)**

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.14] (**[false]**: 1, **[true]**: 0) ≤ **maxof(int)**

→ *[simplify]*

[1.17] **true**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (78,32)

Condition defined at:

To prove: minof(signed int) ≤ ($heap$_{1032,1;1051,8}$.M2 * **asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs** $heap$_{1032,1;1051,8}$, **this).p2) < (int)0)))**

Given:

$heap$_{init}$.LIMIT == (**int**)80

$heap$_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$heap$_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$heap$_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$heap$_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$heap$_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$heap$_{init}$.**class** WHPrang ∈ r2 == (**int**)172

$heap$_{init}$.**class** WHPrang ∈ a2 == (**int**)176

$heap$_{init}$.**class** WHPrang ∈ b2 == (**int**)35

$heap$_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

$heap$_{init}$.**class** WHPrang ∈ r3 == (**int**)170

$heap$_{init}$.**class** WHPrang ∈ a3 == (**int**)178

$heap$_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **static_cast<int>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this).p1), static_cast<int>($heap$_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a1) ≤
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a2) ≤
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**

$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\$heap_{funcstart\_1032,1}$.a3))) $==$
asType$<$**integer**$>$(div3.quot)

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\$heap_{funcstart\_1032,1}$.a3))) $==$
asType$<$**integer**$>$(div3.rem)

(**asType**$<$**integer**$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) $<$
asType$<$**integer**$>$($\$heap_{funcstart\_1032,1}$.a3)) $=>$
(**asType**$<$**integer**$>$(div3.rem) $==$ **asType**$<$**integer**$>$(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**$<$**integer**$>$($\$heap_{funcstart\_1032,1}$.a3) $\leq$
asType$<$**integer**$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) $=>$
!(0 $==$ **asType**$<$**integer**$>$(div3.quot))

!(0 $==$ **asType**$<$**integer**$>$(div3.rem)) || !(0 $==$
asType$<$**integer**$>$(div3.quot))

temp1 $==$ ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ $==$ $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$\$$r $\rightarrow$
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**replace**(p1 $\rightarrow$
asType$<$P1Type$>$(($\$heap_{funcstart\_1032,1}$.M1 *
asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed
int**$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0))) +
temp1)))

temp2 $==$ ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**$<$**signed int**$>$(div2.rem)) $-$
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**$<$**signed int**$>$(div2.quot))

minof(**signed int**) $\leq$ temp2

temp2 $\leq$ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 $==$ div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast$<$**int**$>$($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 $==$ div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast$<$**int**$>$($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)).p2),

static_cast<int>($heap$_{funcstart_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2),
static_cast<int>($heap$_{funcstart_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast<int>**($heap$_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast<int>**($heap$_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast<int>**((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2)) && (**asType<integer>**(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2) < **asType<integer>**($heap.**class** WHPrang ∈
M2))

→ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 <
asType<integer>($heap.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 <
asType<integer>($heap$_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 <
asType<integer>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) ∧ (0 <
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

[Take given term]

[50.0] (($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$heap_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed**
int>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
operator*(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 →
asType<P1Type>(($\text{\$heap}_{funcstart\_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(($\text{\$heap}_{funcstart\_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[const static or extern object]*

[53.2] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(($\text{\$heap}_{init}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((((**int**)30269 *
asType<int>(**static_cast<integer>**(**static_cast<signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *

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asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this).p1) < (int)0))) + temp1)))**

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r →
this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace(p1 →
asType<P1Type>((30269 *
asType<int>(static_cast<integer>(static_cast<signed
int>(this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < (int)0))) + temp1)))**

→ *[simplify]*

[53.9] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r →
this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace(p1 →
asType<P1Type>((30269 * asType<int>(static_cast<integer>(0 <
−this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1))) + temp1)))**

→ *[from term 8.0, literala < −**this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[53.9.0]* -2 < (0 + 0)
>
> → *[simplify]*
>
> *[53.9.2]* **true**

[53.10] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r →
this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace(p1 →
asType<P1Type>((30269 * asType<int>(static_cast<integer>(false)))
+ temp1)))**

→ *[simplify]*

[53.11] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r →
this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace(p1 →
asType<P1Type>((30269 * asType<int>(([false]: 1, []: 0))) + temp1)))**

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r →
this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace(p1 →
asType<P1Type>((30269 * asType<int>(([false]: 1, [true]: 0))) +
temp1)))**

→ *[simplify]*

[53.15] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r →
this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace(p1 →
asType<P1Type>(0 + temp1)))**

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*

this.\$r.value(*heapIs \$heap$_{funcstart\_1032,1}$*).*p1, 177).quot) + (171 * div(***heapIs** \$heap$_{funcstart\_1032,1}$*, **this.\$r.value**(*heapIs \$heap$_{funcstart\_1032,1}$*).p1, 177).rem)]*

[53.16] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(0 + ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ (\$heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0)))

→ *[simplify]*

[1.1] -32768 ≤ (\$heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0)))

→ *[from term 53.19, \$heap$_{1032,1;1051,8}$ is equal to*
*\$heap$_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs***
*\$heap$_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(***heapIs** \$heap$_{funcstart\_1032,1}$,*
this.\$r.value(*heapIs \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(***heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs*
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))]

[1.2] -32768 ≤ (\$heap$_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0)))

→ *[const member of object with modified fields]*

[1.3] -32768 ≤ (\$heap$_{funcstart\_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0)))

→ *[const static or extern object]*

[1.4] $-32768 \leq (\$\text{heap}_{init}.\text{M2} *$
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[1.5] $-32768 \leq ((\textbf{int})30307 *$
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0)))

→ *[simplify]*

[1.6] $-32768 \leq (30307 *$
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0)))

→ *[from term 53.19, $\$\text{heap}_{1032,1;1051,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$.__replace(this.$r \rightarrow$ this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).__replace(p1 → (-2 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.7] $-32768 \leq (30307 *$
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$.__**replace(this.$r →** **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__**replace(p1 → (-2 * div(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.8] $-32768 \leq (30307 *$
asType<int>(static_cast<integer>(static_cast<signed int>(this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$.__**replace(this.$r →** **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__**replace(p1 → ((-2 * div(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0)))

→ *[evaluate dereferenced pointer into modified heap]*

[1.9] $-32768 \leq (30307 *$
asType<int>(static_cast<integer>(static_cast<signed int>(([this.$r == this.$r]: this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).__**replace(p1 → (-2 *** div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] $-32768 \leq (30307 \ *$
asType<int>(static_cast<integer>(static_cast<signed int>(([this.$r
== this.$r]: this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$**)._replace(**p1 $\rightarrow$ (-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r ==**
this.$r]: this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0)))

$\rightarrow$ *[simplify]*

[1.17] $-32768 \leq (30307 \ *$ **asType<int>(static_cast<integer>**(0 <
$-$**this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2)))

$\rightarrow$ *[from term 24.0, literala $< -$**this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[1.17.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.17.2] **true**

[1.18] $-32768 \leq (30307 \ *$ **asType<int>(static_cast<integer>(false)))**

$\rightarrow$ *[simplify]*

[1.19] $-32768 \leq (30307 \ *$ **asType<int>**(([**false**]: 1, []: 0)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.20] $-32768 \leq (30307 \ *$ **asType<int>**(([**false**]: 1, [**true**]: 0)))

$\rightarrow$ *[simplify]*

[1.24] **true**

Proof of verification condition: Arithmetic result of operator '*' is within
limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(78,32)

Condition defined at:

To prove: ($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) $\leq$
maxof(signed int)

Given:

$\$\text{heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M1 $==$ $(\textbf{int})30269$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r1 $==$ $(\textbf{int})171$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a1 $==$ $(\textbf{int})177$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b1 $==$ $(\textbf{int})2$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M2 $==$ $(\textbf{int})30307$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r2 $==$ $(\textbf{int})172$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a2 $==$ $(\textbf{int})176$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b2 $==$ $(\textbf{int})35$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M3 $==$ $(\textbf{int})30323$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r3 $==$ $(\textbf{int})170$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a3 $==$ $(\textbf{int})178$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b3 $==$ $(\textbf{int})63$

div1 $==$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) $==$
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) $==$
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1)) $=>$
(**asType<integer>**(div1.rem) $==$ **asType<integer>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<integer>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) $=>$
!(0 $==$ **asType<integer>**(div1.quot))

!(0 $==$ **asType<integer>**(div1.rem)) $||$!(0 $==$
asType<integer>(div1.quot))

div2 $==$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) $==$

asType<integer>(div2.quot)

(asType<integer>(static_cast<int>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(asType<integer>(div2.rem) == **asType<integer>(operator*(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(asType<integer>(static_cast<int>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(asType<integer>(static_cast<int>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(asType<integer>(div3.rem) == **asType<integer>(operator*(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3) $\leq$
asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) $-$
($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

$\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace(this.\$r** $\rightarrow$
operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$

asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($heap$_{1032,1;1051,8}$.r2 * **static_cast**<signed int>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<signed int>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast**<int>($heap$_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast**<int>($heap$_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast**<int>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<integer>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1)) && (**asType**<integer>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1) < **asType**<integer>($heap$.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <

asType<**integer**>($heap.**class** WHPrang ∈ M1))

→ [const static or extern object]

[7.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <
asType<**integer**>($heap$_{init}$.**class** WHPrang ∈ M1))

→ [expand definition of constant 'M1' at prang.cpp (28,26)]

[7.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ [simplify]

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) ∧ (0 <
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

→ [expand definition of operator '*' in class 'pointer' at built in declaration]

[18.1] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

→ [simplify]

[18.2] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{funcstart\_1032,1}$.a2))

→ [const static or extern object]

[18.3] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{init}$.a2))

→ [expand definition of constant 'a2' at prang.cpp (35,26)]

[18.4] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ [simplify]

[18.6] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**

$heap$_{funcstart_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < **asType**<**integer**>($heap.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>($heap.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>($heap$_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) ∧ (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2

[Take given term]

[50.0] (($heap$_{funcstart_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] (($heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}.$_**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\to$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}.$_**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}.$_**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\to$ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}.$_**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>(0 + temp1)))

$\to$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]

[53.16] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}.$_**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\to$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}.$_**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take goal term]

[1.0] ($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) $\leq$
maxof(**signed int**)

$\to$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*

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$heap_{funcstart\_1032,1}.\_$**replace**(this.$r \to$ this.$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[1.1] ($heap_{funcstart\_1032,1}.\_$**replace**(this.$r \to$ this.$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) ≤ **maxof**(**signed int**)

→ [const member of object with modified fields]

[1.2] ($heap_{funcstart\_1032,1}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) ≤ **maxof**(**signed int**)

→ [const static or extern object]

[1.3] ($heap_{init}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) ≤ **maxof**(**signed int**)

→ [expand definition of constant 'M2' at prang.cpp (33,26)]

[1.4] ((**int**)30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) ≤ **maxof**(**signed int**)

→ [simplify]

[1.5] (30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) ≤ **maxof**(**signed int**)

→ [from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}.\_$**replace**(this.$r \to$ this.$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[1.6] (30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}.\_$**replace**(this.$r \to$ this.$r.$**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) ≤ **maxof(signed int**)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.7] (30307 * **asType<int>(static_cast<integer>(static_cast<signed int>(this.$r.value(heapIs** $heap_{funcstart\_1032,1}$._**replace(this.$r** → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)._**replace(p1** → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) ≤ **maxof(signed int**)

→ *[evaluate dereferenced pointer into modified heap]*

[1.8] (30307 * **asType<int>(static_cast<integer>(static_cast<signed int>(([this.$r == this.$r]: this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)._**replace(p1** → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) ≤ **maxof(signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.9] (30307 * **asType<int>(static_cast<integer>(static_cast<signed int>(([this.$r == this.$r]: this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)._**replace(p1** → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r == this.$r**)]: **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) ≤ **maxof(signed int**)

→ *[simplify]*

[1.16] (30307 * **asType<int>(static_cast<integer>(0 < −this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2))) ≤ **maxof(signed int**)

→ *[from term 24.0, literala < −**this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.16.0] -2 < (0 + 0)

→ *[simplify]*

[1.16.2] **true**

[1.17] (30307 * **asType<int>(static_cast<integer>(false))) ≤ maxof(signed int**)

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$\rightarrow$ *[simplify]*

[1.18] (30307 * **asType<int>**((([**false**]: 1, []: 0))) $\leq$ **maxof(signed int)**

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.19] (30307 * **asType<int>**((([**false**]: 1, [**true**]: 0))) $\leq$ **maxof(signed int)**

$\rightarrow$ *[simplify]*

[1.24] **true**

Proof of verification condition: Arithmetic result of operator '+' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (78,16)

Condition defined at:

To prove: minof(signed int) $\leq$ ((\$heap$_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

Given:

\$heap$_{init}$.LIMIT == (**int**)80

\$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

\$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

\$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

\$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

\$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

\$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

\$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

\$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

\$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

\$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

\$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

\$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast<int>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1), **static_cast<int>**(\$heap$_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(asType<integer>(static_cast<int>(operator*(heapIs
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(asType<integer>(div1.rem) == **asType<integer>(operator*(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1) ≤
asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(asType<integer>(static_cast<int>(operator*(heapIs
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(asType<integer>(static_cast<int>(operator*(heapIs
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(asType<integer>(div2.rem) == **asType<integer>(operator*(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a2) ≤
asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a3))

(asType<integer>(static_cast<int>(operator*(heapIs
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) /

asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.$r →
operator*(**heapIs** $heap$_{funcstart_1032,1}$, **this**).**_replace**(p1 →
asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($heap$_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\land$ (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),

static_cast<int>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2),
static_cast<int>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**(heap_{init}.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType<integer>**(**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType<integer>**(**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2) < **asType<integer>**(\$heap.**class** WHPrang $\in$
M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>(heap_{init}.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) $\wedge$ (0 <
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Take given term]

[50.0] ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] ((\$heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) − (\$heap$_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 *

asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$\mathrm{heap}_{1032,1;1051,8}$ == $\$\mathrm{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.\$r.value**(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$\mathrm{heap}_{1032,1;1051,8}$ == $\$\mathrm{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.\$r.value**(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala < −**this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[53.9.0]* -2 < (0 + 0)
>
> $\rightarrow$ *[simplify]*
>
> *[53.9.2]* **true**

[53.10] $\$\mathrm{heap}_{1032,1;1051,8}$ == $\$\mathrm{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$\mathrm{heap}_{1032,1;1051,8}$ == $\$\mathrm{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$\mathrm{heap}_{1032,1;1051,8}$ == $\$\mathrm{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.15] $\$\mathrm{heap}_{1032,1;1051,8}$ == $\$\mathrm{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$\mathrm{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>(0 + temp1)))

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*

this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**).p1, 177).quot) + (171 ***
*div(***heapIs** $\$heap_{funcstart\_1032,1}$**, this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(p1 →**
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**).p1, 177).quot) + (171 ***
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.$r →**
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(p1 → ((-2 * div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).p1,**
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$.**_replace(this.$r →** **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**)._replace(p1 → (-2 * div(heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**).p1, 177).quot) + (171 ***
*div(***heapIs** $\$heap_{funcstart\_1032,1}$**, this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$.**_replace(this.$r →** **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**)._replace(p1 → ((-2 * div(heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**).p1, 177).quot) + (171 ***
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed**
int>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed**
int>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($\$heap_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.5] ((172 * **static_cast<signed int>**(div2.rem)) $-$ ($\$\mathrm{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) $-$ ($\$\mathrm{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.7] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$\mathrm{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\$\mathrm{heap}_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$heap_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**

$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[55.0] **minof**(**signed int**) ≤ temp2

→ *[simplify]*

[55.3] -32769 < temp2

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[55.4] -32769 < ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ (($\text{heap}_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

→ *[simplify]*

[1.1] -32768 ≤ (($\text{heap}_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.2] -32768 ≤ (($\text{heap}_{funcstart\_1032,1}$._**replace**(**this.$r** →

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[const member of object with modified fields]*

[1.3] -32768 $\leq$ (($\$heap_{funcstart\_1032,1}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[const static or extern object]*

[1.4] -32768 $\leq$ (($\$heap_{init}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[1.5] -32768 $\leq$ ((((**int**)30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[simplify]*

[1.6] -32768 $\leq$ ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.7] -32768 $\leq$ ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.8] -32768 $\leq$ ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)

→ *[evaluate dereferenced pointer into modified heap]*

[1.9] -32768 ≤ ((30307 * **asType<int>(static_cast<integer>(static_cast<signed int>**(([**this.$r == this.$r**]: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] -32768 ≤ ((30307 * **asType<int>(static_cast<integer>(static_cast<signed int>**(([**this.$r == this.$r**]: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r == this.$r**)]: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)

→ *[simplify]*

[1.17] -32768 ≤ ((30307 * **asType<int>(static_cast<integer>**(0 < −**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)

→ *[from term 24.0, literala < −**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.17.0] -2 < (0 + 0)

→ *[simplify]*

[1.17.2] **true**

[1.18] -32768 ≤ ((30307 * **asType<int>(static_cast<integer>(false)**)) + temp2)

→ *[simplify]*

[1.19] -32768 ≤ ((30307 * **asType<int>**(([**false**]: 1, []: 0))) + temp2)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.20] -32768 ≤ ((30307 * **asType<int>**(([**false**]: 1, [**true**]: 0))) + temp2)

→ *[simplify]*

[1.23] -32768 ≤ (0 + temp2)

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *

*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[1.24] -32768 ≤ (0 + ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))

→ *[simplify]*

[1.28] -32769 < ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

→ *[from term 55.4, literala < ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) is true whenever (-1 + literala) < -32769]*

Proof of rule precondition:

[1.28.0] (-32769 + -1) < -32769

→ *[simplify]*

[1.28.2] **true**

[1.29] **true**

Proof of verification condition: Arithmetic result of operator '+' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (78,16)

Condition defined at:

To prove: (($\$heap_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤ **maxof**(**signed int**))

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang ∈ b1 == (**int**)2

heap_{init}.**class** WHPrang $\in$ M2 == (**int**)30307

heap_{init}.**class** WHPrang $\in$ r2 == (**int**)172

heap_{init}.**class** WHPrang $\in$ a2 == (**int**)176

heap_{init}.**class** WHPrang $\in$ b2 == (**int**)35

heap_{init}.**class** WHPrang $\in$ M3 == (**int**)30323

heap_{init}.**class** WHPrang $\in$ r3 == (**int**)170

heap_{init}.**class** WHPrang $\in$ a3 == (**int**)178

heap_{init}.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) < **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a2)) => (**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a2) ≤ **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) => !(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 == **asType**<**integer**>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) / **asType**<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) % **asType**<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤ **asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$\$r$ → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −

($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(signed int) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\to$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 < \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1) \,\&\&$
$(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1 <$
$\textbf{asType}{<}\textbf{integer}{>}((\textbf{int})30269))$

$\to$ *[simplify]*

[7.10] $(\text{-}30269 < -\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1) \wedge (0 <$
$\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1)$

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 < \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1$

[Take given term]

[18.0] $div2 == \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator*}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this}).p2),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$heap_{funcstart\_1032,1}.a2))$

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] $div2 == \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$heap_{funcstart\_1032,1}.a2))$

$\to$ *[simplify]*

[18.2] $div2 == \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p2, \textbf{static\_cast}{<}\textbf{int}{>}(\$heap_{funcstart\_1032,1}.a2))$

$\to$ *[const static or extern object]*

[18.3] $div2 == \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p2, \textbf{static\_cast}{<}\textbf{int}{>}(\$heap_{init}.a2))$

$\to$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] $div2 == \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p2, \textbf{static\_cast}{<}\textbf{int}{>}((\textbf{int})176))$

$\to$ *[simplify]*

[18.6] $div2 == \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p2, 176)$

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] $(0 < \textbf{asType}{<}\textbf{integer}{>}(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p2)) \,\&\& \, (\textbf{asType}{<}\textbf{integer}{>}(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p2) < \textbf{asType}{<}\textbf{integer}{>}(\$heap.\textbf{class } WHPrang \in$
$M2))$

$\to$ *[simplify]*

[23.2] $(0 < \textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2) \,\&\&$
$(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2 <$

asType<**integer**>($heap.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] $(0 < $ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2) && ($ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2 $<$
asType<**integer**>($heap$_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 < $ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2) && ($ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2 $<$
asType<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] $(\text{-}30307 < -$**this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2) ∧ (0 <$
this.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 < $ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2

[Take given term]

[50.0] ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] ((\$heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) −
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).rem)) −
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem) − (\$heap$_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] $((171 * \mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - (\$\mathrm{heap}_{init}.\mathrm{b1} * \textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] $((171 * \mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - ((\textbf{int})2 * \textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[simplify]*

[50.8] $((171 * \mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - (2 * \textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\mathrm{div1.quot}))) == \mathrm{temp1}$

$\rightarrow$ *[from term 2.6, div1 is equal to div(*$\textbf{heapIs } \$heap_{funcstart\_1032,1}$, $\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1, 177)]$

[50.9] $((171 * \mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}) - (2 * \textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{quot}))) == \mathrm{temp1}$

$\rightarrow$ *[simplify]*

[50.14] $0 == (-\mathrm{temp1} + (\text{-}2 * \mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1},$ $\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{quot}) + (171 *$ $\mathrm{div}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$ $\$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p1}, 177).\mathrm{rem}))$

[Take given term]

[53.0] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$ $\textbf{operator}^*(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}((\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{M1} *$ $\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}).\mathrm{p1}) < (\textbf{int})0))) +$ $\mathrm{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$ $\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}((\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{M1} *$ $\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$ $\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}).\mathrm{p1}) < (\textbf{int})0))) +$ $\mathrm{temp1})))$

$\rightarrow$ *[const static or extern object]*

[53.2] $\$\mathrm{heap}_{1032,1;1051,8} == \$\mathrm{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$ $\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\mathrm{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\mathrm{p1} \rightarrow$ $\textbf{asType}{<}\mathrm{P1Type}{>}((\$\mathrm{heap}_{init}.\mathrm{M1} *$

asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(((**int**)30269 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<int>(**static_cast**<integer>(0 <
−**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<int>(**static_cast**<integer>(**false**)))
+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace***(**this.\$r** → **this.\$r.value***(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace***(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast<signed int>**(div2.rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($\$\text{heap}_{funcstart\_1032,1}$.r2 * **static_cast<signed int>**(div2.rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($\$\text{heap}_{init}$.r2 * **static_cast<signed int>**(div2.rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((**(int)**172 * **static_cast<signed int>**(div2.rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast<signed int>**(div2.rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast<signed int>**(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 53.19, $\$\text{heap}_{1032,1;1051,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$.__replace(this.\$r → this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).__replace(p1 → (-2 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\$\text{heap}_{funcstart\_1032,1}$.__**replace(this.**\$r → **this.**\$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - (\text{\$heap}_{funcstart\_1032,1}.b2 *$ **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - (\text{\$heap}_{init}.b2 *$ **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - ((\textbf{int})35 *$ **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.12] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - (35 *$ **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart_1032,1}).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - (35 *$ **static_cast<signed int>**(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).quot))) == temp2$

$\rightarrow$ *[simplify]*

[54.18] 0 == ($-$temp2 + (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).quot) + (172 *$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem))$

[Take given term]

[56.0] temp2 $\leq$ **maxof(signed int)**

$\rightarrow$ *[simplify]*

[56.9] -32768 < $-$temp2

$\rightarrow$ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2, 176).quot) + (172 * div(**heapIs** \$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart_1032,1}).p2, 176).rem)]*

[56.10] -32768 < $-$((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).quot) + (172 *$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem))$

$\rightarrow$ *[simplify]*

[56.13] -32768 < ((35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (-172 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))

[Take goal term]

[1.0] (($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[from term 53.19, $\$\text{heap}_{1032,1;1051,8}$ is equal to*
*$\$\text{heap}_{funcstart\_1032,1}$._**replace***(**this.**$r → **this.**$r.**value***(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$)._**replace***(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[1.1] (($\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[const member of object with modified fields]*

[1.2] (($\$\text{heap}_{funcstart\_1032,1}$.M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[const static or extern object]*

[1.3] (($\$\text{heap}_{init}$.M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[1.4] ((((**int**)30307 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[simplify]*

[1.5] ((30307 * **asType<int>**(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤

maxof(signed int)

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}$._**replace**(this.$r → this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.6] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$._**replace**(this.$r → this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2) ≤ **maxof(signed int**)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.7] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$._**replace**(this.$r → this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2) ≤ **maxof(signed int**)

→ *[evaluate dereferenced pointer into modified heap]*

[1.8] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r == this.$r**]: this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), []: this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2) ≤ **maxof(signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.9] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r == this.$r**]: this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r == this.$r**)]: this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2) ≤ **maxof(signed int**)

→ *[simplify]*

[1.16] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <

$-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[from term 24.0, literala $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.16.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.16.2] **true**

[1.17] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp2) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.18] ((30307 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp2) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.19] ((30307 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) + temp2) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.22] (0 + temp2) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[1.23] (0 + ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.39] -32768 < ((-172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) + (35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))

$\rightarrow$ *[from term 56.13, literala < ((-172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) + (35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot)) is true whenever (-1 + literala) < -32768]*

Proof of rule precondition:

[1.39.0] (-32768 + -1) < -32768

$\rightarrow$ *[simplify]*

[1.39.2] **true**

[1.40] **true**

Proof of verification condition: Type constraint satisfied in implicit conversion from 'signed int' to 'P2Type'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (78,16)

Condition defined at:

To prove: minof(signed int) $\leq$ **(($heap$_{1032,1;1051,8}$.M2 * asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $heap$_{1032,1;1051,8}$, this).p2) < (int)0))) + temp2)**

Given:

$heap$_{init}$.LIMIT == (int)80

$heap$_{init}$.**class** WHPrang $\in$ M1 == (int)30269

$heap$_{init}$.**class** WHPrang $\in$ r1 == (int)171

$heap$_{init}$.**class** WHPrang $\in$ a1 == (int)177

$heap$_{init}$.**class** WHPrang $\in$ b1 == (int)2

$heap$_{init}$.**class** WHPrang $\in$ M2 == (int)30307

$heap$_{init}$.**class** WHPrang $\in$ r2 == (int)172

$heap$_{init}$.**class** WHPrang $\in$ a2 == (int)176

$heap$_{init}$.**class** WHPrang $\in$ b2 == (int)35

$heap$_{init}$.**class** WHPrang $\in$ M3 == (int)30323

$heap$_{init}$.**class** WHPrang $\in$ r3 == (int)170

$heap$_{init}$.**class** WHPrang $\in$ a3 == (int)178

$heap$_{init}$.**class** WHPrang $\in$ b3 == (int)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **static_cast<int>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this).p1)**, **static_cast<int>(**$heap$_{funcstart\_1032,1}$.a1))

(**asType<integer>(static_cast<int>(operator*(heapIs** $heap$_{funcstart_1032,1}$, **this).p1)) / asType<integer>(static_cast<int>(**$heap$_{funcstart\_1032,1}$.a1))) == asType<integer>(div1.quot)**

(**asType<integer>(static_cast<int>(operator*(heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1) ≤
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %

asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a3) $\leq$ **asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

temp1 == ($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$\text{heap}_{1032,1;1051,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(this.\$r $\rightarrow$ **operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

temp2 == ($\text{heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\text{heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) $\leq$ temp2

temp2 $\leq$ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2),

static_cast<int>($heap$_{funcstart_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast<int>**($heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast<int>**($heap$_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast<int>**((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)) && (**asType<integer>**(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < **asType<integer>**($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType<integer>**($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType<integer>**($heap$_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType<integer>**((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) $\land$ (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2

[Take given term]

[50.0] (($heap$_{funcstart_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] (($heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($\mathbf{int}$)171 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (($\mathbf{int}$)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] $0 == (-\text{temp1} + (\text{-2} * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{this.\$r.value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$
$\text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))$

[Take given term]

[53.0] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}<\text{P1Type}>((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}<\text{P1Type}>((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[const static or extern object]*

[53.2] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}<\text{P1Type}>((\$\text{heap}_{init}.\text{M1} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}<\text{P1Type}>(((\textbf{int})30269 *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[simplify]*

[53.4] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}<\text{P1Type}>((30269 *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →

asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.__replace(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$.__replace(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($\$heap_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*

this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2, 176)]

[54.6] ((172 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.*__replace__*(this.$r → this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).*__replace__*(p1 → (-2 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.__replace__(**this.$r** → **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed
int>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value(heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[55.0] **minof(signed int)** ≤ temp2

→ *[simplify]*

[55.3] -32769 < temp2

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value(heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem)]*

[55.4] -32769 < ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value(heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem))

[Take goal term]

[1.0] **minof(signed int)** ≤ ((\$heap$_{1032,1;1051,8}$.M2 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

→ *[simplify]*

[1.1] -32768 ≤ ((\$heap$_{1032,1;1051,8}$.M2 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

→ *[from term 53.19, \$heap$_{1032,1;1051,8}$ is equal to
\$heap$_{funcstart\_1032,1}$.**_replace(this**.\$r → **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.2] -32768 ≤ ((\$heap$_{funcstart\_1032,1}$.**_replace(this**.\$r →
this.\$r.**value(heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value(heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<int>(static_cast<integer>(static_cast<signed

int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[const member of object with modified fields]*

[1.3] -32768 $\leq$ (($\$heap_{funcstart\_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[const static or extern object]*

[1.4] -32768 $\leq$ (($\$heap_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[1.5] -32768 $\leq$ (((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[simplify]*

[1.6] -32768 $\leq$ ((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to
$\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r \rightarrow$ **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[1.7] -32768 $\leq$ ((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r \rightarrow$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.8] -32768 $\leq$ ((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r \rightarrow$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).p2) < (**int**)0))) + temp2)

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[1.9] -32768 $\leq$ ((30307 *

asType\<int\>(static_cast\<integer\>(static_cast\<signed int\>(([this.\$r == this.\$r]: this.\$r.value(heapIs \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] -32768 ≤ ((30307 *
asType\<int\>(static_cast\<integer\>(static_cast\<signed int\>(([this.\$r == this.\$r]: this.\$r.value(heapIs \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r == this.\$r**)]: **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)

→ *[simplify]*

[1.17] -32768 ≤ ((30307 * **asType\<int\>(static_cast\<integer\>**(0 < −**this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p2))) + temp2)

→ *[from term 24.0, literala < −**this.\$r.value**(heapIs \$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.17.0] -2 < (0 + 0)

→ *[simplify]*

[1.17.2] **true**

[1.18] -32768 ≤ ((30307 * **asType\<int\>(static_cast\<integer\>(false)**)) + temp2)

→ *[simplify]*

[1.19] -32768 ≤ ((30307 * **asType\<int\>**(([**false**]: 1, []: 0))) + temp2)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.20] -32768 ≤ ((30307 * **asType\<int\>**(([**false**]: 1, [**true**]: 0))) + temp2)

→ *[simplify]*

[1.23] -32768 ≤ (0 + temp2)

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)]*

[1.24] -32768 ≤ (0 + ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 *

div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))

$\rightarrow$ *[simplify]*

[1.28] -32769 < ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

$\rightarrow$ *[from term 55.4, literala < ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.*$r.***value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(*heapIs* $\$heap_{funcstart\_1032,1}$, **this**.*$r.***value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) is true whenever (-1 + literala) < -32769]*

    Proof of rule precondition:

    [1.28.0] (-32769 + -1) < -32769

    $\rightarrow$ *[simplify]*

    [1.28.2] **true**

[1.29] **true**

Proof of verification condition: Type constraint satisfied in implicit
conversion from 'signed int' to 'P2Type'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(78,16)

Condition defined at:

To prove: (($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) $\leq$
maxof(**signed int**))

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}<\textbf{integer}>(\text{div2.quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div2.rem})) \;||\; !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}),$
$\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \;/$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div3.quot})$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \;\%$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div3.rem})$

$(\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}) <$
$\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) =>$
$(\textbf{asType}<\textbf{integer}>(\text{div3.rem}) == \textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}))$

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$
$\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) =>$
$!(0 == \textbf{asType}<\textbf{integer}>(\text{div3.quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div3.rem})) \;||\; !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div3.quot}))$

$\text{temp1} == (\$\text{heap}_{funcstart\_1032,1}.\text{r1} * \textbf{static\_cast}<\textbf{signed int}>(\text{div1.rem})) -$
$(\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}<\textbf{signed int}>(\text{div1.quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp1}$

$\text{temp1} \leq \textbf{maxof}(\textbf{signed int})$

$\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\text{this}.\$\text{r} \rightarrow$
$\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}<\text{P1Type}>((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\text{temp2} == (\$\text{heap}_{1032,1;1051,8}.\text{r2} * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.rem})) -$
$(\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp2}$

$\text{temp2} \leq \textbf{maxof}(\textbf{signed int})$

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(heap_{init}.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(heap.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>(heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>(heap_{init}.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <

asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) ∧ (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(\$heap.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] $(0 <$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 $<$
asType<**integer**>(heap_{init}.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 <$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 $<$
asType<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 $<$ $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) $\wedge$ (0 $<$
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 $<$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2

[Take given term]

[50.0] (($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] ((heap_{init}.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)]

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ (heap_{init}.b1 * **static_cast**<**signed
int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$\$$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → **asType**<P1Type>(($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala < $-$**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[53.9.0]* -2 < (0 + 0)
>
> $\rightarrow$ *[simplify]*
>
> *[53.9.2]* **true**

[53.10] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$ this.$r.**value**(*heapIs*
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$ this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed
int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.2] (($\text{\$heap}_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.3] (($\text{\$heap}_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((($\textbf{int}$)172 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$*).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)) $-$ ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.7] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.*_**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[56.0] temp2 ≤ **maxof**(**signed int**)

→ *[simplify]*

[56.9] -32768 < −temp2

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[56.10] -32768 < −((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

→ *[simplify]*

[56.13] -32768 < ((35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (-172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take goal term]

[1.0] (($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to
$heap$_{funcstart_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs**
$heap$_{funcstart_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r**.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))]*

[1.1] (($heap$_{funcstart_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs**
$heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r**.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[const member of object with modified fields]*

[1.2] (($heap$_{funcstart_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[const static or extern object]*

[1.3] (($heap$_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[1.4] ((((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[simplify]*

[1.5] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to
$heap$_{funcstart_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs**
$heap$_{funcstart_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,*

this.$r.value*(***heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 ***
*div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value***(***heapIs***
$\$heap_{funcstart\_1032,1}$*).p1, 177).rem)))]*

[1.6] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** →
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.7] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** →
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[evaluate dereferenced pointer into modified heap]*

[1.8] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(([**this.$r** == **this.$r**]: **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2) ≤ **maxof**(**signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.9] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(([**this.$r** == **this.$r**]: **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r** == **this.$r**)]:
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2) ≤
maxof(**signed int**)

→ *[simplify]*

[1.16] ((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2) ≤
maxof(**signed int**)

→ *[from term 24.0, literala < −**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.16.0] -2 < (0 + 0)

→ *[simplify]*

[1.16.2] **true**

[1.17] ((30307 * **asType<int>**(**static_cast<integer>**(**false**))) + temp2) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.18] ((30307 * **asType<int>**(([**false**]: 1, []: 0))) + temp2) ≤ **maxof**(**signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.19] ((30307 * **asType<int>**(([**false**]: 1, [**true**]: 0))) + temp2) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.22] (0 + temp2) ≤ **maxof**(**signed int**)

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[1.23] (0 + ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.39] -32768 < ((-172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) + (35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))

→ *[from term 56.13, literala < ((-172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) + (35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot)) is true whenever (-1 + literala) < -32768]*

Proof of rule precondition:

[1.39.0] (-32768 + -1) < -32768

→ *[simplify]*

[1.39.2] **true**

[1.40] **true**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (80,30)

Condition defined at:

To prove: minof(signed int) $\leq$ ($\text{\$heap}_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem))

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast<int>**(**operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) / **asType<integer>**(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) == **asType<integer>**(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) % **asType<integer>**(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) == **asType<integer>**(div1.rem)

(**asType<integer>**(**operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < **asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>

(asType\<integer\>(div1.rem) **== asType\<integer\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

!(0 == **asType\<integer\>**(div1.rem)) || !(0 ==
asType\<integer\>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(asType\<integer\>(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.quot)

(asType\<integer\>(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.rem)

(asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(asType\<integer\>(div2.rem) **== asType\<integer\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType\<integer\>**(div2.quot))

!(0 == **asType\<integer\>**(div2.rem)) || !(0 ==
asType\<integer\>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(asType\<integer\>(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.quot)

(asType\<integer\>(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.rem)

(asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(asType\<integer\>(div3.rem) **== asType\<integer\>**(**operator***(**heapIs**

$heap_{funcstart\_1032,1}$, **this**).p3))

($\textbf{asType}\textbf{<integer>}$($heap_{funcstart\_1032,1}$.a3) $\leq$
$\textbf{asType}\textbf{<integer>}$(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == $\textbf{asType}\textbf{<integer>}$(div3.quot))

!(0 == $\textbf{asType}\textbf{<integer>}$(div3.rem)) || !(0 ==
$\textbf{asType}\textbf{<integer>}$(div3.quot))

temp1 == ($heap_{funcstart\_1032,1}$.r1 * $\textbf{static\_cast}\textbf{<signed int>}$(div1.rem)) $-$
($heap_{funcstart\_1032,1}$.b1 * $\textbf{static\_cast}\textbf{<signed int>}$(div1.quot))

$\textbf{minof}(\textbf{signed int}) \leq$ temp1

temp1 $\leq \textbf{maxof}(\textbf{signed int})$

$heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 $\rightarrow$
$\textbf{asType}\textbf{<P1Type>}$(($heap_{funcstart\_1032,1}$.M1 *
$\textbf{asType}\textbf{<int>}$($\textbf{static\_cast}\textbf{<integer>}$($\textbf{static\_cast}\textbf{<signed}$
$\textbf{int>}$(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($heap_{1032,1;1051,8}$.r2 * $\textbf{static\_cast}\textbf{<signed int>}$(div2.rem)) $-$
($heap_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}\textbf{<signed int>}$(div2.quot))

$\textbf{minof}(\textbf{signed int}) \leq$ temp2

temp2 $\leq \textbf{maxof}(\textbf{signed int})$

$heap_{1032,1;1054,8}$ == $heap_{1032,1;1051,8}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $heap_{1032,1;1051,8}$, **this**).**_replace**(p2 $\rightarrow$
$\textbf{asType}\textbf{<P2Type>}$(($heap_{1032,1;1051,8}$.M2 *
$\textbf{asType}\textbf{<int>}$($\textbf{static\_cast}\textbf{<integer>}$($\textbf{static\_cast}\textbf{<signed}$
$\textbf{int>}$(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap_{funcstart\_1032,1}$,
$\textbf{static\_cast}\textbf{<int>}$(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1),
$\textbf{static\_cast}\textbf{<int>}$($heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap_{funcstart\_1032,1}$,
$\textbf{static\_cast}\textbf{<int>}$(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1),
$\textbf{static\_cast}\textbf{<int>}$($heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, $\textbf{static\_cast}\textbf{<int>}$($heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

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[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2),

static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>($heap$_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

→ *[simplify]*

[34.2] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$\text{heap}_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType<integer>**(**this**.$\$$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3)) && (**asType<integer>**(**this**.$\$$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3) < **asType<integer>**($\$\text{heap}$.**class** WHPrang ∈
M3))

→ *[simplify]*

[39.2] (0 < **this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3 <
asType<integer>($\$\text{heap}$.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3 <
asType<integer>($\$\text{heap}_{init}$.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3 <
asType<integer>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) $\land$ (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[42.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % **asType**<**integer**>(178)) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 % 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[42.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[42.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) < 0]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.7] ([0 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[from term 40.0, literala < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[42.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[42.7.2] **true**

[42.8] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) % 178), [!(**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) $<$ 0)]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) % 178) == **asType**$<$**integer**$>$(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.11] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) % 178), [!(0 $<$ $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) % 178) == **asType**$<$**integer**$>$(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[from term 40.0, literala $<$ $-$**this**.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p3 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[42.11.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[42.11.2] **true**

[42.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) % 178), [!**false**]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) % 178) == **asType**$<$**integer**$>$(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.17] 0 == ($-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem + (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 % 178))

[Take given term]

[50.0] (($heap_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($heap_{init}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast<signed int>**(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast<signed int>**(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{init}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed int>**(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$._**replace**(**this**.$r → **operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**)._**replace**(p1 →

asType<P1Type>((\$heap$_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((\$heap$_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((\$heap$_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.4] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$

asType\<P1Type\>((30269 * **asType**\<**int**\>(**static_cast**\<**integer**\>(0 < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ [from term 8.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ [simplify]

[53.9.2] **true**

[53.10] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>((30269 * **asType**\<**int**\>(**static_cast**\<**integer**\>(**false**))) + temp1)))

→ [simplify]

[53.11] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>((30269 * **asType**\<**int**\>((([**false**]: 1, []: 0))) + temp1)))

→ [explicitly assert falsehood of skipped guards in subsequent guards]

[53.12] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>((30269 * **asType**\<**int**\>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ [simplify]

[53.15] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>(0 + temp1)))

→ [from term 50.14, temp1 is equal to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)]

[53.16] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>(0 + ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ [simplify]

[53.19] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] ((\$heap$_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._replace(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._replace(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] ((\$heap$_{funcstart\_1032,1}$._replace(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed int**>(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] ((\$heap$_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] ((\$heap$_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

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$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$.**replace***(**this**.$r \rightarrow$ **this**.$r.**value***(**heapIs**
$\$heap_{funcstart\_1032,1}$*).**replace***(p1 \rightarrow (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value***(**heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value***(**heapIs**
$\$heap_{funcstart\_1032,1}$*).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r
$\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 *
static_cast<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed
int**>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed
int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value***(**heapIs** $\$heap_{funcstart\_1032,1}$*).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed
int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

$\rightarrow$ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{1032,1;1051,8}$._**replace**(**this.\$r** → **operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**)._**replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r → this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(heapIs $\text{\$heap}_{funcstart\_1032,1}$, this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $\text{\$heap}_{funcstart\_1032,1}$, this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.2] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** → **operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**)._**replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))._**replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** → ([**this.\$r** == **this.\$r**]: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**_replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** → ([**this.\$r** == **this.\$r**]: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r** == **this.\$r**)]: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**_replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace(p1** → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.8] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ **asType**<P2Type>((\$heap_{funcstart_1032,1}._**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[const member of object with modified fields]*

[57.9] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ **asType**<P2Type>((\$heap_{funcstart_1032,1}.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[const static or extern object]*

[57.10] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ **asType**<P2Type>((\$heap_{init}.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>((([**this.\$r**
== **this.\$r**]: **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).$\_$**replace**(p2 →
asType<P2Type>((30307 *
asType<int>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r**
== **this.$r**]: **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 → (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r** ==
this.$r**)]: **this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

[57.23] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.$\_$**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).$\_$**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).$\_$**replace**(p2 →
asType<P2Type>((30307 * **asType**<int>(**static_cast**<**integer**>(0 <
−**this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this.$r**.**value**(heapIs $heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.$\_$**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).$\_$**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).$\_$**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).$\_$**replace**(p2 →
asType<P2Type>((30307 * **asType**<int>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.**value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(0 + ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(this.$r → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.$r → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ ($heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem))

→ *[simplify]*

[1.1] -32768 ≤ ($heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem))

→ *[from term 57.33, $heap_{1032,1;1054,8}$ is equal to $heap_{funcstart\_1032,1}$._**replace**(this.$r → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.$r → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.2] -32768 ≤ ($heap_{funcstart\_1032,1}$._**replace**(this.$r → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.$r →

this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast<signed int>**(div3.rem))

→ *[const member of object with modified fields]*

[1.4] -32768 ≤ (\$heap$_{funcstart\_1032,1}$.r3 * **static_cast<signed int>**(div3.rem))

→ *[const static or extern object]*

[1.5] -32768 ≤ (\$heap$_{init}$.r3 * **static_cast<signed int>**(div3.rem))

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[1.6] -32768 ≤ ((**int**)170 * **static_cast<signed int>**(div3.rem))

→ *[simplify]*

[1.7] -32768 ≤ (170 * **static_cast<signed int>**(div3.rem))

→ *[from term 34.6, div3 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178)]*

[1.8] -32768 ≤ (170 * **static_cast<signed int>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem))

→ *[simplify]*

[1.11] -32769 < (170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem)

→ *[literal comparison of product]*

[1.12] ([170 < 0]: (-32769 / -170) < −div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem, [0 < 170]: (-32769 / 170) < div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem, [0 == 170]: -32769 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.13] ([170 < 0]: (-32769 / -170) < −div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem, [(0 < 170) ∧ !(170 < 0)]: (-32769 / 170) < div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem, [(0 == 170) ∧ !(0 < 170) ∧ !(170 < 0)]: -32769 < 0)

→ *[simplify]*

[1.21] -193 < div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem

$\rightarrow$ *[negate goal and search for contradiction]*

[1.22] !(-193 < div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[1.24] 192 < $-$div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem

[Create new term from terms 1.24, 42.17 using rule: transitivity 15]

[78.0] $(0 + 192) <$ $-($**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3 % 178)

$\rightarrow$ *[simplify]*

[78.2] **false**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (80,30)

Condition defined at:

To prove: ($\$\text{heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) $\leq$ **maxof**(**signed int**)

Given:

$\$\text{heap}_{init}$.LIMIT == (**int**)80

$\$\text{heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$\text{heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$\text{heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$\text{heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$\text{heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$\text{heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$\text{heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$\text{heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\$\text{heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\$\text{heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\$\text{heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\$\text{heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType<integer>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**($\$heap_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,

static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$\$r$ →
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$.**_replace**(this.$\$r$ →
operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(\$heap$_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $\land$ (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(heap_{init}.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 <

asType<**integer**>($heap$_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) ∧ (0 <
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a3))

→ *[simplify]*

[34.2] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, **static_cast**<**int**>($heap$_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, **static_cast**<**int**>($heap$_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) < **asType**<**integer**>($heap.**class** WHPrang ∈
M3))

→ *[simplify]*

[39.2] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 < $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) $\land$ (0 <
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] ((\$heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ (\$heap$_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ (\$heap$_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\text{\$heap}_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 → **asType**<P1Type>(($\text{\$heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(($\text{\$heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\to$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\to$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\to$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\to$ *[from term 8.0, literala < $-$**this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

$\to$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

→ *[simplify]*

[53.11] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\text{\$heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast<signed int>**(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.2] (($heap_{funcstart\_1032,1}$.r2 * **static_cast<signed int>**(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.3] (($heap_{init}$.r2 * **static_cast<signed int>**(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast<signed int>**(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.5] ((172 * **static_cast<signed int>**(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]

[54.6] ((172 * **static_cast<signed int>**(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.7] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}$._**replace**(this.$r → **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$.**_replace**(**this**.$\$$r → **operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).**_replace**(p2 → **asType<P2Type>**(($\$heap_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.2] $\$heap_{1032,1;1054,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**)._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$heap_{1032,1;1054,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$heap_{1032,1;1054,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r → ([**this**.\$r == **this**.\$r]: **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []: **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$))._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$heap_{1032,1;1054,8} == \$heap_{funcstart\_1032,1}$._**replace**(this.\$r →

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → ([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r == **this**.$r)]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$))._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.8] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(($\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[const member of object with modified fields]*

[57.9] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.$r** $\rightarrow$
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** $\rightarrow$
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{funcstart\_1032,1}$.M2 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[const static or extern object]*

[57.10] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.$r** $\rightarrow$
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** $\rightarrow$
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{init}$.M2 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.$r** $\rightarrow$
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** $\rightarrow$
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
asType<P2Type>((((**int**)30307 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.12] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r.value(heapIs***
*$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →

asType<P2Type>((30307 *
asType<int>(static_cast<integer>(static_cast<signed
int>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r
== **this**.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r
== **this**.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

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[57.23] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** $\to$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.$r** $\to$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 $\to$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)))

$\to$ *[from term 24.0, literala $< -$**this.**r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p2*
is false whenever -2 $< (0 +$ literala)]

Proof of rule precondition:

[57.23.0] -2 $< (0 + 0)$

$\to$ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** $\to$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.$r** $\to$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 $\to$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

$\to$ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** $\to$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.$r** $\to$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 $\to$
asType<P2Type>((30307 * **asType**<**int**>(((**[false]**: 1, **[]**: 0))) + temp2)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** $\to$

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(*$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this**.$r →

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] ($\$\text{heap}_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) ≤ **maxof**(**signed int**)

→ *[from term 57.33, $\$\text{heap}_{1032,1;1054,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$.__replace(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 → (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.1] ($\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast<signed int>**(div3.rem)) ≤ **maxof**(**signed int**)

→ *[const member of object with modified fields]*

[1.3] ($\$\text{heap}_{funcstart\_1032,1}$.r3 * **static_cast<signed int>**(div3.rem)) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.4] ($\$\text{heap}_{init}$.r3 * **static_cast<signed int>**(div3.rem)) ≤ **maxof**(**signed int**)

$\rightarrow$ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[1.5] $((\mathbf{int})170 * \mathbf{static\_cast{<}signed\ int{>}}(\text{div3.rem})) \leq \mathbf{maxof}(\mathbf{signed\ int})$

$\rightarrow$ *[simplify]*

[1.6] $(170 * \mathbf{static\_cast{<}signed\ int{>}}(\text{div3.rem})) \leq \mathbf{maxof}(\mathbf{signed\ int})$

$\rightarrow$ *[from term 34.6, div3 is equal to div($\mathbf{heapIs}$ \$heap$_{funcstart\_1032,1}$,* $\mathbf{this.\$r.value}(\mathbf{heapIs}$ *\$heap$_{funcstart\_1032,1}$).p3, 178)]*

[1.7] $(170 * \mathbf{static\_cast{<}signed\ int{>}}(\text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$ $\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem})) \leq \mathbf{maxof}(\mathbf{signed}$ $\mathbf{int})$

$\rightarrow$ *[simplify]*

[1.18] $\text{-}32768 < (\text{-}170 * \text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem})$

$\rightarrow$ *[literal comparison of product]*

[1.19] $([\text{-}170 < 0]: (\text{-}32768\ /\ 170) < -\text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$ $\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem}, [0 < \text{-}170]: (\text{-}32768\ /$ $\text{-}170) < \text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem}, [\text{-}170 == 0]: \text{-}32768 < 0)$

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.20] $([\text{-}170 < 0]: (\text{-}32768\ /\ 170) < -\text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$ $\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem}, [(0 < \text{-}170) \wedge !(\text{-}170$ $< 0)]: (\text{-}32768\ /\ \text{-}170) < \text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$ $\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem}, [(\text{-}170 == 0) \wedge$ $!(\text{-}170 < 0) \wedge !(0 < \text{-}170)]: \text{-}32768 < 0)$

$\rightarrow$ *[simplify]*

[1.24] $\text{-}193 < -\text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem}$

$\rightarrow$ *[negate goal and search for contradiction]*

[1.25] $!(\text{-}193 < -\text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem})$

$\rightarrow$ *[simplify]*

[1.28] $192 < \text{div}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}).\text{p3}, 178).\text{rem}$

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[42.0] $(\mathbf{asType{<}integer{>}}(\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\text{p3})\ \%$ $\mathbf{asType{<}integer{>}}(178)) == \mathbf{asType{<}integer{>}}(\text{div}(\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\text{p3},$ $178).\text{rem})$

$\rightarrow$ *[simplify]*

[42.2] (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 % 178) ==
asType<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[42.3] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) %
178), []: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)
% 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[42.4] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) %
178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) %
178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.7] ([0 < $-$**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3]:
$-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) %
178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) %
178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[from term 40.0, literala < $-$**this.**$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p3
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[42.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[42.7.2] **true**

[42.8] ([**false**]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3) % 178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).rem)

$\rightarrow$ *[simplify]*

[42.11] ([**false**]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3) % 178), [!(0 < $-$**this.**$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p3)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem)

→ *[from term 40.0, literala < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[42.11.0] -2 < (0 + 0)

→ *[simplify]*

[42.11.2] **true**

[42.12] ([**false**]: −(−**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3) % 178), [!**false**]:
asType<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178)
== **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

→ *[simplify]*

[42.17] 0 == (−div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem + (**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3 % 178))

→ *[remainder is less than divisor]*

Proof of rule precondition:

[42.17.0] (178 + −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) ≤ 0

→ *[simplify]*

[42.17.11] 177 < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem

→ *[from term 1.28, literala < div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem is true whenever
(-1 + literala) < 192]*

Proof of rule precondition:

[42.17.11.0] (-1 + 177) < 192

→ *[simplify]*

[42.17.11.2] **true**

[42.17.12] **true**

[42.18] **false**

Proof of verification condition: Arithmetic result of operator '*' is within

limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (80,57)

Condition defined at:

To prove: minof(signed int) $\leq$ ($\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

Given:

heap_{init}.LIMIT == (**int**)80

heap_{init}.**class** WHPrang $\in$ M1 == (**int**)30269

heap_{init}.**class** WHPrang $\in$ r1 == (**int**)171

heap_{init}.**class** WHPrang $\in$ a1 == (**int**)177

heap_{init}.**class** WHPrang $\in$ b1 == (**int**)2

heap_{init}.**class** WHPrang $\in$ M2 == (**int**)30307

heap_{init}.**class** WHPrang $\in$ r2 == (**int**)172

heap_{init}.**class** WHPrang $\in$ a2 == (**int**)176

heap_{init}.**class** WHPrang $\in$ b2 == (**int**)35

heap_{init}.**class** WHPrang $\in$ M3 == (**int**)30323

heap_{init}.**class** WHPrang $\in$ r3 == (**int**)170

heap_{init}.**class** WHPrang $\in$ a3 == (**int**)178

heap_{init}.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

($\mathbf{asType}\text{<}\mathbf{integer}\text{>}$($\$\text{heap}_{funcstart\_1032,1}$.a3) $\leq$
$\mathbf{asType}\text{<}\mathbf{integer}\text{>}$($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p3)) =>
!(0 == $\mathbf{asType}\text{<}\mathbf{integer}\text{>}$(div3.quot))

!(0 == $\mathbf{asType}\text{<}\mathbf{integer}\text{>}$(div3.rem)) || !(0 ==
$\mathbf{asType}\text{<}\mathbf{integer}\text{>}$(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * $\mathbf{static\_cast}\text{<}\mathbf{signed\ int}\text{>}$(div1.rem)) −
($\$\text{heap}_{funcstart\_1032,1}$.b1 * $\mathbf{static\_cast}\text{<}\mathbf{signed\ int}\text{>}$(div1.quot))

$\mathbf{minof}(\mathbf{signed\ int}) \leq$ temp1

temp1 $\leq \mathbf{maxof}(\mathbf{signed\ int})$

$\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.$\mathbf{\_replace}$(this.\$r $\rightarrow$
$\mathbf{operator}$*($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).$\mathbf{\_replace}$(p1 $\rightarrow$
$\mathbf{asType}\text{<}\mathbf{P1Type}\text{>}$(($\$\text{heap}_{funcstart\_1032,1}$.M1 *
$\mathbf{asType}\text{<}\mathbf{int}\text{>}$($\mathbf{static\_cast}\text{<}\mathbf{integer}\text{>}$($\mathbf{static\_cast}\text{<}\mathbf{signed}$
$\mathbf{int}\text{>}$($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p1) < ($\mathbf{int}$)0))) +
temp1)))

temp2 == ($\$\text{heap}_{1032,1;1051,8}$.r2 * $\mathbf{static\_cast}\text{<}\mathbf{signed\ int}\text{>}$(div2.rem)) −
($\$\text{heap}_{1032,1;1051,8}$.b2 * $\mathbf{static\_cast}\text{<}\mathbf{signed\ int}\text{>}$(div2.quot))

$\mathbf{minof}(\mathbf{signed\ int}) \leq$ temp2

temp2 $\leq \mathbf{maxof}(\mathbf{signed\ int})$

$\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{1032,1;1051,8}$.$\mathbf{\_replace}$(this.\$r $\rightarrow$
$\mathbf{operator}$*($\mathbf{heapIs}$ $\$\text{heap}_{1032,1;1051,8}$, $\mathbf{this}$).$\mathbf{\_replace}$(p2 $\rightarrow$
$\mathbf{asType}\text{<}\mathbf{P2Type}\text{>}$(($\$\text{heap}_{1032,1;1051,8}$.M2 *
$\mathbf{asType}\text{<}\mathbf{int}\text{>}$($\mathbf{static\_cast}\text{<}\mathbf{integer}\text{>}$($\mathbf{static\_cast}\text{<}\mathbf{signed}$
$\mathbf{int}\text{>}$($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\text{heap}_{1032,1;1051,8}$, $\mathbf{this}$).p2) < ($\mathbf{int}$)0))) + temp2)))

Proof:

[Take given term]

[2.0] div1 == div($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$,
$\mathbf{static\_cast}\text{<}\mathbf{int}\text{>}$($\mathbf{operator}$*($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\mathbf{this}$).p1),
$\mathbf{static\_cast}\text{<}\mathbf{int}\text{>}$($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$,
$\mathbf{static\_cast}\text{<}\mathbf{int}\text{>}$($\mathbf{this}$.\$r.$\mathbf{value}$($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p1),
$\mathbf{static\_cast}\text{<}\mathbf{int}\text{>}$($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.\$r.$\mathbf{value}$($\mathbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}$).p1, $\mathbf{static\_cast}\text{<}\mathbf{int}\text{>}$($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div($\mathbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\mathbf{this}$.\$r.$\mathbf{value}$($\mathbf{heapIs}$

$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\text{\$heap}$.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$\text{heap}_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\$\text{heap}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\$\text{heap}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\$\text{heap}_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**)).p3,

static_cast<int>($heap$_{funcstart_1032,1}$.a3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3),
static_cast<int>($heap$_{funcstart_1032,1}$.a3))

→ *[simplify]*

[34.2] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, **static_cast<int>**($heap$_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, **static_cast<int>**($heap$_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, **static_cast<int>**((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3)) && (**asType<integer>**(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3) < **asType<integer>**($heap.**class** WHPrang ∈
M3))

→ *[simplify]*

[39.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 <
asType<integer>($heap.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 <
asType<integer>($heap$_{init}$.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 <
asType<integer>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) ∧ (0 <
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[41.0] (**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) /
asType<**integer**>(178)) == **asType**<**integer**>(div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).quot)

$\rightarrow$ *[simplify]*

[41.2] (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 / 178) ==
asType<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[41.3] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) /
178), []: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[41.4] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) /
178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.7] ([0 < −**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3]:
−(−**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) /
178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[from term 40.0, literala < −**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[41.7.2] **true**

[41.8] ([**false**]: −(−**asType**<**integer**>(**this.**$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p3) / 178), [!(**asType**<**integer**>(**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.11] ([**false**]: $-(-$**asType**<**integer**>(**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) / 178), [!(0 < $-$**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3)]: **asType**<**integer**>(**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[from term 40.0, literala < $-$**this.$r.value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[41.11.2] **true**

[41.12] ([**false**]: $-(-$**asType**<**integer**>(**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) / 178), [!**false**]: **asType**<**integer**>(**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.17] 0 == ($-$div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot + (**this.$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 / 178))

[Take given term]

[50.0] (($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\text{\$heap}_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b1

* **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +

temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala* $<$ $-$**this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)*.p1 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$._**replace**(this.$r $\rightarrow$
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType$<$P1Type$>$((30269 * **asType**$<$**int**$>$(**static_cast**$<$**integer**$>$(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$._**replace**(this.$r $\rightarrow$
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType$<$P1Type$>$((30269 * **asType**$<$**int**$>$((([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$._**replace**(this.$r $\rightarrow$
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType$<$P1Type$>$((30269 * **asType**$<$**int**$>$((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.15] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$._**replace**(this.$r $\rightarrow$
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType$<$P1Type$>$(0 + temp1)))

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(***heapIs** $heap_{funcstart\_1032,1}$,
this.r.**value**(*heapIs* $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(***heapIs** $heap_{funcstart\_1032,1}$, ***this.**r.**value**(*heapIs*
$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$._**replace**(this.$r $\rightarrow$
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType$<$P1Type$>$(0 + ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}$._**replace**(this.$r $\rightarrow$
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($heap$_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to*
$heap$_{funcstart_1032,1}$.__replace(this.$r → this.$r.value(heapIs
*$heap$_{funcstart_1032,1}$).__replace(p1 → (-2 * div(heapIs $heap$_{funcstart_1032,1}$,*
this.$r.value(heapIs *$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs***
$heap$_{funcstart_1032,1}$).p1, 177).rem)))]

[54.1] (($heap$_{funcstart_1032,1}$.__replace(**this.$r → this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed**
int>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed**
int>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($heap$_{funcstart_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($heap$_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$,*
this.$r.value(heapIs *$heap$_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p2, 176).rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to*
$heap$_{funcstart_1032,1}$.__replace(this.$r → this.$r.value(heapIs

$heap_{funcstart\_1032,1}$)._**replace***(p1 → (-2 * div(***heapIs** $heap_{funcstart\_1032,1}$*,* **this.$r.value***(***heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(***heapIs** $heap_{funcstart\_1032,1}$*,* **this.$r.value***(***heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(***heapIs** $heap_{funcstart\_1032,1}$*,* **this.$r.value***(***heapIs** $heap_{funcstart\_1032,1}$*).p2, 176)]*

[54.13] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$.**_replace(this.\$r** →
operator*(heapIs $\$heap_{1032,1;1051,8}$, **this).**_**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator*(heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r**.value(heapIs*
*$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(heapIs $\$heap_{funcstart\_1032,1}$,*
*this.\$r**.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(heapIs $\$heap_{funcstart\_1032,1}$, **this.\$r**.value(heapIs*
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.2] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.**value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** → **operator*(heapIs**
$\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r**.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator*(heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.**value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.**value(heapIs** $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.**value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator*(heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.**value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r**.**value(heapIs**

$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to*
*$heap_{funcstart\_1032,1}$.**_replace***(**this**.$r → **this**.$r.**value***(**heapIs***
*$heap_{funcstart\_1032,1}$).**_replace***(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.$r.**value***(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value***(**heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to*
$heap$_{funcstart_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,*
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 **
div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))]*

[57.13] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ [*expand definition of operator '*' in class 'pointer' at built in declaration*]

[57.14] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ [*evaluate dereferenced pointer into modified heap*]

[57.15] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.**$r
== **this.**$r]: **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ [*explicitly assert falsehood of skipped guards in subsequent guards*]

[57.16] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>((([**this.\$r**
== **this.\$r**]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r** ==
this.\$r)]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ [simplify]

[57.23] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2))) + temp2)))

→ [from term 24.0, literala < −**this.\$r.value**(heapIs $heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ [simplify]

[57.23.2] **true**

[57.24] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ [simplify]

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[57.25] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\$heap_{1032,1;1054,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 + ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ ($heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

→ *[simplify]*

[1.1] -32768 ≤ ($heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

→ *[from term 57.33, $heap_{1032,1;1054,8}$ is equal to $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.2] -32768 ≤ ($heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).$\_$**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).$\_$**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast<signed**
int>(div3.quot))

→ *[const member of object with modified fields]*

[1.4] -32768 ≤ ($\text{heap}_{funcstart\_1032,1}$.b3 * **static_cast<signed**
int>(div3.quot))

→ *[const static or extern object]*

[1.5] -32768 ≤ (heap_{init}.b3 * **static_cast<signed int>**(div3.quot))

→ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[1.6] -32768 ≤ ((**int**)63 * **static_cast<signed int>**(div3.quot))

→ *[simplify]*

[1.7] -32768 ≤ (63 * **static_cast<signed int>**(div3.quot))

→ *[from term 34.6, div3 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178)]*

[1.8] -32768 ≤ (63 * **static_cast<signed int>**(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot))

→ *[simplify]*

[1.11] -32769 < (63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

→ *[literal comparison of product]*

[1.12] ([63 < 0]: (-32769 / -63) < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot, [0 < 63]: (-32769 /
63) < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot, [0 == 63]: -32769 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.13] ([63 < 0]: (-32769 / -63) < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot, [(0 < 63) ∧ !(63 <
0)]: (-32769 / 63) < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot, [(0 == 63) ∧ !(0 < 63) ∧ !(63 < 0)]:
-32769 < 0)

→ *[simplify]*

[1.21] -521 < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot

→ *[negate goal and search for contradiction]*

[1.22] !(-521 < div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

→ *[simplify]*

[1.24] 520 < −div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot

[Create new term from terms 1.24, 41.17 using rule: transitivity 15]

[77.0] (0 + 520) < −(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 / 178)

→ *[simplify]*

[77.7] 92560 < −**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

→ *[from term 40.0, literala < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[77.7.0] -2 < (0 + 92560)

→ *[simplify]*

[77.7.2] **true**

[77.8] **false**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (80,57)

Condition defined at:

To prove: (\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot)) ≤ **maxof**(**signed int**)

Given:

heap_{init}.LIMIT == (**int**)80

heap_{init}.**class** WHPrang ∈ M1 == (**int**)30269

heap_{init}.**class** WHPrang ∈ r1 == (**int**)171

heap_{init}.**class** WHPrang ∈ a1 == (**int**)177

heap_{init}.**class** WHPrang ∈ b1 == (**int**)2

heap_{init}.**class** WHPrang ∈ M2 == (**int**)30307

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r2 == $(\textbf{int})172$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a2 == $(\textbf{int})176$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b2 == $(\textbf{int})35$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M3 == $(\textbf{int})30323$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r3 == $(\textbf{int})170$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a3 == $(\textbf{int})178$

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b3 == $(\textbf{int})63$

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType$<$**integer**$>$(div1.quot)

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType$<$**integer**$>$(div1.rem)

(**asType**$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$
asType$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**$<$**integer**$>$(div1.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**$<$**integer**$>$(div1.quot))

!(0 == **asType**$<$**integer**$>$(div1.rem)) || !(0 ==
asType$<$**integer**$>$(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType$<$**integer**$>$(div2.quot)

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType$<$**integer**$>$(div2.rem)

(**asType**$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) $<$

asType$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**$<$**integer**$>$(div2.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a2) $\leq$
asType$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**$<$**integer**$>$(div2.quot))

!(0 == **asType**$<$**integer**$>$(div2.rem)) || !(0 ==
asType$<$**integer**$>$(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a3))

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType$<$**integer**$>$(div3.quot)

(**asType**$<$**integer**$>$(**static_cast**$<$**int**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType$<$**integer**$>$(**static_cast**$<$**int**$>$($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType$<$**integer**$>$(div3.rem)

(**asType**$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3) $<$
asType$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a3)) =>
(**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**$<$**integer**$>$($\text{\$heap}_{funcstart\_1032,1}$.a3) $\leq$
asType$<$**integer**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**$<$**integer**$>$(div3.quot))

!(0 == **asType**$<$**integer**$>$(div3.rem)) || !(0 ==
asType$<$**integer**$>$(div3.quot))

temp1 == ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$
($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(this.\$r $\rightarrow$
operator*(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).**replace**(p1 $\rightarrow$
asType$<$P1Type$>$(($\text{\$heap}_{funcstart\_1032,1}$.M1 *
asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed
int**$>$(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) $<$ (**int**)0))) +
temp1)))

temp2 == ($\text{\$heap}_{1032,1;1051,8}$.r2 * **static_cast**$<$**signed int**$>$(div2.rem)) $-$
($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**$<$**signed int**$>$(div2.quot))

minof(signed int) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

$\$heap_{1032,1;1054,8} ==$ $\$heap_{1032,1;1051,8}$.__replace__(this.$r $\to$
operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).__replace__(p2 $\to$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\to$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\to$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\to$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\to$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap.**class** WHPrang $\in$
M1))

$\to$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}) \,\&\&$
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1} <$
$\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{init}.\textbf{class } \text{WHPrang} \in \text{M1}))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}) \,\&\&$
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1} <$
$\textbf{asType}{<}\textbf{integer}{>}((\textbf{int})30269))$

$\rightarrow$ *[simplify]*

[7.10] $(\text{-}30269 < -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}) \land (0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1})$

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}$

[Take given term]

[18.0] $\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] $\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$\rightarrow$ *[simplify]*

[18.2] $\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, \textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$\rightarrow$ *[const static or extern object]*

[18.3] $\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, \textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{init}.\text{a2}))$

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] $\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, \textbf{static\_cast}{<}\textbf{int}{>}((\textbf{int})176))$

$\rightarrow$ *[simplify]*

[18.6] $\text{div2} == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176)$

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] $(0 < \textbf{asType}{<}\textbf{integer}{>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2})) \,\&\& \,(\textbf{asType}{<}\textbf{integer}{>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}) < \textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}.\textbf{class } \text{WHPrang} \in$

M2))

$\rightarrow$ *[simplify]*

[23.2] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2})$ &&
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2} <$
$\textbf{asType}\textbf{<integer>}(\$\text{heap}.\textbf{class WHPrang} \in \text{M2}))$

$\rightarrow$ *[const static or extern object]*

[23.3] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2})$ &&
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2} <$
$\textbf{asType}\textbf{<integer>}(\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2}))$

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2})$ &&
$(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2} <$
$\textbf{asType}\textbf{<integer>}((\textbf{int})30307))$

$\rightarrow$ *[simplify]*

[23.10] $(\text{-}30307 < -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2}) \wedge (0 <$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2})$

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2}$

[Take given term]

[34.0] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**($\$\text{heap}_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) < **asType**<**integer**>(\$heap.**class** WHPrang ∈ M3))

→ *[simplify]*

[39.2] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 < **asType**<**integer**>(\$heap.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 < **asType**<**integer**>(heap_{init}.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 < **asType**<**integer**>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) ∧ (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

→ *[separate conjunction and work on first sub-term]*

[39.11] -30323 < −**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[41.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) / **asType**<**integer**>(178)) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

→ *[simplify]*

[41.2] (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 / 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

→ *[expand definition of operator './' in class 'int' at built in declaration]*

[41.3] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <

0]: $-(-\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3)$ /
178), []: $\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3)$ /
178) == $\textbf{asType}\textbf{<integer>}(\text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3, 178).\text{quot})$

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[41.4] $([\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3) <$
0]: $-(-\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3)$ /
178), $[!(\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3) <$
0)]: $\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3)$ /
178) == $\textbf{asType}\textbf{<integer>}(\text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3, 178).\text{quot})$

$\rightarrow$ *[simplify]*

[41.7] $([0 < -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3]$:
$-(-\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3)$ /
178), $[!(\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3) <$
0)]: $\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3)$ /
178) == $\textbf{asType}\textbf{<integer>}(\text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3, 178).\text{quot})$

$\rightarrow$ *[from term 40.0, literala < $-\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3$
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[41.7.2] **true**

[41.8] $([\textbf{false}]$: $-(-\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p3)$ / 178), $[!(\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p3) < 0)]$: $\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p3)$ / 178) == $\textbf{asType}\textbf{<integer>}(\text{div}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3,$
178).quot)

$\rightarrow$ *[simplify]*

[41.11] $([\textbf{false}]$: $-(-\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p3)$ / 178), $[!(0 < -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p3)]$: $\textbf{asType}\textbf{<integer>}(\textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}).p3)$ / 178) == $\textbf{asType}\textbf{<integer>}(\text{div}(\textbf{heapIs }$
$\$heap_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3,$
178).quot)

$\rightarrow$ *[from term 40.0, literala < $-\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p3$
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.11.0] $-2 < (0 + 0)$

$\rightarrow$ *[simplify]*

[41.11.2] **true**

[41.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) / 178), [!**false**]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) / 178) $==$ **asType**$<$**integer**$>$(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.17] $0 ==$ ($-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot + (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 / 178))

[Take given term]

[50.0] (($heap_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($heap_{init}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($**int**$)171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**$<$**signed int**$>$(div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($heap_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($heap_{init}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((\$heap$_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((\$heap$_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((\$heap$_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala $< -$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 $< (0 + literala)]$*

Proof of rule precondition:

[53.9.0] -2 $< (0 + 0)$

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>((30269 * **asType**\<**int**\>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**\<P1Type\>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**\<**signed int**\>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**\<**signed int**\>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**\<**signed int**\>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**\<**signed int**\>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.2] (($\text{\$heap}_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.3] (($\text{\$heap}_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((($\textbf{int}$)172 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(***heapIs*** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(***heapIs*** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.7] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.***replace***(**this.\$r** $\rightarrow$ **this.\$r**.**value**(***heapIs*** $\text{\$heap}_{funcstart\_1032,1}$).***replace***(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(***heapIs*** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(***heapIs*** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** $\rightarrow$ **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$._**replace**(**this**.\$r → **operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 → **asType<P2Type>**(($\$heap_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.2] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).**_replace**(p2 →
asType<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p2 →
asType<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.**$r ==
this.$r)]: **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$))._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.7] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[const member of object with modified fields]*

[57.9] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**

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$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{heap}_{funcstart\_1032,1}$.M2 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{heap}_{1032,1;1051,8}$, **this**).p2) < **(int)**0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((heap_{init}.M2 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{heap}_{1032,1;1051,8}$, **this**).p2) < **(int)**0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((**(int)**30307 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{heap}_{1032,1;1051,8}$, **this**).p2) < **(int)**0))) + temp2)))

→ *[simplify]*

[57.12] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

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$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).p1,**
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).p1, 177).rem))).** **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace**(this.$r → **this.$r.value(heapIs***
$\$heap_{funcstart\_1032,1}$). **_replace***(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([this.$r
== this.$r]: this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([this.$r
== this.$r]: this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r ==
this.$r**)]: this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

[57.23] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**

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$\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\$$heap$_{1032,1;1054,8}$ == $\$$heap$_{funcstart\_1032,1}$. **_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp2)))

→ *[simplify]*

[57.25] $\$$heap$_{1032,1;1054,8}$ == $\$$heap$_{funcstart\_1032,1}$. **_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$$heap$_{1032,1;1054,8}$ == $\$$heap$_{funcstart\_1032,1}$. **_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ [simplify]

[57.29] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$. **_replace(this.$r** →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace(this.$r** →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ [from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$. **_replace(this.$r** →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace(this.$r** →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ [simplify]

[57.33] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$. **_replace(this.$r** →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace(this.$r** →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot)) $\leq$
maxof(**signed int**)

$\rightarrow$ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}$._**replace***(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$)._**replace***(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.\$r.value(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 **
*div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace***(**this.\$r** $\rightarrow$*
this.\$r.value(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*)._**replace***(p1 $\rightarrow$ ((-2 * div(***heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p1,*
*177).quot) + (171 * div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace***(p2 $\rightarrow$ (-35 * div(***heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p2,*
*176).quot) + (172 * div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.1] ($\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast**<**signed
int**>(div3.quot)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[const member of object with modified fields]*

[1.3] ($\text{\$heap}_{funcstart\_1032,1}$.b3 * **static_cast**<**signed int**>(div3.quot)) $\leq$
maxof(**signed int**)

$\rightarrow$ *[const static or extern object]*

[1.4] ($\text{\$heap}_{init}$.b3 * **static_cast**<**signed int**>(div3.quot)) $\leq$ **maxof**(**signed
int**)

$\rightarrow$ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[1.5] ((**int**)63 * **static_cast**<**signed int**>(div3.quot)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.6] (63 * **static_cast**<**signed int**>(div3.quot)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$*).p3, 178)]*

[1.7] (63 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.18] -32768 < (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[literal comparison of product]*

[1.19] ([-63 < 0]: (-32768 / 63) < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot, [0 < -63]: (-32768 / -63) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot, [-63 == 0]: -32768 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.20] ([-63 < 0]: (-32768 / 63) < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot, [(0 < -63) $\wedge$!(-63 < 0)]: (-32768 / -63) < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot, [(-63 == 0) $\wedge$!(-63 < 0) $\wedge$!(0 < -63)]: -32768 < 0)

$\rightarrow$ *[simplify]*

[1.24] -521 < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot

$\rightarrow$ *[negate goal and search for contradiction]*

[1.25] !(-521 < $-$div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[1.28] 520 < div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot

[Create new term from terms 1.28, 41.17 using rule: transitivity 16]

[77.0] (0 + 520) < (**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 / 178)

$\rightarrow$ *[simplify]*

[77.8] 92737 < **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.11] -30323 < $-$**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

$\rightarrow$ *[from term 77.8, literala < $-$**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (92737 + literala)]*

Proof of rule precondition:

[39.11.0] -2 < (-30323 + 92737)

→ *[simplify]*

[39.11.2] **true**

[39.12] **false**

Proof of verification condition: Arithmetic result of operator '-' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (80,52)

Condition defined at:

To prove: minof(signed int) $\leq$ (($\text{\$heap}_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) $-$ ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast<int>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) / **asType<integer>**(**static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) == **asType<integer>**(div1.quot)

(asType<integer>(static_cast<int>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p1)) %**
asType<integer>(static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p1) <**
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(asType<integer>(div1.rem) == **asType<integer>(operator*(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this).p1))

(asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p1)) =>**
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p2),**
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(asType<integer>(static_cast<int>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this).p2)) /**
asType<integer>(static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(asType<integer>(static_cast<int>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this).p2)) %**
asType<integer>(static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p2) <**
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(asType<integer>(div2.rem) == **asType<integer>(operator*(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this).p2))

(asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<integer>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p2)) =>**
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p3),**
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(asType<integer>(static_cast<int>(operator*(heapIs
$\$\text{heap}_{funcstart\_1032,1}$, **this).p3)) /**
asType<integer>(static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(asType<integer>(static_cast<int>(operator*(heapIs

$heap$_{funcstart_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$._**replace**(this.$r →
operator*(**heapIs** $heap$_{funcstart_1032,1}$, **this**)._**replace**(p1 →
asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($heap$_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

$heap$_{1032,1;1054,8}$ == $heap$_{1032,1;1051,8}$._**replace**(this.$r →
operator*(**heapIs** $heap$_{1032,1;1051,8}$, **this**)._**replace**(p2 →
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),

static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(heap_{init}.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(heap_{init}.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**($\$\text{heap}_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, **static_cast<int>**((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType<integer>**(**this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType<integer>**(**this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2) < **asType<integer>**($\$\text{heap}$.**class** WHPrang ∈
M2))

→ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>($\$\text{heap}$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>($\$\text{heap}_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2 <
asType<integer>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) ∧ (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

→ *[simplify]*

[34.2] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(heap_{init}.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3) < **asType**<**integer**>(heap.**class** WHPrang ∈
M3))

→ *[simplify]*

[39.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>(heap.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>(heap_{init}.**class** WHPrang ∈ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

$\rightarrow$ *[separate conjunction and work on first sub-term]*

[39.11] -30323 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[41.0] (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) /
asType<**integer**>(178)) == **asType**<**integer**>(div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot)

$\rightarrow$ *[simplify]*

[41.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 / 178) ==
asType<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[41.3] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <
0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) /
178), []: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[41.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <
0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) /
178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.7] ([0 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3]:
$-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) /
178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) /

178) == **asType\<integer\>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[from term 40.0, literala $< -$**this**.$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[41.7.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[41.7.2] **true**

[41.8] ([**false**]: $-(-$**asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178), [!(**asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) $<$ 0)]: **asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178) == **asType\<integer\>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.11] ([**false**]: $-(-$**asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178), [!(0 $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)]: **asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178) == **asType\<integer\>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[from term 40.0, literala $< -$**this**.$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[41.11.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[41.11.2] **true**

[41.12] ([**false**]: $-(-$**asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178), [!**false**]: **asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) / 178) == **asType\<integer\>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.17] 0 == ($-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot + (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 / 178))

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[42.0] (**asType\<integer\>**(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) %

asType<integer>(178)) == **asType<integer>**(div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3,
178).rem)

→ *[simplify]*

[42.2] (**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 % 178) ==
asType<integer>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).rem)

→ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[42.3] ([**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0]: −(−**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) %
178), []: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)
% 178) == **asType<integer>**(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[42.4] ([**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0]: −(−**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) %
178), [!(**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0)]: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) %
178) == **asType<integer>**(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

→ *[simplify]*

[42.7] ([0 < −**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3]:
−(−**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) %
178), [!(**asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0)]: **asType<integer>**(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) %
178) == **asType<integer>**(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)

→ *[from term 40.0, literala < −**this.**$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p3
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[42.7.0] -2 < (0 + 0)

→ *[simplify]*

[42.7.2] **true**

[42.8] ([**false**]: −(−**asType<integer>**(**this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3) % 178), [!(**asType<integer>**(**this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3) < 0)]: **asType<integer>**(**this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3) % 178) == **asType<integer>**(div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3,
178).rem)

$\rightarrow$ *[simplify]*

[42.11] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3) % 178), [!(0 < $-$**this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3)]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3) % 178) == **asType**$<$**integer**$>$(div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[from term 40.0, literala $< -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[42.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[42.11.2] **true**

[42.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3) % 178), [!**false**]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3) % 178) == **asType**$<$**integer**$>$(div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.17] 0 == ($-$div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3, 178).rem + (**this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3 % 178))

[Take given term]

[50.0] (($\$$heap$_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$$heap$_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$$heap$_{init}$.r1 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$$heap$_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((($\mathbf{int}$)171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$$heap$_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**$<$**signed int**$>$(div1.rem)) $-$ ($\$$heap$_{funcstart\_1032,1}$.b1 * **static_cast**$<$**signed int**$>$(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**$<$**signed int**$>$(div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)) $-$

($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) $-$ ($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) $-$ ($heap$_{init}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast<signed int>**(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast<signed int>**(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast<signed int>**(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r $\rightarrow$ **operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).**_replace**(p1 $\rightarrow$ **asType<P1Type>**(($heap$_{funcstart_1032,1}$.M1 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\rightarrow$ **asType<P1Type>**(($heap$_{funcstart_1032,1}$.M1 *

asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[const static or extern object]*

[53.2] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 →
asType<**P1Type**>(($\$\text{heap}_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 →
asType<**P1Type**>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 →
asType<**P1Type**>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 →
asType<**P1Type**>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 →
asType<**P1Type**>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.$_{-}$**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).$_{-}$**replace**(p1 $\to$ **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)))

$\to$ *[simplify]*

[53.11] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.$_{-}$**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).$_{-}$**replace**(p1 $\to$ **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.$_{-}$**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).$_{-}$**replace**(p1 $\to$ **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

$\to$ *[simplify]*

[53.15] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.$_{-}$**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).$_{-}$**replace**(p1 $\to$ **asType**<P1Type>(0 + temp1)))

$\to$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.$_{-}$**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).$_{-}$**replace**(p1 $\to$ **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))

$\to$ *[simplify]*

[53.19] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.$_{-}$**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).$_{-}$**replace**(p1 $\to$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\text{\$heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\to$ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.$_{-}$**replace**(**this**.\$r $\to$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).$_{-}$**replace**(p1 $\to$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*

this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**).p1, 177).quot) + (171 ***
*div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$*).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$._**replace(this.$r → this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)**.p1, 177).quot) + (171 ***
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast<signed
int>**(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed
int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast<signed int>**(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($\$heap_{init}$.r2 * **static_cast<signed int>**(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast<signed int>**(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast<signed int>**(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 *
static_cast<signed int>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(***heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)*.p2, 176)]*

[54.6] ((172 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{1032,1;1051,8}$.b2 *
static_cast<signed int>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$._**replace(this.$r → this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)*).p1, 177).quot) + (171 ***
*div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$*).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$._**replace(this.$r**

$\rightarrow$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem) $-$ (\$heap$_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem) $-$ (\$heap$_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem) $-$ ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.12] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem) $-$ (35 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem) $-$ (35 * **static_cast<signed int>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

$\rightarrow$ *[simplify]*

[54.18] 0 == ($-$temp2 + (-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] \$heap$_{1032,1;1054,8}$ == \$heap$_{1032,1;1051,8}$.**_replace**(**this**.\$r $\rightarrow$ **operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).**_replace**(p2 $\rightarrow$ **asType<P2Type>**((\$heap$_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, \$heap$_{1032,1;1051,8}$ is equal to*

$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$ **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.2] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(**this.**$r \to$ **operator***(**heapIs**
$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$ **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**)._**replace**(p2 \to
asType<P2Type>(($heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ [expand definition of operator '*' in class 'pointer' at built in declaration]

[57.3] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))))._**replace**(p2 \to
asType<P2Type>(($heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ [evaluate dereferenced pointer into modified heap]

[57.4] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r \to$ ([**this.**$r ==$
this.$r]: **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$))._**replace**(p2 \to

asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → ([**this**.\$r ==
this.\$r]: **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)), [!(**this**.\$r ==
this.\$r)]: **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to*
*$heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs***
*$heap$_{funcstart_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,*
***this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs***
$heap$_{funcstart_1032,1}$).p1, 177).rem)))]

[57.8] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{funcstart\_1032,1}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{init}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>(((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ [simplify]

[57.12] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to*
*$heap$_{funcstart_1032,1}$. **_replace***(**this.\$r** → **this.\$r.value**(**heapIs**
*$heap$_{funcstart_1032,1}$). **_replace***(p1 → (-2 * div(**heapIs** *$heap$_{funcstart\_1032,1}$,*
this.\$r.value(**heapIs** *$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** *$heap$_{funcstart_1032,1}$, **this.\$r.value**(**heapIs***
$heap$_{funcstart_1032,1}$).p1, 177).rem)))]

[57.13] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**

$\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(**this.$\$$r** →
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$.__**replace**(**this.$\$$r** →
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\$$heap$_{1032,1;1054,8}$ == $\$$heap$_{funcstart\_1032,1}$.__**replace**(**this.$\$$r** →
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(**this.$\$$r** →
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$\$$r**
== **this.$\$$r**]: **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → (-2 *
div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\$$heap$_{1032,1;1054,8}$ == $\$$heap$_{funcstart\_1032,1}$.__**replace**(**this.$\$$r** →
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(**this.$\$$r** →
this.$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.$\$$r**.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$\$$r**
== **this.$\$$r**]: **this.$\$$r**.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__**replace**(p1 → (-2 *

div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.\$r ==
this.\$r)]: **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

$\rightarrow$ *[simplify]*

[57.23] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)))

$\rightarrow$ *[from term 24.0, literala < $-$**this**.\$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(false)))
+ temp2)))

$\rightarrow$ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ [simplify]

[57.33] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ (($\text{\$heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed
int**>(div3.rem)) − ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed
int**>(div3.quot)))

→ [simplify]

[1.1] -32768 ≤ (($\text{\$heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot)))

*→ [from term 57.33, $heap$_{1032,1;1054,8}$ is equal to
$heap$_{funcstart_1032,1}$._**replace**(this.$r → this.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem)))]*

[1.2] -32768 ≤ (($\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,

176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

→ *[const member of object with modified fields]*

[1.4] -32768 ≤ (($\$heap_{funcstart\_1032,1}$.r3 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

→ *[const static or extern object]*

[1.5] -32768 ≤ (($\$heap_{init}$.r3 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[1.6] -32768 ≤ (((**int**)170 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

→ *[simplify]*

[1.7] -32768 ≤ ((170 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

→ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p3, 178)]*

[1.8] -32768 ≤ ((170 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

→ *[simplify]*

[1.9] -32768 ≤ ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot)))

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p2, 176).rem)))]*

[1.10] -32768 ≤ ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

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$\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\$\text{heap}_{funcstart\_1032,1}$.**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast**<**signed int**>(div3.quot)))

→ *[const member of object with modified fields]*

[1.12] -32768 ≤ ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\$\text{heap}_{funcstart\_1032,1}$.b3 * **static_cast**<**signed int**>(div3.quot)))

→ *[const static or extern object]*

[1.13] -32768 ≤ ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\$\text{heap}_{init}$.b3 * **static_cast**<**signed int**>(div3.quot)))

→ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[1.14] -32768 ≤ ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − ((**int**)63 * **static_cast**<**signed int**>(div3.quot)))

→ *[simplify]*

[1.15] -32768 ≤ ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div3.quot)))

→ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[1.16] -32768 ≤ ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)))

→ *[simplify]*

[1.21] -32769 < ((-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))

→ *[negate goal and search for contradiction]*

[1.22] !(-32769 < ((-63 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem)))

→ *[simplify]*

[1.27] 32768 < ((63 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) + (-170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem))

[Copy term 1.27]

[85.0] 32768 < ((-170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem) + (63 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot))

→ *[from term 42.17, div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem is equal to **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 % 178]*

[85.1] 32768 < ((-170 * (**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 % 178)) + (63 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot))

[Create new term from term 41.17 using rule: condition for equality of division]

[133.0] ((178 * (0 + −(−div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot))) < (1 + **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)) ∧ (**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 < (178 * (0 + 1 + −(−div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot))))

→ *[simplify]*

[133.15] (-1 < ((-178 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) + **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)) ∧ (-178 < (−**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 + (178 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot)))

[Work on sub-term 2 of conjunction in term 133.15]

[134.0] -1 < ((-178 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) + **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

[Create new term from terms 134.0, 39.11 using rule: transitivity 2]

[145.0] (-30323 + -1 + 1) < (-178 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[145.1] -30323 < (-178 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[literal comparison of product]*

[145.2] ([-178 < 0]: (-30323 / 178) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot, [0 < -178]: (-30323 / -178) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot, [-178 == 0]: -30323 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[145.3] ([-178 < 0]: (-30323 / 178) < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot, [(0 < -178) $\wedge$!(-178 < 0)]: (-30323 / -178) < div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot, [(-178 == 0) $\wedge$!(-178 < 0) $\wedge$!(0 < -178)]: -30323 < 0)

$\rightarrow$ *[simplify]*

[145.7] -171 < $-$div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot

[Create new term from terms 145.7, 85.1 using rule: transitivity 5]

[148.0] 32768 < ((-170 * (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 % 178)) + (63 * $-$(-171 + 1)))

$\rightarrow$ *[simplify]*

[148.5] 22058 < (-170 * (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 % 178))

$\rightarrow$ *[literal comparison of product]*

[148.6] ([-170 < 0]: (22058 / 170) < $-$(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 % 178), [0 < -170]: (22058 / -170) < (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 % 178), [-170 == 0]: 22058 < 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[148.7] ([-170 < 0]: (22058 / 170) < $-$(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 % 178), [(0 < -170) $\wedge$!(-170 < 0)]: (22058 / -170) < (**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 % 178), [(-170 == 0) $\wedge$!(-170 < 0) $\wedge$!(0 < -170)]: 22058 < 0)

$\rightarrow$ *[simplify]*

[148.12] **false**

Proof of verification condition: Arithmetic result of operator '-' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (80,52)

Condition defined at:

To prove: $(($heap$_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) $-$ ($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) $\leq$ **maxof(signed int)**

Given:

$heap$_{init}$.LIMIT == (**int**)80

$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **static_cast<int>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1), **static_cast<int>**($heap$_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1)) / **asType<integer>**(**static_cast<int>**($heap$_{funcstart\_1032,1}$.a1))) == **asType<integer>**(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1)) % **asType<integer>**(**static_cast<int>**($heap$_{funcstart\_1032,1}$.a1))) == **asType<integer>**(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < **asType<integer>**($heap$_{funcstart\_1032,1}$.a1)) => (**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1))

$(\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a1}) \leq$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) =>$
$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div1.quot}))$

$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div1.rem})) \ || \ !(0 ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div1.quot}))$

$\text{div2} == \text{div}(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \ /$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div2.quot})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \ \%$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div2.rem})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}) <$
$\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}{<}\textbf{integer}{>}(\text{div2.rem}) == \textbf{asType}{<}\textbf{integer}{>}(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div2.quot}))$

$!(0 == \textbf{asType}{<}\textbf{integer}{>}(\text{div2.rem})) \ || \ !(0 ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}),$
$\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \ /$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div3.quot})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \ \%$
$\textbf{asType}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{int}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}{<}\textbf{integer}{>}(\text{div3.rem})$

$(\textbf{asType}{<}\textbf{integer}{>}(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}) <$
$\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) =>$
$(\textbf{asType}{<}\textbf{integer}{>}(\text{div3.rem}) == \textbf{asType}{<}\textbf{integer}{>}(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}))$

$(\textbf{asType}{<}\textbf{integer}{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$

asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 $\rightarrow$
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) $\leq$ temp2

temp2 $\leq$ **maxof**(**signed int**)

$\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$.**_replace**(**this**.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).**_replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(heap_{init}.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(heap.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(heap.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(heap_{init}.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2) ∧ (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

→ *[simplify]*

[34.2] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3) < **asType**<**integer**>(\$heap.**class** WHPrang ∈
M3))

→ *[simplify]*

[39.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) ∧ (0 <
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[41.0] (**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) /
asType<**integer**>(178)) == **asType**<**integer**>(div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3,
178).quot)

$\rightarrow$ *[simplify]*

[41.2] (**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 / 178) ==
asType<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[expand definition of operator './' in class 'int' at built in declaration]*

[41.3] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) /
178), []: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[41.4] ([**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) /
178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.7] ([0 < $-$**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3]:
$-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) /
178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) <
0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) /
178) == **asType**<**integer**>(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[from term 40.0, literala < $-$**this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[41.7.2] **true**

[41.8] ([**false**]: $-(-$**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3) / 178), [!(**asType**<**integer**>(**this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this.**$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) / 178), [!(0 < $-$**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[from term 40.0, literala < $-$***this**.\$r.***value**(heapIs $heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[41.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[41.11.2] **true**

[41.12] ([**false**]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) / 178), [!**false**]: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) / 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot)

$\rightarrow$ *[simplify]*

[41.17] 0 == ($-$div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot + (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 / 178))

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[42.0] (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % **asType**<**integer**>(178)) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.2] (**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 % 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[expand definition of operator '.%' in class 'int' at built in declaration]*

[42.3] ([**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) < 0]: $-(-$**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178), []: **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[42.4] ([**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) < 0]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.7] ([0 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[from term 40.0, literala < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[42.7.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[42.7.2] **true**

[42.8] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178), [!(**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) < 0)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.11] ([**false**]: $-(-$**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178), [!(0 < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)]: **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) % 178) == **asType**<**integer**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[from term 40.0, literala < $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[42.11.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[42.11.2] **true**

[42.12] ([**false**]: $-(-$**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178), [!**false**]: **asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) % 178) == **asType**$<$**integer**$>$(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)

$\rightarrow$ *[simplify]*

[42.17] 0 == ($-$div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem + (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 % 178))

[Take given term]

[47.0] (**asType**$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3) $<$ **asType**$<$**integer**$>$($\text{heap}_{funcstart\_1032,1}$.a3)) => (**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[47.1] (**asType**$<$**integer**$>$(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) $<$ **asType**$<$**integer**$>$($\text{heap}_{funcstart\_1032,1}$.a3)) => (**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[simplify]*

[47.2] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 $<$ **asType**$<$**integer**$>$($\text{heap}_{funcstart\_1032,1}$.a3)) => (**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[const static or extern object]*

[47.3] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 $<$ **asType**$<$**integer**$>$(heap_{init}.a3)) => (**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[47.4] (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 $<$ **asType**$<$**integer**$>$((**int**)178)) => (**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[simplify]*

[47.9] (-178 $<$ $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) => (**asType**$<$**integer**$>$(div3.rem) == **asType**$<$**integer**$>$(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3))

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178)]*

[47.10] (-178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) =>
(**asType**<**integer**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**)).p3))

$\rightarrow$ *[simplify]*

[47.11] (-178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem ==
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**)).p3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[47.12] (-178 < −**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) =>
(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem ==
asType<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3))

$\rightarrow$ *[simplify]*

[47.18] (0 == (−**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem)) $\vee$ (177 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

[Take given term]

[50.0] (($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] ((heap_{init}.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − ($\text{heap}_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$*).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) −
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\text{heap}_{funcstart\_1032,1}$.b1 *

static_cast<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(($\text{\$heap}_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.4] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −***this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 *is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))

+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [const member of object with modified fields]

[54.2] (($\text{\$heap}_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [const static or extern object]

[54.3] (($\text{\$heap}_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [expand definition of constant 'r2' at prang.cpp (34,26)]

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [simplify]

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [simplify]

[54.7] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[54.8] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$._**replace**(**this**.\$r → **operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.2] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.__replace__(**this.$r** →
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.$r** → **operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$.__replace__(**this.$r** → **this.$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).__replace__(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.__replace__(**this.$r** →
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.$r** →
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.__replace__(**this.$r** →
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).__replace__(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.__replace__(**this.$r** →
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.$r** → ([**this.$r** ==
this.$r**]: **this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).__replace__(p1 → (-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).__replace__(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.__replace__(**this.$r** →

this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → ([**this**.\$r == **this**.\$r]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.\$r == **this**.\$r)]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)).**_replace**(p2 → **asType**<P2Type>((\$heap$_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((\$heap$_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, \$heap$_{1032,1;1051,8}$ is equal to \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.8] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((\$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem)))).M2 *}$
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[const member of object with modified fields]*

[57.9] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace(**this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(**this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 $\rightarrow$
asType<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$**.M2 ***
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[const static or extern object]*

[57.10] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace(**this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(**this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 $\rightarrow$
asType<P2Type>(($\text{\$heap}_{init}$**.M2 ***
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace(**this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(**this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 $\rightarrow$
asType<P2Type>(((int)30307 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[simplify]*

[57.12] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.**$\$r \to$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.**$\$r \to$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 $\to$
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**replace**(**this.**$\$r \to$ **this.**$\$r$.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.**$\$r \to$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.**$\$r \to$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 $\to$
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**replace**(**this.**$\$r \to$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.**$\$r \to$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.**$\$r \to$
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 $\to$

asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

$\to$ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 \to
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([this.$r
== this.$r]: this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 \to ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 \to
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([this.$r
== this.$r]: this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 \to (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(this.$r ==
this.$r)]: this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

$\to$ *[simplify]*

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[57.23] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this**.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p2*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ *[simplify]*

[57.25] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(*$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] (($\$\text{heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[from term 57.33, $\$\text{heap}_{1032,1;1054,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$._**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.1] (($\$\text{heap}_{funcstart\_1032,1}$._**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast**<**signed int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[const member of object with modified fields]*

[1.3] (($\$\text{heap}_{funcstart\_1032,1}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.4] (($heap$_{init}$.r3 * **static_cast<signed int>**(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) ≤
maxof(signed int)

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[1.5] ((**(int)**170 * **static_cast<signed int>**(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3
* **static_cast<signed int>**(div3.quot))) ≤ **maxof(signed int)**

→ *[simplify]*

[1.6] ((170 * **static_cast<signed int>**(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 *
static_cast<signed int>(div3.quot))) ≤ **maxof(signed int)**

→ *[from term 34.6, div3 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p3, 178)]*

[1.7] ((170 * **static_cast<signed int>**(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p3, 178).rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) ≤
maxof(signed int)

→ *[simplify]*

[1.8] ((170 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p3, 178).rem) − ($heap$_{1032,1;1054,8}$.b3 *
static_cast<signed int>(div3.quot))) ≤ **maxof(signed int)**

→ *[from term 57.33, $heap$_{1032,1;1054,8}$ is equal to
$heap$_{funcstart_1032,1}$.**_replace(this.$r → this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace(this.$r →**
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem)))]*

[1.9] ((170 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p3, 178).rem) − ($heap$_{funcstart\_1032,1}$.**_replace(this.$r**
→ **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace(this.$r**
→ **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$,

this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)))).b3 *
static_cast<**signed int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[const member of object with modified fields]*

[1.11] ((170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178).rem) − (\$heap$_{funcstart\_1032,1}$.b3 *
static_cast<**signed int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[const static or extern object]*

[1.12] ((170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178).rem) − (\$heap$_{init}$.b3 * **static_cast**<**signed
int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[1.13] ((170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178).rem) − ((**int**)63 * **static_cast**<**signed
int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.14] ((170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed
int**>(div3.quot))) ≤ **maxof**(**signed int**)

→ *[from term 34.6, div3 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,*
***this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178)]*

[1.15] ((170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed
int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178).quot))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.32] -32768 < ((-170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem) + (63 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3,
178).quot))

→ *[negate goal and search for contradiction]*

[1.33] !(-32768 < ((-170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem) + (63 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3,
178).quot)))

→ *[simplify]*

[1.38] 32767 < ((170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) + (-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot))

[Branch on disjunction or conditional in term 47.18]

[74.0] (0 == (−**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem)) ∨ (177 < **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) ∨ !(0 ==
(−**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem))

[Copy term 1.38]

[75.0] (32767 < ((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))) ∨ (177 <
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p3) ∨ !(0 ==
(−**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem))

→ *[from term 74.0, div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).rem is equal to **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p3]*

[75.1] (32767 < ((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3))) ∨ ...

[Copy term 42.17]

[76.0] (0 == (−div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem + (**this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3 % 178))) ∨ (177 < **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3) ∨ !(0 == (−**this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))

→ *[from term 74.0, div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).rem is equal to **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p3]*

[76.1] (0 == (−**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 +
(**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 % 178))) ∨ ...

[Assume known post-assertion, class invariant or type constraint for term 76.1]

[77.0] (**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 < 178) ∨ (177 <
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p3) ∨ !(0 ==
(−**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 + div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).rem))

$\rightarrow$ *[simplify]*

[77.3] (-178 < $-$**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) $\vee$ ...

[Copy term 75.1]

[80.0] (32767 < ((-63 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot) + (170 * **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3))) $\vee$ (177 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) $\vee$!(0 == ($-$**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 + div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).rem))

$\rightarrow$ *[from term 41.17, div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot is equal to **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 / 178]*

[80.1] (32767 < ((-63 * (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 / 178)) + (170 * **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3))) $\vee$ ...

$\rightarrow$ *[division by larger divisor]*

Proof of rule precondition 1:

[80.1.0.0] literald < $-$**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3

$\rightarrow$ *[unify with term 77.3]*

[80.1.0.1] **true**

Proof of rule precondition 2:

[80.1.1.0] literalc < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3

$\rightarrow$ *[unify with term 40.0]*

[80.1.1.1] **true**

Proof of rule precondition 3:

[80.1.2.0] $-$-178 $\leq$ 178

$\rightarrow$ *[simplify]*

[80.1.2.2] **true**

Proof of rule precondition 4:

[80.1.3.0] -2 < 0

$\rightarrow$ *[simplify]*

[80.1.3.1] **true**

[80.2] (32767 < ((-63 * **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3) + (170 * **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3))) $\vee$ ...

$\rightarrow$ *[simplify]*

[80.4] (32767 < (107 * **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3)) $\vee$ ...

→ *[literal comparison of product]*

[80.5] ([107 < 0]: (32767 / -107) < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, [0 < 107]: (32767 / 107) < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, [0 == 107]: 32767 < 0) ∨ ...

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[80.6] ([107 < 0]: (32767 / -107) < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, [(0 < 107) ∧ !(107 < 0)]: (32767 / 107) < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, [(0 == 107) ∧ !(0 < 107) ∧ !(107 < 0)]: 32767 < 0) ∨ ...

→ *[simplify]*

[80.13] (**true** ∧ (306 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)) ∨ ...

→ *[from term 77.3, literala < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (-178 + literala)]*

Proof of rule precondition:

[80.13.0] -2 < (-178 + 306)

→ *[simplify]*

[80.13.2] **true**

[80.14] (**true** ∧ **false**) ∨ ...

→ *[simplify]*

[80.15] **false** ∨ ...

[Remove 'false' term 80.15 and fetch new term from containing clause]

[81.0] 177 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

[Copy term 1.38]

[84.0] 32767 < ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))

→ *[from term 42.17, div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem is equal to **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 % 178]*

[84.1] 32767 < ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 % 178)))

[Create new term from term 41.17 using rule: condition for equality of division]

[136.0] ((178 * (0 + −(−div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot))) < (1 + **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)) ∧ (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 < (178 * (0 + 1 + −(−div(**heapIs**

476

$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot))))

→ *[simplify]*

[136.15] (-1 < ((-178 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot) + **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3)) ∧ (-178 < (−**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 + (178 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot)))

→ *[separate conjunction and work on first sub-term]*

[136.16] -178 < (−**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 + (178 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot))

[Create new term from terms 136.16, 81.0 using rule: transitivity 2]

[147.0] (-178 + 1 + 177) < (178 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot)

→ *[simplify]*

[147.1] 0 < (178 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot)

→ *[product is positive]*

[147.2] ((0 < 178) ∧ (0 < div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot)) ∨ ((178 < 0) ∧ (div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot < 0))

→ *[simplify]*

[147.7] 0 < div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot

[Create new term from terms 147.7, 84.1 using rule: transitivity 11]

[149.0] (1 + 32767 + (0 * 63)) < (170 * (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 % 178))

→ *[simplify]*

[149.2] 32768 < (170 * (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 % 178))

→ *[literal comparison of product]*

[149.3] ([170 < 0]: (32768 / -170) < −(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 % 178), [0 < 170]: (32768 / 170) < (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 % 178), [0 == 170]: 32768 < 0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[149.4] ([170 < 0]: (32768 / -170) < −(**this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3 % 178), [(0 < 170) ∧ !(170 < 0)]: (32768 / 170) <
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3 % 178), [(0 == 170) ∧ !(0 <
170) ∧ !(170 < 0)]: 32768 < 0)

→ *[simplify]*

[149.13] **false**

Proof of verification condition: Type constraint satisfied in explicit
conversion from 'integer' to 'int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(81,18)

Condition defined at:

To prove: minof(int) ≤ **static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0)

Given:

$heap$_{init}$.LIMIT == (**int**)80

$heap$_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$heap$_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$heap$_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$heap$_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$heap$_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$heap$_{init}$.**class** WHPrang ∈ r2 == (**int**)172

$heap$_{init}$.**class** WHPrang ∈ a2 == (**int**)176

$heap$_{init}$.**class** WHPrang ∈ b2 == (**int**)35

$heap$_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

$heap$_{init}$.**class** WHPrang ∈ r3 == (**int**)170

$heap$_{init}$.**class** WHPrang ∈ a3 == (**int**)178

$heap$_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a1))) ==

asType$<$integer$>$(div1.quot)

(asType$<$integer$>$(**static_cast$<$int$>$**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType$<$integer$>$(**static_cast$<$int$>$**($\$heap_{funcstart\_1032,1}$.a1))) ==
asType$<$integer$>$(div1.rem)

(asType$<$integer$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) $<$
asType$<$integer$>$($\$heap_{funcstart\_1032,1}$.a1)) =>
(asType$<$integer$>$(div1.rem) == **asType$<$integer$>$**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(asType$<$integer$>$($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType$<$integer$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType$<$integer$>$**(div1.quot))

!(0 == **asType$<$integer$>$**(div1.rem)) || !(0 ==
asType$<$integer$>$(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast$<$int$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast$<$int$>$($\$heap_{funcstart\_1032,1}$.a2))

(asType$<$integer$>$(**static_cast$<$int$>$**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType$<$integer$>$(**static_cast$<$int$>$**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType$<$integer$>$(div2.quot)

(asType$<$integer$>$(**static_cast$<$int$>$**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType$<$integer$>$(**static_cast$<$int$>$**($\$heap_{funcstart\_1032,1}$.a2))) ==
asType$<$integer$>$(div2.rem)

(asType$<$integer$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) $<$
asType$<$integer$>$($\$heap_{funcstart\_1032,1}$.a2)) =>
(asType$<$integer$>$(div2.rem) == **asType$<$integer$>$**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(asType$<$integer$>$($\$heap_{funcstart\_1032,1}$.a2) $\leq$
asType$<$integer$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType$<$integer$>$**(div2.quot))

!(0 == **asType$<$integer$>$**(div2.rem)) || !(0 ==
asType$<$integer$>$(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast$<$int$>$(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast$<$int$>$($\$heap_{funcstart\_1032,1}$.a3))

(asType$<$integer$>$(**static_cast$<$int$>$**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType$<$integer$>$(**static_cast$<$int$>$**($\$heap_{funcstart\_1032,1}$.a3))) ==
asType$<$integer$>$(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r$ →
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$._**replace**(this.$\$r$ →
operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

minof(**signed int**) ≤ temp3

temp3 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{heap}_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\text{heap}_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\text{heap}_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**(heap_{init}.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1) < **asType<integer>**(heap.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<integer>(heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<integer>(heap_{init}.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 <
asType<integer>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) ∧ (0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\text{\$heap}$.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\text{\$heap}$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\text{\$heap}_{init}$.**class** WHPrang ∈ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 <$ **this.**$r.$**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 $< -$**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $\land$ (0 < **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] $(0 <$ **asType**<**integer**>(**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[simplify]*

[39.2] $(0 <$ **this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) && (**this.**\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <

asType<**integer**>($heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 <
asType<**integer**>($heap_{init}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 < $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) $\wedge$ (0 <
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] (($heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($heap_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$
($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($heap_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) $-$
($heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($heap_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(($\$heap_{init}$.M1 *

asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(operator*(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this).p1) $<$ (int)0))) + temp1)))**

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace(this.\$r $\rightarrow$ this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace(p1 $\rightarrow$ asType$<$P1Type$>$(((int)30269 * asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(operator*(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this).p1) $<$ (int)0))) + temp1)))**

$\rightarrow$ *[simplify]*

[53.4] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace(this.\$r $\rightarrow$ this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace(p1 $\rightarrow$ asType$<$P1Type$>$((30269 * asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(operator*(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this).p1) $<$ (int)0))) + temp1)))**

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace(this.\$r $\rightarrow$ this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace(p1 $\rightarrow$ asType$<$P1Type$>$((30269 * asType$<$int$>$(static_cast$<$integer$>$(static_cast$<$signed int$>$(this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1) $<$ (int)0))) + temp1)))**

$\rightarrow$ *[simplify]*

[53.9] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace(this.\$r $\rightarrow$ this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace(p1 $\rightarrow$ asType$<$P1Type$>$((30269 * asType$<$int$>$(static_cast$<$integer$>$(0 $<$ $-$this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1))) + temp1)))**

$\rightarrow$ *[from term 8.0, literala $<$ $-$**this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace(this.\$r $\rightarrow$ this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace(p1 $\rightarrow$ asType$<$P1Type$>$((30269 * asType$<$int$>$(static_cast$<$integer$>$(false))) + temp1)))**

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**($heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**

$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast<signed int>**(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast<signed int>**(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($\$heap_{init}$.r2 * **static_cast<signed int>**(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((**(int)**172 * **static_cast<signed int>**(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast<signed int>**(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$._**replace**(this.\$r → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}).p2, 176).\text{rem}) - (\text{\$heap}_{funcstart\_1032,1}.b2\ *$
static_cast<signed int>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).\text{rem}) - (\text{\$heap}_{init}.b2\ *$ **static_cast<signed
int>**(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).\text{rem}) - ((\textbf{int})35\ *$ **static_cast<signed
int>**(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).\text{rem}) - (35\ *$ **static_cast<signed
int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.\$r.value(**heapIs** $heap_{funcstart_1032,1}).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).\text{rem}) - (35\ *$ **static_cast<signed
int>**(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart_1032,1}).p2, 176).\text{quot}))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p2, 176).\text{quot}) + (172\ *$
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart_1032,1}).p2, 176).\text{rem}))

[Take given term]

[57.0] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
operator*(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).__**replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}.M2\ *$
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to*
$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r.value}(\textbf{heapIs}$
$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\text{-2}\ *\ div(\textbf{heapIs}\ heap_{funcstart\_1032,1},$
***this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}).p1, 177).quot) + (171\ *$*
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs***
$heap_{funcstart_1032,1}).p1, 177).rem)))]

[57.2] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 → ((-2\ *\ div(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}).p1,$

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace(this.\$r** → **operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**). **replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator*(heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))). **replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator*(heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace(this.\$r** → ([**this.\$r** == **this.\$r**]: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)). **replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator*(heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem})))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow ([\textbf{this.\$r} ==$
$\textbf{this.\$r}]: \textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow (\text{-2} *$
$\text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).quot}) + (171 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1},$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem})), [!(\textbf{this.\$r} ==$
$\textbf{this.\$r})]: \textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1})).\_\textbf{replace}(\text{p2} \rightarrow$
$\textbf{asType}<\text{P2Type}>((\text{\$heap}_{1032,1;1051,8}.\text{M2} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}*(\textbf{heapIs } \text{\$heap}_{1032,1;1051,8}, \textbf{this}).\text{p2}) < (\textbf{int})0))) + \text{temp2})))$

$\rightarrow$ *[simplify]*

[57.7] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177).quot}) + (171 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem})))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177).quot}) + (171 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))).\_\textbf{replace}(\text{p2} \rightarrow$
$\textbf{asType}<\text{P2Type}>((\text{\$heap}_{1032,1;1051,8}.\text{M2} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}*(\textbf{heapIs } \text{\$heap}_{1032,1;1051,8}, \textbf{this}).\text{p2}) < (\textbf{int})0))) + \text{temp2})))$

$\rightarrow$ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to*
$\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
*$\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\text{-2} * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1},$*
*$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).p1, 177).quot) + (171 *$*
$\text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).p1, 177).rem)))]$

[57.8] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177).quot}) + (171 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem})))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177).quot}) + (171 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))).\_\textbf{replace}(\text{p2} \rightarrow$
$\textbf{asType}<\text{P2Type}>((\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177).quot}) + (171 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem})))).\text{M2} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}*(\textbf{heapIs } \text{\$heap}_{1032,1;1051,8}, \textbf{this}).\text{p2}) < (\textbf{int})0))) + \text{temp2})))$

→ *[const member of object with modified fields]*

[57.9] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($heap_{funcstart\_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($heap_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.* **replace***(**this**.\$r → **this**.\$r.**value***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).* **replace***(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.13] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r →

this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(static_cast<integer>(static_cast<signed int>(([**this**.\$r == **this**.\$r]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)), []: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(static_cast<integer>(static_cast<signed int>(([**this**.\$r == **this**.\$r]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.\$r == **this**.\$r)]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.23] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −***this***.$r.***value***(***heapIs*** $\$heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp2)))

→ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(heapIs
$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] **minof(int)** $\le$ **static_cast<integer>(static_cast<signed int>(operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)

$\to$ *[simplify]*

[1.1] -32768 $\le$ **static_cast<integer>(static_cast<signed int>(operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)

$\to$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.2] -32768 $\le$ **static_cast<integer>(static_cast<signed int>(operator*(heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0)

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.3] -32768 $\le$ **static_cast<integer>(static_cast<signed int>(this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\to$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**\$r →
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p2, 176).rem))))).p3) < (**int**)0)

→ *[evaluate dereferenced pointer into modified heap]*

[1.4] -32768 ≤ **static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.**\$r ==
this.\$r]: **this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__replace__(p1 → ((-2 *
div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 →
(-35 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$.__replace__(**this.**\$r →
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.5] -32768 ≤ **static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.**\$r ==
this.\$r]: **this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__replace__(p1 → ((-2 *
div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 →
(-35 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.**\$r ==
this.\$r)]: **this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$.__replace__(**this.**\$r →
this.\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0)

→ *[simplify]*

[1.13] -32768 ≤ **static_cast**<**integer**>(0 < −**this.**\$r.**value**(**heapIs**
$\$$heap$_{funcstart\_1032,1}$).p3)

→ *[from term 40.0, literala < −**this.**\$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.13.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.13.2] **true**

[1.14] -32768 ≤ **static_cast<integer>(false)**

$\rightarrow$ *[simplify]*

[1.15] -32768 ≤ ([**false**]: 1, []: 0)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.16] -32768 ≤ ([**false**]: 1, [**true**]: 0)

$\rightarrow$ *[simplify]*

[1.18] **true**

Proof of verification condition: Type constraint satisfied in explicit conversion from 'integer' to 'int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (81,18)

Condition defined at:

To prove: static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$heap_{1032,1;1054,8}$, **this).p3) < (int)0) ≤ maxof(int)**

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang ∈ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang ∈ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang ∈ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang ∈ r3 == (**int**)170

$\$heap_{init}$.**class** WHPrang ∈ a3 == (**int**)178

$\$heap_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,

static_cast<int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(**asType<integer>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(**asType<integer>**(div3.rem) == **asType<integer>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType<integer>**($\$\text{heap}_{funcstart\_1032,1}$.a3) $\leq$
asType<integer>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) $-$
($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

$\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.__replace__(this.$r $\rightarrow$
operator*(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).__replace__(p1 $\rightarrow$
asType<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$\text{heap}_{1032,1;1051,8}$.r2 * **static_cast<signed int>**(div2.rem)) $-$
($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))

minof(signed int) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

$\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{1032,1;1051,8}$.__replace__(this.$r $\rightarrow$
operator*(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).__replace__(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($\$\text{heap}_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) $-$
($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))

minof(signed int) $\leq$ temp3

temp3 $\leq$ **maxof(signed int)**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType<integer>**($\$heap$.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>($\$heap$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 $<$
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 $< -$**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\land$ (0 $<$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 $<$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 $<$ **asType**<**integer**>(**this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this.$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2) $<$ **asType**<**integer**>($\$heap$.**class** WHPrang $\in$
M2))

$\rightarrow$ *[simplify]*

[23.2] (0 $<$ **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 $<$
asType<**integer**>($\$heap$.**class** WHPrang $\in$ M2))

→ *[const static or extern object]*

[23.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 $< -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $\wedge$ $(0 <$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

→ *[simplify]*

[34.2] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$

M3))

→ *[simplify]*

[39.2] $(0 <$ **this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3) &&
(**this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap.**class** WHPrang $\in$ M3))

→ *[const static or extern object]*

[39.3] $(0 <$ **this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3) &&
(**this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] $(0 <$ **this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3) &&
(**this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 $<$ $-$**this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3) $\wedge$ $(0 <$
this.$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this.**$r.**value**($\textbf{heapIs}$ \$heap$_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] ((\$heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ (\$heap$_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ($\$heap_{init}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 → **asType<P1Type>**(($\$heap_{funcstart\_1032,1}$.M1 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType<P1Type>**(($\$heap_{funcstart\_1032,1}$.M1 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$

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this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(false)))
+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 →
asType<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 →
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$. **replace**(**this.**$r → **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$). **replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***

$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[54.1] (($heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed
int**>(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($heap_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) −
($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) −
($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to
$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r
→ **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1})$.p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).rem) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).rem) $-$ ($\text{\$heap}_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).rem) $-$ ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.12] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).rem) $-$ (35 * **static_cast<signed int>**(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1})$.p2, 176)]*

[54.13] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).rem) $-$ (35 * **static_cast<signed int>**(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).quot))) == temp2

$\rightarrow$ *[simplify]*

[54.18] 0 == ($-$temp2 + (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1})$.p2, 176).rem))

[Take given term]

[57.0] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{1032,1;1051,8}$.**_replace**(**this.\$r** $\rightarrow$ **operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).**_replace**(p2 $\rightarrow$ **asType<P2Type>**(($\text{\$heap}_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1})$.**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*

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this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.2] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** → **operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** → **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))).**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** → ([**this.$r** ==
this.$r**]: **this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed

int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → ([**this**.\$r ==
this.\$r]: **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.\$r ==
this.\$r)]: **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →

asType<P2Type>(($heap$_{funcstart_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[const member of object with modified fields]*

[57.9] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** $\to$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$
asType<P2Type>(($heap$_{funcstart_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[const static or extern object]*

[57.10] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** $\to$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$
asType<P2Type>(($heap$_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this.$r** $\to$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** $\to$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$

asType<P2Type>(((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.12] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to
$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.13] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(static_cast<integer>(static_cast<signed
int>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$. **_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$. **_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(static_cast<integer>(static_cast<signed **int**>(([**this**.\$r
== **this**.\$r]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$. **_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(static_cast<integer>(static_cast<signed **int**>(([**this**.\$r
== **this**.\$r]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

$\rightarrow$ *[simplify]*

[57.23] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)))

$\rightarrow$ *[from term 24.0, literala < $-$**this**.$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

$\rightarrow$ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.\$r.value(*heapIs $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 **
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs*
$heap_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

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[57.33] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] **static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs**
$\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0) ≤ **maxof**(**int**)

→ *[from term 57.33, $heap$_{1032,1;1054,8}$ is equal to*
*$heap$_{funcstart_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs***
*$heap$_{funcstart_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,*
***this.\$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $heap$_{funcstart_1032,1}$, **this.\$r.value**(**heapIs***
*$heap$_{funcstart_1032,1}$).p1, 177).rem)))).__replace__(**this.\$r** →*
this.\$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs
*$heap$_{funcstart_1032,1}$, **this.\$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.\$r.value**(**heapIs***
*$heap$_{funcstart_1032,1}$).p1, 177).rem))).__replace__(p2 → (-35 * div(**heapIs***
*$heap$_{funcstart_1032,1}$, **this.\$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.\$r.value**(**heapIs***
$heap$_{funcstart_1032,1}$).p2, 176).rem)))]

[1.1] **static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → (-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0) ≤ **maxof**(**int**)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.2] **static_cast**<**integer**>(**static_cast**<**signed int**>(**this.\$r.value**(**heapIs**

$heap_{funcstart\_1032,1}$._replace(this.\$r → this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs $heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(this.\$r →
this.\$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs
$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(p2 → ((-35 * div(heapIs
$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p2, 176).rem))))).p3) < (int)0) ≤ maxof(int)

→ *[evaluate dereferenced pointer into modified heap]*

[1.3] static_cast<integer>(static_cast<signed int>(([this.\$r == this.\$r]:
this.\$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs
$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(p2 → (-35 * div(heapIs
$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p2, 176).rem)), []: this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$._replace(this.\$r → this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$)._replace(p1 → (-2 * div(heapIs $heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (int)0) ≤ maxof(int)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.4] static_cast<integer>(static_cast<signed int>(([this.\$r == this.\$r]:
this.\$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs
$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(p2 → (-35 * div(heapIs
$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p2, 176).rem)), [!(this.\$r == this.\$r)]:
this.\$r.value(heapIs $heap_{funcstart\_1032,1}$._replace(this.\$r →
this.\$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → (-2 * div(heapIs
$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (int)0) ≤ maxof(int)

→ *[simplify]*

[1.12] static_cast<integer>(0 < −this.\$r.value(heapIs
$heap_{funcstart\_1032,1}$).p3) ≤ maxof(int)

$\rightarrow$ *[from term 40.0, literala < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.12.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.12.2] **true**

[1.13] **static_cast**<**integer**>(**false**) $\leq$ **maxof**(**int**)

$\rightarrow$ *[simplify]*

[1.14] ([**false**]: 1, []: 0) $\leq$ **maxof**(**int**)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.15] ([**false**]: 1, [**true**]: 0) $\leq$ **maxof**(**int**)

$\rightarrow$ *[simplify]*

[1.18] **true**

Proof of verification condition: Arithmetic result of operator '*' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (81,32)

Condition defined at:

To prove: minof(**signed int**) $\leq$ ($\$heap_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ M3 $==$ (**int**)30323

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ r3 $==$ (**int**)170

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ a3 $==$ (**int**)178

$\text{\$heap}_{init}.\textbf{class}$ WHPrang $\in$ b3 $==$ (**int**)63

div1 $==$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) $==$
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) $==$
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1)) $=>$
(**asType**<**integer**>(div1.rem) $==$ **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1) $\le$
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) $=>$
!(0 $==$ **asType**<**integer**>(div1.quot))

!(0 $==$ **asType**<**integer**>(div1.rem)) || !(0 $==$
asType<**integer**>(div1.quot))

div2 $==$ div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) $==$
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) $==$
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2)) $=>$
(**asType**<**integer**>(div2.rem) $==$ **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2) $\le$

asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$._**replace**(**this**.\$r →

operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

minof(**signed int**) ≤ temp3

temp3 ≤ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <

asType<**integer**>($heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <
asType<**integer**>($heap$_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) ∧ (0 <
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p2),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($heap.**class** WHPrang ∈
M2))

→ [simplify]

[23.2] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($heap.**class** WHPrang ∈ M2))

→ [const static or extern object]

[23.3] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($heap_{init}.**class** WHPrang ∈ M2))

→ [expand definition of constant 'M2' at prang.cpp (33,26)]

[23.4] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

→ [simplify]

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) ∧ (0 <
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($heap_{funcstart_1032,1}.a3))

→ [expand definition of operator '*' in class 'pointer' at built in declaration]

[34.1] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3),
static_cast<**int**>($heap_{funcstart_1032,1}.a3))

→ [simplify]

[34.2] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($heap_{funcstart_1032,1}.a3))

→ [const static or extern object]

[34.3] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($heap_{init}.a3))

→ [expand definition of constant 'a3' at prang.cpp (40,26)]

[34.4] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] $(0 <$ **asType**$<$**integer**$>($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3$))$ && $($**asType**$<$**integer**$>($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3$) <$ **asType**$<$**integer**$>(\$heap.$**class** WHPrang $\in$ M3$))$

$\rightarrow$ *[simplify]*

[39.2] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3$)$ && $($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 $<$ **asType**$<$**integer**$>(\$heap.$**class** WHPrang $\in$ M3$))$

$\rightarrow$ *[const static or extern object]*

[39.3] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3$)$ && $($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 $<$ **asType**$<$**integer**$>(\$heap_{init}.$**class** WHPrang $\in$ M3$))$

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3$)$ && $($**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 $<$ **asType**$<$**integer**$>(($**int**$)30323))$

$\rightarrow$ *[simplify]*

[39.10] $(-30323 < -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3$) \wedge (0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3$)$

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] $(($$\$heap_{funcstart\_1032,1}$.r1 * **static_cast**$<$**signed int**$>($div1.rem$)) - ($$\$heap_{funcstart_1032,1}$.b1 * **static_cast**$<$**signed int**$>($div1.quot$))) ==$ temp1

$\rightarrow$ *[const static or extern object]*

[50.1] $(($$\$heap_{init}$.r1 * **static_cast**$<$**signed int**$>($div1.rem$)) - ($$\$heap_{funcstart_1032,1}$.b1 * **static_cast**$<$**signed int**$>($div1.quot$))) ==$ temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] $((($**int**$)171$ * **static_cast**$<$**signed int**$>($div1.rem$)) - ($$\$heap_{funcstart_1032,1}$.b1 * **static_cast**$<$**signed int**$>($div1.quot$))) ==$ temp1

$\rightarrow$ *[simplify]*

[50.3] $((171$ * **static_cast**$<$**signed int**$>($div1.rem$)) - ($$\$heap_{funcstart_1032,1}$.b1 * **static_cast**$<$**signed int**$>($div1.quot$))) ==$ temp1

→ *[from term 2.6, div1 is equal to div(***heapIs*** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177)]*

[50.4] $((171 *$ **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) $-$
($\$heap_{funcstart\_1032,1}$.b1 $*$ **static_cast**<**signed int**>(div1.quot))) $==$ temp1

→ *[simplify]*

[50.5] $((171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b1 $*$
static_cast<**signed int**>(div1.quot))) $==$ temp1

→ *[const static or extern object]*

[50.6] $((171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{init}$.b1 $*$ **static_cast**<**signed
int**>(div1.quot))) $==$ temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] $((171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 $*$ **static_cast**<**signed
int**>(div1.quot))) $==$ temp1

→ *[simplify]*

[50.8] $((171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 $*$ **static_cast**<**signed
int**>(div1.quot))) $==$ temp1

→ *[from term 2.6, div1 is equal to div(***heapIs*** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177)]*

[50.9] $((171 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 $*$ **static_cast**<**signed
int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot))) $==$ temp1

→ *[simplify]*

[50.14] $0 == (-$temp1 $+$ (-2 $*$ div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) $+$ (171 $*$
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}$.__replace__(**this.**$r $\rightarrow$
operator$*$(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).__replace__(p1 $\rightarrow$
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 $*$
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator**$*$(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) $+$
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)))

→ *[simplify]*

[53.11] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

→ *[simplify]*

[53.15] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))

→ *[simplify]*

[53.19] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\text{\$heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −

529

($heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to $heap$_{funcstart_1032,1}$._**replace**(this.$r → this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))]*

[54.1] ((\$heap$_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart_1032,1}$, **this.**$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast<signed int>**(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] ((\$heap$_{funcstart\_1032,1}$.r2 * **static_cast<signed int>**(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] ((\$heap$_{init}$.r2 * **static_cast<signed int>**(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast<signed int>**(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast<signed int>**(div2.rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast<signed int>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2, 176).rem)) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2, 176).rem) − (\$heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to $heap$_{funcstart_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 **

*div(***heapIs** *$heap$_{*funcstart*_1032,1}, **this.$r.value(***heapIs** $heap$_{*funcstart*_1032,1}*).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$._**replace**(this.$r → **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(***heapIs** *$heap$_{funcstart_1032,1}, **this.$r.value(***heapIs** $heap$_{funcstart_1032,1}*).p2, 176)]*

[54.13] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $heap$_{1032,1;1054,8}$ == $heap$_{1032,1;1051,8}$._**replace**(this.$r → **operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**)._**replace**(p2 →

asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to*
*$heap$_{funcstart_1032,1}$.*_**replace**(*this.$r $\rightarrow$ **this.$r.value**(*heapIs*
$heap$_{funcstart_1032,1}$).*_**replace**(*p1 $\rightarrow$ (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,*
***this.$r.value**(*heapIs $heap$_{funcstart_1032,1}$*).p1, 177).quot) + (171 **
*div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(*heapIs*
$heap$_{funcstart_1032,1}$).p1, 177).rem)))]*

[57.2] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$._**replace**(**this.$r $\rightarrow$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(**this.$r $\rightarrow$ **operator***(**heapIs**
$heap$_{funcstart_1032,1}$._**replace**(**this.$r $\rightarrow$ **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))), **this**)._**replace**(p2 $\rightarrow$
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$._**replace**(**this.$r $\rightarrow$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(**this.$r $\rightarrow$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$._**replace**(**this.$r $\rightarrow$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))))._**replace**(p2 $\rightarrow$
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $heap$_{1032,1;1054,8}$ == $heap$_{funcstart_1032,1}$._**replace**(**this.$r $\rightarrow$
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(**this.$r $\rightarrow$ ([**this.$r ==
this.$r**]: **this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 *

532

div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).__replace__(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**$r → ([**this.**$r ==
this.$r]: **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.**$r ==
this.$r)]: **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).__replace__(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.__replace__(**this.**$r → **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
*$**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((\$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((\$heap$_{funcstart\_1032,1}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((\$heap$_{init}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** →
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.$r** →
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** →
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$\text{heap}_{1032,1;1051,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(this.$r → **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.13] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.$r** →
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** →
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.$r** →
this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ [expand definition of operator '*' in class 'pointer' at built in declaration]

[57.14] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

→ [evaluate dereferenced pointer into modified heap]

[57.15] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r
== this.\$r**]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ [explicitly assert falsehood of skipped guards in subsequent guards]

[57.16] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.**$r
== **this.**$r]: **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.**$r ==
this.$r)]: **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

[57.23] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ *[simplify]*

[57.25] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp2)))

→ *[simplify]*

[57.29] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 + temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(0 + ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$. **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ ($\$\text{heap}_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

→ *[simplify]*

[1.1] -32768 ≤ ($\$\text{heap}_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$. **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.2] -32768 ≤ ($\$\text{heap}_{funcstart\_1032,1}$. **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))).M3 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

→ *[const member of object with modified fields]*

[1.4] -32768 ≤ ($heap_{funcstart\_1032,1}$.M3 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

→ *[const static or extern object]*

[1.5] -32768 ≤ ($heap_{init}$.M3 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[1.6] -32768 ≤ ((**int**)30323 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

→ *[simplify]*

[1.7] -32768 ≤ (30323 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0)))

→ *[from term 57.33, $heap_{1032,1;1054,8}$ is equal to*
*$heap_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
***this.$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →*
this.$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs
*$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs***
*$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p2, 176).rem)))]

[1.8] -32768 ≤ (30323 *
asType<int>(static_cast<integer>(static_cast<signed

int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}.\_$**replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).\_$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_$**replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).\_$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace**(p2 $\rightarrow$ (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart_1032,1}).p2, 176).rem))), **this**).p3) < (**int**)0)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.9] -32768 $\leq$ (30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}.\_$**replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).\_$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_$**replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).\_$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart_1032,1}).p2, 176).rem)))))).p3) < (**int**)0)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[1.10] -32768 $\leq$ (30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r
== **this**.$r]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).\_$**replace**(p1 $\rightarrow$ ((-2
* div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart_1032,1}).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace**(p2 $\rightarrow$
(-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart_1032,1}).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p2, 176).rem)), []:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}.\_$**replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).\_$**replace**(p1 $\rightarrow$ (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart_1032,1}).p1, 177).rem)))))).p3) < (**int**)0)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.11] -32768 $\leq$ (30323 *
asType<int>(static_cast<integer>(static_cast<signed int>(([this.$r
== this.$r]: this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2
* div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$
(-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.$r** ==
this.$r)]: this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.$r** $\rightarrow$
this.$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0)))

$\rightarrow$ *[simplify]*

[1.19] -32768 $\leq$ (30323 * **asType<int>(static_cast<integer>**(0 <
$-$**this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)))

$\rightarrow$ *[from term 40.0, literala* < $-$**this.$r.value(heapIs** *$\text{heap}_{funcstart_1032,1}$).p3*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[1.19.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.19.2] **true**

[1.20] -32768 $\leq$ (30323 * **asType<int>(static_cast<integer>(false)))**

$\rightarrow$ *[simplify]*

[1.21] -32768 $\leq$ (30323 * **asType<int>**(([**false**]: 1, []: 0)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.22] -32768 $\leq$ (30323 * **asType<int>**(([**false**]: 1, [**true**]: 0)))

$\rightarrow$ *[simplify]*

[1.26] **true**

Proof of verification condition: Arithmetic result of operator '*' is within
limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(81,32)

Condition defined at:

To prove: ($\text{\$heap}_{1032,1;1054,8}$.M3 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) $\leq$
maxof(signed int)

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType<integer>(static_cast<int>(operator*(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>(static_cast<int>(operator*(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>(operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>(operator*(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<integer>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==

asType<integer>(div1.quot))

div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2),
static_cast<int>(\$heap$_{funcstart\_1032,1}$.a2))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p2)) /
asType<integer>(**static_cast<int>**(\$heap$_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p2)) %
asType<integer>(**static_cast<int>**(\$heap$_{funcstart\_1032,1}$.a2))) ==
asType<integer>(div2.rem)

(**asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2) <
asType<integer>(\$heap$_{funcstart\_1032,1}$.a2)) =>
(**asType<integer>**(div2.rem) == **asType<integer>**(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p2))

(**asType<integer>**(\$heap$_{funcstart\_1032,1}$.a2) ≤
asType<integer>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType<integer>**(div2.quot))

!(0 == **asType<integer>**(div2.rem)) || !(0 ==
asType<integer>(div2.quot))

div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>(\$heap$_{funcstart\_1032,1}$.a3))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p3)) /
asType<integer>(**static_cast<int>**(\$heap$_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p3)) %
asType<integer>(**static_cast<int>**(\$heap$_{funcstart\_1032,1}$.a3))) ==
asType<integer>(div3.rem)

(**asType<integer>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3) <
asType<integer>(\$heap$_{funcstart\_1032,1}$.a3)) =>
(**asType<integer>**(div3.rem) == **asType<integer>**(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p3))

(**asType<integer>**(\$heap$_{funcstart\_1032,1}$.a3) ≤
asType<integer>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType<integer>**(div3.quot))

!(0 == **asType<integer>**(div3.rem)) || !(0 ==
asType<integer>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

$heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$._**replace**(this.$r $\to$
operator*(**heapIs** $heap$_{funcstart_1032,1}$, **this**)._**replace**(p1 $\to$
asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($heap$_{1032,1;1051,8}$.r2 * **static_cast<signed int>**(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))

minof(signed int) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

$heap$_{1032,1;1054,8}$ == $heap$_{1032,1;1051,8}$._**replace**(this.$r $\to$
operator*(**heapIs** $heap$_{1032,1;1051,8}$, **this**)._**replace**(p2 $\to$
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($heap$_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))

minof(signed int) $\leq$ temp3

temp3 $\leq$ **maxof(signed int)**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

$\to$ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast<int>**($heap$_{funcstart\_1032,1}$.a1))

$\to$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast<int>**($heap$_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\land$ (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M2))

→ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) ∧ (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

→ *[simplify]*

[34.2] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$heap_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($\$heap.**class** WHPrang ∈
M3))

→ *[simplify]*

[39.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 <
asType<**integer**>($\$heap.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 <
asType<**integer**>($\$heap_{init}.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) ∧ (0 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] $((\$heap_{funcstart_1032,1}.r1 * $ **static_cast**$<$**signed int**$>$(div1.rem)) $-$ $(\$heap_{funcstart_1032,1}.b1 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[const static or extern object]*

[50.1] $((\$heap_{init}.r1 * $ **static_cast**$<$**signed int**$>$(div1.rem)) $-$ $(\$heap_{funcstart_1032,1}.b1 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] $(((\textbf{int})171 * $ **static_cast**$<$**signed int**$>$(div1.rem)) $-$ $(\$heap_{funcstart_1032,1}.b1 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[simplify]*

[50.3] $((171 * $ **static_cast**$<$**signed int**$>$(div1.rem)) $-$ $(\$heap_{funcstart_1032,1}.b1 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] $((171 * $ **static_cast**$<$**signed int**$>$(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) $-$ $(\$heap_{funcstart_1032,1}.b1 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[simplify]*

[50.5] $((171 * $ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ $(\$heap_{funcstart_1032,1}.b1 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[const static or extern object]*

[50.6] $((171 * $ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ $(\$heap_{init}.b1 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] $((171 * $ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ $((\textbf{int})2 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[simplify]*

[50.8] $((171 * $ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ $(2 * $ **static_cast**$<$**signed int**$>$(div1.quot))) $==$ temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$r.**value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] $((171 * $ div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\text{heap}_{1032,1;1051,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\text{heap}_{1032,1;1051,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $\text{heap}_{1032,1;1051,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((heap_{init}.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\text{heap}_{1032,1;1051,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\text{heap}_{1032,1;1051,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.$**_replace**(**this**.$\$$r $\rightarrow$
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.$**_replace**(**this**.$\$$r $\rightarrow$
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala $< -$**this**.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.$**_replace**(**this**.$\$$r $\rightarrow$
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.$**_replace**(**this**.$\$$r $\rightarrow$
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.$**_replace**(**this**.$\$$r $\rightarrow$
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}.$**_replace**(**this**.$\$$r $\rightarrow$
this.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>(0 + temp1)))

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **

*div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace(this.$r →** **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace(p1 →** **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8} ==$ $\$heap_{funcstart\_1032,1}$.**_replace(this.$r →** **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace(p1 →** ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace(this.$r →** **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace(p1 →** (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$.**_replace(this.$r →** **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).**_replace(p1 →** ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($\$heap_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((((**int**)172 * **static_cast**<**signed int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] $((172 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.rem})) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[from term 18.6, div2 is equal to div(\textbf{heapIs} \$heap$_{funcstart\_1032,1}$, \textbf{this.\$r.value}(\textbf{heapIs} \$heap$_{funcstart\_1032,1}$).p2, 176)]*

[54.6] $((172 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1},$ $\textbf{this.\$r}.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem})) -$ $(\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.7] $((172 * \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} *$ $\textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[from term 53.19, \$heap$_{1032,1;1051,8}$ is equal to* $\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\text{-2} * div(\textbf{heapIs} \$heap_{funcstart\_1032,1},$ $\textbf{this.\$r}.\textbf{value}(\textbf{heapIs} \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$ $div(\textbf{heapIs} \$heap_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$heap_{funcstart_1032,1}).p1, 177).rem)))]*

[54.8] $((172 * \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r}$ $\rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((\text{-2} *$ $\text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 * \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1},$ $\textbf{this.\$r}.\textbf{value}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\text{b2} *$ $\textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[const member of object with modified fields]*

[54.9] $((172 * \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{funcstart\_1032,1}.\text{b2} *$ $\textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[const static or extern object]*

[54.10] $((172 * \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{init}.\text{b2} * \textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] $((172 * \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - ((\textbf{int})35 * \textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.12] $((172 * \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (35 * \textbf{static\_cast}<\textbf{signed}$ $\textbf{int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) $-$ (35 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

$\rightarrow$ *[simplify]*

[54.18] 0 == ($-$temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$._**replace(this.$r** $\rightarrow$ **operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 $\rightarrow$ **asType<P2Type>**(($\$heap_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace(this.$r** $\rightarrow$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).rem)))]*

[57.2] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace(this.$r** $\rightarrow$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.$r** $\rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace(this.$r** $\rightarrow$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**)._**replace**(p2 $\rightarrow$ **asType<P2Type>**(($\$heap_{1032,1;1051,8}$.M2 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace(this.$r** $\rightarrow$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.$r** $\rightarrow$

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))).**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.$r $\rightarrow$ ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.$r $\rightarrow$ ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)).**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.7] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**

$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).p1,**
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).p1, 177).rem)))._replace(p2 →**
asType<P2Type>((\$heap_{1032,1;1051,8}.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap_{1032,1;1051,8}, **this).p2) < (int)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value(heapIs***
*$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((\$heap_{funcstart_1032,1}._**replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap_{1032,1;1051,8}, **this).p2) < (int)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.\$r** →
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((\$heap_{funcstart_1032,1}.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap_{1032,1;1051,8}, **this).p2) < (int)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace(this.\$r** →

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{init}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>(((**int**)30307 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}.\_$**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem))))._**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}.\_$**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}.\_$**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem))))._**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}.\_$**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}.\_$**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem))))._**replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).$p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 *

asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r == **this**.$r)]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.23] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ *[simplify]*

[57.25] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 + temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.$r.value(heapIs** *$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 ** div(**heapIs** *$heap_{funcstart_1032,1}$,* **this.$r.value(heapIs** *$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 + ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))))

[Take goal term]

[1.0] ($heap_{1032,1;1054,8}$.M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) ≤ **maxof(signed int)**

→ *[from term 57.33, $heap_{1032,1;1054,8}$ is equal to $heap_{funcstart\_1032,1}$.**_replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,* **this.$r.value(heapIs** *$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 ** div(**heapIs** *$heap_{funcstart_1032,1}$,* **this.$r.value(heapIs** *$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r →* **this.$r.value(heapIs** *$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 ** div(**heapIs**

$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs* $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]

[1.1] ($\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) ≤
maxof(signed int)

→ [const member of object with modified fields]

[1.3] ($\$heap_{funcstart\_1032,1}$.M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) ≤
maxof(signed int)

→ [const static or extern object]

[1.4] ($\$heap_{init}$.M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) ≤
maxof(signed int)

→ [expand definition of constant 'M3' at prang.cpp (38,26)]

[1.5] ((**int**)30323 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) ≤
maxof(signed int)

→ [simplify]

[1.6] (30323 * **asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) ≤
maxof(signed int)

→ [from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to

$heap_{funcstart\_1032,1}.\_$**replace(this.\$r → this.\$r.value(heapIs**
$heap_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $heap_{funcstart_1032,1}).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace(this.\$r →
this.\$r.value(heapIs** $heap_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace**(p2 → (-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart_1032,1}).p2, 176).rem)))]*

[1.7] (30323 * **asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $heap_{funcstart\_1032,1}.\_$**replace(this.\$r →
this.\$r.value(heapIs** $heap_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_$**replace(this.\$r →
this.\$r.value(heapIs** $heap_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace**(p2 → (-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart_1032,1}).p2, 176).rem))), **this**).p3) < **(int)**0))) ≤ **maxof(signed
int)**

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.8] (30323 * **asType<int>(static_cast<integer>(static_cast<signed
int>(this.\$r.value(heapIs** $heap_{funcstart\_1032,1}.\_$**replace(this.\$r →
this.\$r.value(heapIs** $heap_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_$**replace(this.\$r →
this.\$r.value(heapIs** $heap_{funcstart\_1032,1}).\_$**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart_1032,1}).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$heap_{funcstart_1032,1}).p2, 176).rem))))).p3) < **(int)**0))) ≤ **maxof(signed int)**

→ *[evaluate dereferenced pointer into modified heap]*

[1.9] (30323 * **asType<int>(static_cast<integer>(static_cast<signed
int>**(([**this.\$r == this.\$r**]: **this.\$r.value(heapIs**

$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), []: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) ≤ **maxof**(**signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] (30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r == this.\$r**]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.\$r == this.\$r**)]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.18] (30323 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3))) ≤ **maxof**(**signed int**)

→ *[from term 40.0, literala < −**this.\$r.value**(heapIs $heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.18.0] -2 < (0 + 0)

→ *[simplify]*

[1.18.2] **true**

[1.19] (30323 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.20] (30323 * **asType**<**int**>(([**false**]: 1, []: 0))) ≤ **maxof**(**signed int**)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.21] (30323 * **asType\<int\>**((([**false**]: 1, [**true**]: 0))) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.26] **true**

Proof of verification condition: Arithmetic result of operator '+' is within limit of type 'signed int'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (81,16)

Condition defined at:

To prove: minof(signed int) $\leq$ (($heap_{1032,1;1054,8}$.M3 * **asType\<int\>**(**static_cast\<integer\>**(**static_cast\<signed int\>**(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)

Given:

$heap_{init}$.LIMIT == (**int**)80

$heap_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$heap_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$heap_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$heap_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$heap_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$heap_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$heap_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$heap_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$heap_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$heap_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$heap_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$heap_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap_{funcstart\_1032,1}$, **static_cast\<int\>**(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1), **static_cast\<int\>**($heap_{funcstart\_1032,1}$.a1))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1)) / **asType\<integer\>**(**static_cast\<int\>**($heap_{funcstart\_1032,1}$.a1))) == **asType\<integer\>**(div1.quot)

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$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) \%$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a1}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div1.rem})$

$(\textbf{asType}<\textbf{integer}>(\textbf{operator*}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) <$
$\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a1})) =>$
$(\textbf{asType}<\textbf{integer}>(\text{div1.rem}) == \textbf{asType}<\textbf{integer}>(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}))$

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a1}) \leq$
$\textbf{asType}<\textbf{integer}>(\textbf{operator*}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) =>$
$!(0 == \textbf{asType}<\textbf{integer}>(\text{div1.quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div1.rem})) \,||\, !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div1.quot}))$

$\text{div2} == \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{operator*}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}),$
$\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) /$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.quot})$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \%$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.rem})$

$(\textbf{asType}<\textbf{integer}>(\textbf{operator*}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}) <$
$\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}<\textbf{integer}>(\text{div2.rem}) == \textbf{asType}<\textbf{integer}>(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}))$

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}<\textbf{integer}>(\textbf{operator*}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}<\textbf{integer}>(\text{div2.quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div2.rem})) \,||\, !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{operator*}(\textbf{heapIs} \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}),$
$\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator*}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) /$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div3.quot})$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator*}(\textbf{heapIs}$

$heap$_{funcstart_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p3))

(**asType**<**integer**>($heap$_{funcstart_1032,1}$.a3) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.$r $\to$
operator*(**heapIs** $heap$_{funcstart_1032,1}$, **this**).**_replace**(p1 $\to$
asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($heap$_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) $\leq$ temp2

temp2 $\leq$ **maxof**(**signed int**)

$heap$_{1032,1;1054,8}$ == $heap$_{1032,1;1051,8}$.**_replace**(**this**.$r $\to$
operator*(**heapIs** $heap$_{1032,1;1051,8}$, **this**).**_replace**(p2 $\to$
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($heap$_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

minof(**signed int**) $\leq$ temp3

temp3 $\leq$ **maxof**(**signed int**)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,

static_cast<int>(operator*(heapIs $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(this.\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>(**$\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>(**$\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>((int)177))**

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**\$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>(this.**\$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType<integer>(this.**\$r.**value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType<integer>(**\$heap.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this.**\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.**\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this.**\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.**\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this.**\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.**\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>((int)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this.**\$r.**value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 <

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] $(0 <$ **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2) $<$ **asType**<**integer**>($\text{\$heap}$.**class** WHPrang $\in$
M2))

$\rightarrow$ *[simplify]*

[23.2] $(0 <$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 $<$
asType<**integer**>($\text{\$heap}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] $(0 <$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 $<$
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 <$ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p2) && (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p2 $<$ **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 $< -$**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p2) $\wedge$ (0 $<$ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p2

[Take given term]

[34.0] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3), **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3, **static_cast**<**int**>($\$heap_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 $<$ **asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3)) && (**asType**<**integer**>(**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3) $<$ **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[simplify]*

[39.2] (0 $<$ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3) && (**this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1})$.p3 $<$ **asType**<**integer**>($\$heap$.**class** WHPrang $\in$ M3))

→ *[const static or extern object]*

[39.3] $(0 <$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] $(0 <$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) ∧ (0 <
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] $((\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
$(\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] $((\text{\$heap}_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
$(\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] $(((\textbf{int})171$ * **static_cast**<**signed int**>(div1.rem)) −
$(\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] $((171$ * **static_cast**<**signed int**>(div1.rem)) − $(\text{\$heap}_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.4] $((171$ * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) −
$(\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] $((171$ * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) − $(\text{\$heap}_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] $((171$ * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem) − (\$heap$_{init}$.b1 * **static_cast**<**signed**

int>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__**replace**(**this**.$\$r$ → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).__**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.__**replace**(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 → **asType**<P1Type>(($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +

temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$

asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}.$_**replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

→ *[simplify]*

[53.15] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}.$_**replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.$r.**value**(*$heap_{funcstart_1032,1}$*).p1, 177).quot) + (171 **
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)]

[53.16] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}.$_**replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(0 + ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $heap_{1032,1;1051,8}$ == $heap_{funcstart\_1032,1}.$_**replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to*
*$heap_{funcstart\_1032,1}.$_**replace**(**this**.$r → **this**.$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.$r.**value**(*$heap_{funcstart_1032,1}$*).p1, 177).quot) + (171 **
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[54.1] (($heap_{funcstart\_1032,1}.$_**replace**(**this**.r → **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed**
int>(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed**

int>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.2] (($heap$_{funcstart_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($heap$_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((**(int)**172 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$,* **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to $heap$_{funcstart_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.10] $((172 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{init}.\text{b2} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] $((172 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - ((\textbf{int})35 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.12] $((172 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (35 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[from term 18.6, div2 is equal to div(*$\textbf{heapIs } \$heap_{funcstart\_1032,1}$*, *$\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2, 176)$*]*

[54.13] $((172 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (35 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.18] $0 == (-\text{temp2} + (\text{-}35 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{quot}) + (172 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}))$

[Take given term]

[57.0] $\$\text{heap}_{1032,1;1054,8} == \$\text{heap}_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this.}\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{1032,1;1051,8}, \textbf{this}).\_\textbf{replace}(\text{p2} \rightarrow \textbf{asType}{<}\text{P2Type}{>}((\$\text{heap}_{1032,1;1051,8}.\text{M2} * \textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed int}{>}(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{1032,1;1051,8}, \textbf{this}).\text{p2}) < (\textbf{int})0))) + \text{temp2})))$

$\rightarrow$ *[from term 53.19, *$\$heap_{1032,1;1051,8}$* is equal to *$\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.}\$r \rightarrow \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs }$ *$\$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\text{-}2 * \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$ *$\textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$ *$\text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs }$ *$\$heap_{funcstart\_1032,1}).p1, 177).rem)))$*]*

[57.2] $\$\text{heap}_{1032,1;1054,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.}\$\text{r} \rightarrow \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-}2 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this.}\$\text{r.}\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\textbf{this.}\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs }$

$heap_{funcstart\_1032,1}.$_**replace(this.\$r** $\to$ **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).$_**replace(p1** $\to$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))), **this).**_**replace(p2** $\to$ **asType**<P2Type>(($heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}.$_**replace(this.\$r** $\to$ **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).$_**replace(p1** $\to$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).$_**replace(this.\$r** $\to$ **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}.$_**replace(this.\$r** $\to$ **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).$_**replace(p1** $\to$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))).$_**replace(p2** $\to$ **asType**<P2Type>(($heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}.$_**replace(this.\$r** $\to$ **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).$_**replace(p1** $\to$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).$_**replace(this.\$r** $\to$ ([**this.\$r** == **this.\$r**]: **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).$_**replace(p1** $\to$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$)).$_**replace(p2** $\to$ **asType**<P2Type>(($heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}.$_**replace(this.\$r** $\to$ **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).$_**replace(p1** $\to$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).$_**replace(this.\$r** $\to$ ([**this.\$r** == **this.\$r**]: **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).$_**replace(p1** $\to$ (-2 *

div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$\text{heap}_{1032,1;1051,8}$ is equal to*
*$\$\text{heap}_{funcstart\_1032,1}$.**_replace**(this.$r → this.$r.value(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,*
*this.$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, this.$r.value(**heapIs***
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($\text{\$heap}_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.*__replace__*(**this**.\$r → **this**.\$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).*__replace__*(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.15] $heap_{1032,1;1054,8} ==$ $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>((([**this.\$r** == **this.\$r**]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), []: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $heap_{1032,1;1054,8} ==$ $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>((([**this.\$r** == **this.\$r**]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r** == **this.\$r**)]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.23] $heap_{1032,1;1054,8} ==$ $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala* < −**this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2
is false whenever -2 < *(0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ *[simplify]*

[57.25] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →

this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) + temp2)))

→ [simplify]

[57.29] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(0 + temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(0 + ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)))))

→ [simplify]

[57.33] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] ((\$heap$_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) − (\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[from term 57.33, \$heap$_{1032,1;1054,8}$ is equal to* $\text{\$heap}_{funcstart\_1032,1}$.__replace*(this.\$r →* **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace*(p1 → ((-2 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace*(this.\$r →* **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace*(p1 → ((-2 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).__replace*(p2 → (-35 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.1] ((\$heap$_{funcstart\_1032,1}$.__**replace**(this.\$r → **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(this.\$r → **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 → ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast**<**signed int**>(div3.rem)) − (\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.3] ((\$heap$_{funcstart\_1032,1}$.r3 * **static_cast**<**signed int**>(div3.rem)) − (\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

[58.4] ((\$heap$_{init}$.r3 * **static_cast**<**signed int**>(div3.rem)) − (\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] (((**int**)170 * **static_cast**<**signed int**>(div3.rem)) −

($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.6] ((170 * **static_cast<signed int>**(div3.rem)) $-$ ($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178)]*

[58.7] ((170 * **static_cast<signed int>**(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) $-$ ($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.8] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[from term 57.33, $heap$_{1032,1;1054,8}$ is equal to $heap_{funcstart\_1032,1}$._**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.9] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($heap_{funcstart\_1032,1}$._**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[const member of object with modified fields]*

[58.11] $((170 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{rem}) - (\$\mathrm{heap}_{funcstart\_1032,1}.\mathrm{b3}\ *\ \textbf{static\_cast}\!<\!\textbf{signed int}\!>\!(\mathrm{div3.quot}))) == \mathrm{temp3}$

$\rightarrow$ *[const static or extern object]*

[58.12] $((170 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{rem}) - (\$\mathrm{heap}_{init}.\mathrm{b3}\ *\ \textbf{static\_cast}\!<\!\textbf{signed int}\!>\!(\mathrm{div3.quot}))) == \mathrm{temp3}$

$\rightarrow$ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[58.13] $((170 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{rem}) - ((\textbf{int})63\ *\ \textbf{static\_cast}\!<\!\textbf{signed int}\!>\!(\mathrm{div3.quot}))) == \mathrm{temp3}$

$\rightarrow$ *[simplify]*

[58.14] $((170 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{rem}) - (63\ *\ \textbf{static\_cast}\!<\!\textbf{signed int}\!>\!(\mathrm{div3.quot}))) == \mathrm{temp3}$

$\rightarrow$ *[from term 34.6, div3 is equal to div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[58.15] $((170 * \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{rem}) - (63\ *\ \textbf{static\_cast}\!<\!\textbf{signed int}\!>\!(\mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{quot}))) == \mathrm{temp3}$

$\rightarrow$ *[simplify]*

[58.20] $0 == (-\mathrm{temp3} + (\text{-}63\ *\ \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{quot}) + (170\ *\ \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{rem}))$

[Take given term]

[59.0] $\textbf{minof}(\textbf{signed int}) \leq \mathrm{temp3}$

$\rightarrow$ *[simplify]*

[59.3] $\text{-}32769 < \mathrm{temp3}$

$\rightarrow$ *[from term 58.20, temp3 is equal to (-63 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[59.4] $\text{-}32769 < ((\text{-}63\ *\ \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{quot}) + (170\ *\ \mathrm{div}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}, \textbf{this}.\$\mathrm{r}.\textbf{value}(\textbf{heapIs}\ \$\mathrm{heap}_{funcstart\_1032,1}).\mathrm{p3}, 178).\mathrm{rem}))$

[Take goal term]

[1.0] **minof(signed int)** $\leq$ (($\text{\$heap}_{1032,1;1054,8}$.M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this)**.p3) < **(int)**0))) + temp3)

$\rightarrow$ *[simplify]*

[1.1] -32768 $\leq$ (($\text{\$heap}_{1032,1;1054,8}$.M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this)**.p3) < **(int)**0))) + temp3)

$\rightarrow$ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to*
$\text{\$heap}_{funcstart\_1032,1}$. **_replace***(this.\$r* $\rightarrow$ *this.\$r.***value***(heapIs*
$\text{\$heap}_{funcstart\_1032,1}$). **_replace***(p1* $\rightarrow$ *((-2 * div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,*
this.$r.**value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 **
*div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.**$r.**value***(heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace***(this.\$r* $\rightarrow$
this.$r.**value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).* **_replace***(p1* $\rightarrow$ *((-2 * div(***heapIs**
*$\text{\$heap}_{funcstart\_1032,1}$,* **this.**$r.**value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1,*
*177).quot) + (171 * div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.**$r.**value***(heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace***(p2* $\rightarrow$ *(-35 * div(***heapIs**
*$\text{\$heap}_{funcstart\_1032,1}$,* **this.**$r.**value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p2,*
*176).quot) + (172 * div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.**$r.**value***(heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]

[1.2] -32768 $\leq$ (($\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r $\rightarrow$
this.$r.**value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(heapIs
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r $\rightarrow$
this.$r.**value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(heapIs
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(heapIs
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this)**.p3) < **(int)**0))) + temp3)

$\rightarrow$ *[const member of object with modified fields]*

[1.4] -32768 $\leq$ (($\text{\$heap}_{funcstart\_1032,1}$.M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this)**.p3) < **(int)**0))) + temp3)

$\rightarrow$ *[const static or extern object]*

[1.5] -32768 $\leq$ (($\text{\$heap}_{init}$.M3 *
**asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this)**.p3) < **(int)**0))) + temp3)

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[1.6] -32768 ≤ (((**int**)30323 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)

→ *[simplify]*

[1.7] -32768 ≤ ((30323 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to
$\$heap_{funcstart\_1032,1}$._**replace**(this.$r →_ **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.8] -32768 ≤ ((30323 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.9] -32768 ≤ ((30323 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**this.$r.value**(heapIs $\$heap_{funcstart\_1032,1}$._**replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$r →

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p3) < (**int**)0))) + temp3)

→ *[evaluate dereferenced pointer into modified heap]*

[1.10] -32768 ≤ ((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), []: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$. **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.11] -32768 ≤ ((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this**.$r == **this**.$r)]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$. **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3)

→ *[simplify]*

[1.19] -32768 ≤ ((30323 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3))) + temp3)

→ *[from term 40.0, literala < −**this**.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.19.0] -2 < (0 + 0)

→ *[simplify]*

[1.19.2] **true**

[1.20] -32768 ≤ ((30323 * **asType\<int\>**(**static_cast\<integer\>**(**false**))) + temp3)

→ *[simplify]*

[1.21] -32768 ≤ ((30323 * **asType\<int\>**(((**[false]**: 1, **[]**: 0))) + temp3)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.22] -32768 ≤ ((30323 * **asType\<int\>**(((**[false]**: 1, **[true]**: 0))) + temp3)

→ *[simplify]*

[1.25] -32768 ≤ (0 + temp3)

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[1.26] -32768 ≤ (0 + ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)))

→ *[simplify]*

[1.30] -32769 < ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))

→ *[from term 59.4, literala < ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) is true whenever (-1 + literala) < -32769]*

Proof of rule precondition:

[1.30.0] (-32769 + -1) < -32769

→ *[simplify]*

[1.30.2] **true**

[1.31] **true**

Proof of verification condition: Arithmetic result of operator '+' is within limit of type 'signed int'

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (81,16)

Condition defined at:

To prove: (($heap$_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) ≤
maxof(**signed int**)

Given:

$heap$_{init}$.LIMIT == (**int**)80

$heap$_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$heap$_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$heap$_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$heap$_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$heap$_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$heap$_{init}$.**class** WHPrang ∈ r2 == (**int**)172

$heap$_{init}$.**class** WHPrang ∈ a2 == (**int**)176

$heap$_{init}$.**class** WHPrang ∈ b2 == (**int**)35

$heap$_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

$heap$_{init}$.**class** WHPrang ∈ r3 == (**int**)170

$heap$_{init}$.**class** WHPrang ∈ a3 == (**int**)178

$heap$_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) <
asType<**integer**>($heap$_{funcstart_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**

$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($heap_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($heap_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($heap_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($heap_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($heap_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$heap_{funcstart\_1032,1}$, **this**).p3))

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a}3) \leq$
$\textbf{asType}<\textbf{integer}>(\textbf{operator}*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p}3)) =>$
$!(0 == \textbf{asType}<\textbf{integer}>(\text{div}3.\text{quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div}3.\text{rem})) \;||\; !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div}3.\text{quot}))$

$\text{temp}1 == (\$\text{heap}_{funcstart\_1032,1}.\text{r}1 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}1.\text{rem})) -$
$(\$\text{heap}_{funcstart\_1032,1}.\text{b}1 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}1.\text{quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp}1$

$\text{temp}1 \leq \textbf{maxof}(\textbf{signed int})$

$\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\text{r} \rightarrow$
$\textbf{operator}*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\_\textbf{replace}(\text{p}1 \rightarrow$
$\textbf{asType}<\textbf{P1Type}>((\$\text{heap}_{funcstart\_1032,1}.\text{M}1 *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p}1) < (\textbf{int})0))) +$
$\text{temp}1)))$

$\text{temp}2 == (\$\text{heap}_{1032,1;1051,8}.\text{r}2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}2.\text{rem})) -$
$(\$\text{heap}_{1032,1;1051,8}.\text{b}2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}2.\text{quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp}2$

$\text{temp}2 \leq \textbf{maxof}(\textbf{signed int})$

$\$\text{heap}_{1032,1;1054,8} == \$\text{heap}_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this}.\$\text{r} \rightarrow$
$\textbf{operator}*(\textbf{heapIs } \$\text{heap}_{1032,1;1051,8}, \textbf{this}).\_\textbf{replace}(\text{p}2 \rightarrow$
$\textbf{asType}<\textbf{P2Type}>((\$\text{heap}_{1032,1;1051,8}.\text{M}2 *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}*(\textbf{heapIs } \$\text{heap}_{1032,1;1051,8}, \textbf{this}).\text{p}2) < (\textbf{int})0))) + \text{temp}2)))$

$\text{temp}3 == (\$\text{heap}_{1032,1;1054,8}.\text{r}3 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}3.\text{rem})) -$
$(\$\text{heap}_{1032,1;1054,8}.\text{b}3 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}3.\text{quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp}3$

$\text{temp}3 \leq \textbf{maxof}(\textbf{signed int})$

Proof:

[Take given term]

[2.0] $\text{div}1 == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{operator}*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p}1),$
$\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a}1))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] $\text{div}1 == \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p}1),$
$\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a}1))$

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>(heap_{init}.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>(heap_{init}.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) && (**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1 < **asType**<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2), **static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈
M2))

→ *[simplify]*

[23.2] (0 < **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

→ *[simplify]*

[23.10] (-30307 < −**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) ∧ (0 <
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>(\$heap$_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] $(0 <$ **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3) $<$ **asType**<**integer**>(\$heap.**class** WHPrang $\in$
M3))

$\rightarrow$ *[simplify]*

[39.2] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 $<$
asType<**integer**>(\$heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 $<$
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 $<$

asType<integer>((int)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p3) ∧ (0 < **this**.$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p3

[Take given term]

[50.0] ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] ((\$heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) − (\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).rem)) − (\$heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).rem) − (\$heap$_{funcstart_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).rem) − (\$heap$_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → **asType**<P1Type>(((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +

temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala < $-$**this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) +
temp1)))

→ [simplify]

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(0 + temp1)))

→ [from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ [simplify]

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to
$\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[54.1] (($\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed
int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ [const member of object with modified fields]

[54.2] (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ [const static or extern object]

[54.3] (($\text{\$heap}_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((($\textbf{int}$)172 * **static_cast**<**signed int**>(div2.rem)) −
($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)) −
($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to
$\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r** → **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.\$r**
→ **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{funcstart\_1032,1}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem) − ($\text{\$heap}_{init}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$._**replace**(**this**.$r → **operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.2] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**)._**replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *

asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))._**replace**(p2 $\rightarrow$ **asType**<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$ ([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$))._**replace**(p2 $\rightarrow$ **asType**<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$ ([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r == **this**.$r)]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$))._**replace**(p2 $\rightarrow$ **asType**<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r$ → **this.**$\$r$.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *

asType<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.* **_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)**.** **_replace**(p1 $\rightarrow$ *(-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)*.p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)*.p1, 177).rem)))]*

[57.13] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$

this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem))))._replace(**this.$r** $\to$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem)))._replace(**p2 $\to$ asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(([**this.$r == this.$r**]: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem)), []: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)).**p2) < (**int**)0))) + temp2)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._replace(**this.$r** $\to$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem))))._replace(**this.$r** $\to$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem)))._replace(**p2 $\to$ asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(([**this.$r == this.$r**]: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem)), [!(**this.$r == this.$r**)]: **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)).**p2) < (**int**)0))) + temp2)))

$\to$ *[simplify]*

[57.23] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._replace(**this.$r** $\to$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem))))._replace(**this.$r** $\to$ **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1, 177).rem)))._replace(**p2 $\to$ asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(0 <

$-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)))

$\rightarrow$ *[from term 24.0, literala $<$ $-$**this**.$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p2 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**$<$P2Type$>$((30307 * **asType**$<$**int**$>$(**static_cast**$<$**integer**$>$(**false**))) + temp2)))

$\rightarrow$ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**$<$P2Type$>$((30307 * **asType**$<$**int**$>$((([**false**]: 1, []: 0))) + temp2)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**$<$P2Type$>$((30307 * **asType**$<$**int**$>$((([**false**]: 1, [**true**]: 0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.29] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ **asType**<P2Type>(0 +
temp2)))

$\rightarrow$ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.**value**(**heapIs** *$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$,* this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))))

$\rightarrow$ *[simplify]*

[57.33] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] (($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) $-$
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$.__replace__*(***this.$r $\rightarrow$ this.$r.**value***(***heapIs**
$\$heap_{funcstart\_1032,1}$*).*__replace__*(p1 $\rightarrow$ ((-2 * div(***heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.value*(***heapIs** $\$heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 **
*div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value***(***heapIs**
$\$heap_{funcstart\_1032,1}$*).p1, 177).rem)))).*__replace__*(***this.$r $\rightarrow$**
this.$r.value*(***heapIs** $\$heap_{funcstart\_1032,1}$*).*__replace__*(p1 $\rightarrow$ ((-2 * div(***heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value***(***heapIs** $\$heap_{funcstart\_1032,1}$*).p1,*
*177).quot) + (171 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value***(***heapIs**
$\$heap_{funcstart\_1032,1}$*).p1, 177).rem))).*__replace__*(p2 $\rightarrow$ (-35 * div(***heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value***(***heapIs** $\$heap_{funcstart\_1032,1}$*).p2,*
*176).quot) + (172 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value***(***heapIs**
$\$heap_{funcstart\_1032,1}$*).p2, 176).rem)))]*

[58.1] ((\$heap$_{funcstart\_1032,1}$.__replace__(**this.$r $\rightarrow$ this.$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).__replace__(p1 $\rightarrow$ ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.$r.value(**heapIs** \$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.$r $\rightarrow$**
this.$r.value(**heapIs** \$heap$_{funcstart_1032,1}$).__replace__(p1 $\rightarrow$ ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 $\rightarrow$ ((-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast<signed**
int>(div3.rem)) $-$ (\$heap$_{1032,1;1054,8}$.b3 * **static_cast<signed**
int>(div3.quot))) == temp3

$\rightarrow$ *[const member of object with modified fields]*

[58.3] ((\$heap$_{funcstart\_1032,1}$.r3 * **static_cast<signed int>**(div3.rem)) $-$
(\$heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[const static or extern object]*

[58.4] ((\$heap$_{init}$.r3 * **static_cast<signed int>**(div3.rem)) $-$
(\$heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] (((**int**)170 * **static_cast<signed int>**(div3.rem)) $-$
(\$heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.6] ((170 * **static_cast<signed int>**(div3.rem)) $-$ (\$heap$_{1032,1;1054,8}$.b3 *
static_cast<signed int>(div3.quot))) == temp3

$\rightarrow$ *[from term 34.6, div3 is equal to div(***heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.value*(***heapIs** $\$heap_{funcstart\_1032,1}$*).p3, 178)]*

[58.7] ((170 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[simplify]*

[58.8] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.9] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.11] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{funcstart\_1032,1}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[const static or extern object]*

[58.12] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{init}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[58.13] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ((**int**)63 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.14] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[58.15] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

→ *[simplify]*

[58.20] 0 == (−temp3 + (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[60.0] temp3 ≤ **maxof**(**signed int**)

→ *[simplify]*

[60.9] -32768 < −temp3

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[60.10] -32768 < −((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))

→ *[simplify]*

[60.13] -32768 < ((63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (-170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))

[Take goal term]

[1.0] (($\$heap_{1032,1;1054,8}$.M3 *

asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\text{\$heap}_{1032,1;1054,8}$**, this).p3) < (int)0))) + temp3) ≤ maxof(signed int)**

→ *[from term 57.33,* $\text{\$heap}_{1032,1;1054,8}$ *is equal to* $\text{\$heap}_{funcstart\_1032,1}$**._replace***(this.\$r →* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*)._***replace***(p1 → ((-2 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$*,* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$*,* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).rem))))._***replace***(this.\$r →* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*)._***replace***(p1 → ((-2 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$*,* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$*,* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).rem)))._***replace***(p2 → (-35 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$*,* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p2, 176).quot) + (172 * div(***heapIs** $\text{\$heap}_{funcstart\_1032,1}$*,* **this.\$r.value***(heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p2, 176).rem)))]*

[1.1] ((\$heap$_{funcstart\_1032,1}$**._replace***(this.\$r →* **this.\$r.value***(heapIs* \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r → **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)))).M3 * **asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs** \$heap$_{1032,1;1054,8}$, **this).p3) < (int)0))) + temp3) ≤ maxof(signed int)**

→ *[const member of object with modified fields]*

[1.3] ((\$heap$_{funcstart\_1032,1}$**.M3 * asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs** \$heap$_{1032,1;1054,8}$, **this).p3) < (int)0))) + temp3) ≤ maxof(signed int)**

→ *[const static or extern object]*

[1.4] ((\$heap$_{init}$**.M3 * asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs** \$heap$_{1032,1;1054,8}$, **this).p3) < (int)0))) + temp3) ≤ maxof(signed int)**

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[1.5] (((**int**)30323 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) ≤
maxof(**signed int**)

→ *[simplify]*

[1.6] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) ≤
maxof(**signed int**)

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to
$\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** → **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.7] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3) ≤
maxof(**signed int**)

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.8] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed
int>**(**this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.$r** →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p3) < (**int**)0))) + temp3) ≤ **maxof**(**signed int**)

→ *[evaluate dereferenced pointer into modified heap]*

[1.9] ((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r == this.\$r**]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), []: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3) ≤ **maxof**(**signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] ((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r == this.\$r**]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.\$r == this.\$r**)]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.18] ((30323 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3))) + temp3) ≤ **maxof**(**signed int**)

$\rightarrow$ *[from term 40.0, literala $< -$**this**.\$r.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[1.18.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.18.2] **true**

[1.19] ((30323 * **asType<int>**(**static_cast<integer>**(**false**))) + temp3) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.20] ((30323 * **asType<int>**(([**false**]: 1, []: 0))) + temp3) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.21] ((30323 * **asType<int>**(([**false**]: 1, [**true**]: 0))) + temp3) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.24] (0 + temp3) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[1.25] (0 + ((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))) $\leq$ **maxof**(**signed int**)

$\rightarrow$ *[simplify]*

[1.41] -32768 < ((-170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) + (63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot))

$\rightarrow$ *[from term 60.13, literala < ((-170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) + (63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot)) is true whenever (-1 + literala) < -32768]*

Proof of rule precondition:

[1.41.0] (-32768 + -1) < -32768

$\rightarrow$ *[simplify]*

[1.41.2] **true**

[1.42] **true**

Proof of verification condition: Type constraint satisfied in implicit conversion from 'signed int' to 'P3Type'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (81,16)

Condition defined at:

To prove: minof(signed int) $\leq$ ((\$heap$_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** \$heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)

Given:

\$heap$_{init}$.LIMIT == (**int**)80

\$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

\$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

\$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

\$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

\$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

\$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

\$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

\$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

\$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

\$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

\$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

\$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1)) / **asType**<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a1))) == **asType**<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1)) % **asType**<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a1))) ==

asType\<integer\>(div1.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType\<integer\>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType\<integer\>**(div1.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType\<integer\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType\<integer\>**(div1.quot))

!(0 == **asType\<integer\>**(div1.rem)) || !(0 ==
asType\<integer\>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast\<int\>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType\<integer\>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType\<integer\>**(div2.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a2) $\leq$
asType\<integer\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType\<integer\>**(div2.quot))

!(0 == **asType\<integer\>**(div2.rem)) || !(0 ==
asType\<integer\>(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast\<int\>($\text{\$heap}_{funcstart\_1032,1}$.a3))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType\<integer\>(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.rem)

($\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}) < \textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) => ($\textbf{asType}<\textbf{integer}>(\text{div3.rem}) == \textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart_1032,1}, \textbf{this}).\text{p3}))$

($\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq \textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) => !(0 == \textbf{asType}<\textbf{integer}>(\text{div3.quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div3.rem})) \,||\, !(0 == \textbf{asType}<\textbf{integer}>(\text{div3.quot}))$

temp1 == ($\$\text{heap}_{funcstart\_1032,1}.\text{r1} * \textbf{static\_cast}<\textbf{signed int}>(\text{div1.rem})) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}<\textbf{signed int}>(\text{div1.quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp1}$

$\text{temp1} \leq \textbf{maxof}(\textbf{signed int})$

$\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$\text{r} \to \textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\_\textbf{replace}(\text{p1} \to \textbf{asType}<\text{P1Type}>((\$\text{heap}_{funcstart\_1032,1}.\text{M1} * \textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) + \text{temp1})))$

temp2 == ($\$\text{heap}_{1032,1;1051,8}.\text{r2} * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.rem})) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp2}$

$\text{temp2} \leq \textbf{maxof}(\textbf{signed int})$

$\$\text{heap}_{1032,1;1054,8} == \$\text{heap}_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this}.\$\text{r} \to \textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{1032,1;1051,8}, \textbf{this}).\_\textbf{replace}(\text{p2} \to \textbf{asType}<\text{P2Type}>((\$\text{heap}_{1032,1;1051,8}.\text{M2} * \textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed int}>(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{1032,1;1051,8}, \textbf{this}).\text{p2}) < (\textbf{int})0))) + \text{temp2})))$

temp3 == ($\$\text{heap}_{1032,1;1054,8}.\text{r3} * \textbf{static\_cast}<\textbf{signed int}>(\text{div3.rem})) - (\$\text{heap}_{1032,1;1054,8}.\text{b3} * \textbf{static\_cast}<\textbf{signed int}>(\text{div3.quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp3}$

$\text{temp3} \leq \textbf{maxof}(\textbf{signed int})$

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1), **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1) < **asType<integer>**($\$heap.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>($\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>($\$heap_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<integer>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$
M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3), **static_cast**<**int**>($heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($heap_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[simplify]*

[39.2] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 <

asType<**integer**>(heap_{init}.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 < $-$**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) $\land$ (0 <
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] (($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] ((heap_{init}.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ (heap_{init}.b1 * **static_cast**<**signed
int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType**<P1Type>(($\$heap_{init}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(((**int**)30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$\$$r → **this**.$\$$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>((30269 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\to$ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>(0 + temp1)))

$\to$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.$**value**(*$heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)]

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\to$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$
this.$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\to$ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to*
*$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$ **this.**$r.$**value**(**heapIs***
*$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.$**value**(**heapIs** *$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[54.1] (($\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r \to$ **this.**$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed
int**>(div2.rem)) − ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

$\to$ *[const member of object with modified fields]*

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[54.2] $((\$\text{heap}_{funcstart\_1032,1}.\text{r2} * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.rem})) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[const static or extern object]*

[54.3] $((\$\text{heap}_{init}.\text{r2} * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.rem})) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] $(((\textbf{int})172 * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.rem})) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[simplify]*

[54.5] $((172 * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.rem})) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} *$ $\textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] $((172 * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$ $\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem})) -$ $(\$\text{heap}_{1032,1;1051,8}.\text{b2} * \textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[simplify]*

[54.7] $((172 * \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{1032,1;1051,8}.\text{b2} *$ $\textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.__replace(**this**.$\$r$ → **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] $((172 * \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{funcstart\_1032,1}.\textbf{\_\_replace}(\textbf{this}.\$\text{r}$ $\rightarrow \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\textbf{\_\_replace}(\text{p1} \rightarrow ((-2 *$ $\text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 * \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1},$ $\textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\text{b2} *$ $\textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[const member of object with modified fields]*

[54.9] $((172 * \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\$\text{heap}_{funcstart\_1032,1}.\text{b2} *$ $\textbf{static\_cast}\langle\textbf{signed int}\rangle(\text{div2.quot}))) == \text{temp2}$

→ *[const static or extern object]*

[54.10] $((172 * \text{div}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$\text{r}.\textbf{value}(\textbf{heapIs}$

$\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - (\text{\$heap}_{init}.b2 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(div2.quot))) == temp2$

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] $((172 * div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - ((\textbf{int})35 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(div2.quot))) == temp2$

→ *[simplify]*

[54.12] $((172 * div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - (35 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(div2.quot))) == temp2$

→ *[from term 18.6, div2 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.$\$r.$**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176)]

[54.13] $((172 * div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem) - (35 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).quot))) == temp2$

→ *[simplify]*

[54.18] $0 == (-temp2 + (\text{-35} * div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1},$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}).p2, 176).quot) + (172 *$
$div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).p2, 176).rem))$

[Take given term]

[57.0] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{operator}^*(\textbf{heapIs} \text{\$heap}_{1032,1;1051,8}, \textbf{this}).\_\textbf{replace}(p2 \rightarrow$
$\textbf{asType}<\text{P2Type}>((\text{\$heap}_{1032,1;1051,8}.M2 *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs} \text{\$heap}_{1032,1;1051,8}, \textbf{this}).p2) < (\textbf{int})0))) + temp2)))$

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}.\_$**replace***(this.$\$r \rightarrow$ **this.**$\$r.$**value**(**heapIs**
*$\text{\$heap}_{funcstart\_1032,1}).\_$**replace***(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.$\$r.$**value**(**heapIs** *$\text{\$heap}_{funcstart_1032,1}).p1, 177).quot) + (171 ***
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$\$r.$**value***(**heapIs**
$\text{\$heap}_{funcstart_1032,1}).p1, 177).rem)))]

[57.2] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}).p1,$
$177).quot) + (171 * div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).p1, 177).rem)))).\_\textbf{replace}(\textbf{this}.\$r \rightarrow \textbf{operator}^*(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (-2 * div(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1},$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1}).p1, 177).quot) + (171 *$

div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r → ([**this.$r** ==
this.$r**]: **this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$r →
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r → ([**this.$r** ==
this.$r**]: **this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r** ==

this.$r)]: **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to*
*$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r → **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(($\$heap_{funcstart\_1032,1}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$. **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(($\$heap_{init}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$. **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(((**int**)30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$. **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace**(this.$\$r$ → this.$\$r$.**value**(heapIs*
*$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this**.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(heapIs*
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(this.$\$r$ →
this.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r**
== **this.\$r**]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r**
== **this.\$r**]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r** ==
this.\$r)]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

[57.23] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this**.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp2)))

→ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 **
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] $(($heap$_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[from term 57.33, $heap$_{1032,1;1054,8}$ is equal to $heap$_{funcstart_1032,1}$.\_**replace**(this.$r → this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).rem)))).\_**replace**(this.$r → this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p2, 176).rem)))]*

[58.1] (($heap$_{funcstart_1032,1}$.\_**replace**(this.$r → this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).rem)))).\_**replace**(this.$r → this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, this.$r.**value**(heapIs $heap$_{funcstart_1032,1}$).p2, 176).rem)))).r3 * **static_cast**<**signed int**>(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.3] (($heap$_{funcstart_1032,1}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

[58.4] (($heap$_{init}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] (((**int**)170 * **static_cast**<**signed int**>(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.6] ((170 * **static_cast**<**signed int**>(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 *

static_cast<signed int>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178)]*

[58.7] ((170 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) − ($heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.8] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − ($heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[from term 57.33, $heap_{1032,1;1054,8}$ is equal to $heap_{funcstart\_1032,1}$.__replace(**this.$r** → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(**this.$r** → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.9] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − ($heap_{funcstart\_1032,1}$.__replace(**this.$r** → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(**this.$r** → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.11] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − ($heap_{funcstart\_1032,1}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

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[58.12] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\$\text{heap}_{init}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[58.13] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − ((**int**)63 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[simplify]*

[58.14] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178)]*

[58.15] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast<signed int>**(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

→ *[simplify]*

[58.20] 0 == (−temp3 + (-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[59.0] **minof**(**signed int**) ≤ temp3

→ *[simplify]*

[59.3] -32769 < temp3

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)]*

[59.4] -32769 < ((-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))

[Take goal term]

[1.0] **minof**(**signed int**) ≤ (($\$\text{heap}_{1032,1;1054,8}$.M3 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)

→ *[simplify]*

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[1.1] $-32768 \leq (($\$$heap_{1032,1;1054,8}$.M3 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$$heap_{1032,1;1054,8}$, **this).p3) < (int)0)))** + temp3)

$\rightarrow$ *[from term 57.33,* $\$$heap_{1032,1;1054,8}$ *is equal to*
$\$$heap_{funcstart_1032,1}$._**replace***(this.$\$$r \rightarrow$ **this.$\$$r.value(heapIs**
$\$$heap_{funcstart_1032,1}$*)*._**replace***(p1 \rightarrow ((-2 * div(***heapIs** $\$$heap_{funcstart_1032,1}$,
this.$\$$r.value(heapIs $\$$heap_{funcstart_1032,1}$*).p1, 177).quot) + (171 ***
*div(***heapIs** $\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs**
$\$$heap_{funcstart_1032,1}$*).p1, 177).rem))))*._**replace***(this.$\$$r \rightarrow$
this.$\$$r.value(heapIs $\$$heap_{funcstart_1032,1}$*)*._**replace***(p1 \rightarrow ((-2 * div(***heapIs**
$\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs** $\$$heap_{funcstart_1032,1}$*).p1,*
*177).quot) + (171 * div(***heapIs** $\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs**
$\$$heap_{funcstart_1032,1}$*).p1, 177).rem)))*._**replace***(p2 \rightarrow (-35 * div(***heapIs**
$\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs** $\$$heap_{funcstart_1032,1}$*).p2,*
*176).quot) + (172 * div(***heapIs** $\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs**
$\$$heap_{funcstart_1032,1}$*).p2, 176).rem)))]*

[1.2] $-32768 \leq (($\$$heap_{funcstart\_1032,1}$._**replace(this.$\$$r \rightarrow$
this.$\$$r.value(heapIs $\$$heap_{funcstart_1032,1}$)._**replace(p1 \rightarrow ((-2 * div(heapIs**
$\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs** $\$$heap_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs**
$\$$heap_{funcstart_1032,1}$).p1, 177).rem))))._**replace(this.$\$$r \rightarrow$
this.$\$$r.value(heapIs $\$$heap_{funcstart_1032,1}$)._**replace(p1 \rightarrow ((-2 * div(heapIs**
$\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs** $\$$heap_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs**
$\$$heap_{funcstart_1032,1}$).p1, 177).rem)))._**replace(p2 \rightarrow ((-35 * div(heapIs**
$\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs** $\$$heap_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$$heap_{funcstart_1032,1}$, **this.$\$$r.value(heapIs**
$\$$heap_{funcstart_1032,1}$).p2, 176).rem)))).M3 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$$heap_{1032,1;1054,8}$, **this).p3) < (int)0)))** + temp3)

$\rightarrow$ *[const member of object with modified fields]*

[1.4] $-32768 \leq (($\$$heap_{funcstart\_1032,1}$.M3 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$$heap_{1032,1;1054,8}$, **this).p3) < (int)0)))** + temp3)

$\rightarrow$ *[const static or extern object]*

[1.5] $-32768 \leq (($\$$heap_{init}$.M3 *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$$heap_{1032,1;1054,8}$, **this).p3) < (int)0)))** + temp3)

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[1.6] $-32768 \leq ((($**(int)30323** *
asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $\$$heap_{1032,1;1054,8}$, **this).p3) < (int)0)))** + temp3)

$\rightarrow$ *[simplify]*

[1.7] -32768 $\leq$ ((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** \$heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)

$\rightarrow$ *[from term 57.33, \$heap$_{1032,1;1054,8}$ is equal to
\$heap$_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ (-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.8] -32768 $\leq$ ((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ (-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3)

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.9] -32768 $\leq$ ((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, this.\$r.**value**(heapIs
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).p3) < (**int**)0))) + temp3)

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[1.10] -32768 ≤ ((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.\$r
== **this**.\$r]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2
* div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
(-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).p3) < (**int**)0))) + temp3)

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.11] -32768 ≤ ((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.\$r
== **this**.\$r]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2
* div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
(-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this**.\$r ==
this.\$r)]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).p3) < (**int**)0))) + temp3)

$\rightarrow$ *[simplify]*

[1.19] -32768 ≤ ((30323 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3))) + temp3)

$\rightarrow$ *[from term 40.0, literala < −**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[1.19.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[1.19.2] **true**

[1.20] -32768 ≤ ((30323 * **asType<int>**(**static_cast<integer>**(**false**))) + temp3)

→ *[simplify]*

[1.21] -32768 ≤ ((30323 * **asType<int>**((([**false**]: 1, []: 0))) + temp3)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.22] -32768 ≤ ((30323 * **asType<int>**((([**false**]: 1, [**true**]: 0))) + temp3)

→ *[simplify]*

[1.25] -32768 ≤ (0 + temp3)

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[1.26] -32768 ≤ (0 + ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)))

→ *[simplify]*

[1.30] -32769 < ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))

→ *[from term 59.4, literala < ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.**$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) is true whenever (-1 + literala) < -32769]*

Proof of rule precondition:

[1.30.0] (-32769 + -1) < -32769

→ *[simplify]*

[1.30.2] **true**

[1.31] **true**

Proof of verification condition: Type constraint satisfied in implicit conversion from 'signed int' to 'P3Type'

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (81,16)

Condition defined at:

To prove: $(($heap$_{1032,1;1054,8}$.M3 $*$
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) $\leq$
maxof(**signed int**))

Given:

\$heap$_{init}$.LIMIT == (**int**)80

\$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

\$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

\$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

\$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

\$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

\$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

\$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

\$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

\$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

\$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

\$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

\$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>(\$heap$_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>(\$heap$_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

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!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a2) ≤
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\text{heap}_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\text{heap}_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==

asType<integer>(div3.quot))

temp1 == ($heap$_{funcstart_1032,1}$.r1 * **static_cast<signed int>**(div1.rem)) $-$ ($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

$heap$_{1032,1;1051,8}$ == $heap$_{funcstart_1032,1}$.**_replace(this.$r $\rightarrow$
operator*(**heapIs** $heap$_{funcstart_1032,1}$, **this)._replace**(p1 $\rightarrow$
asType<P1Type>(($heap$_{funcstart_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) < **(int)**0))) +
temp1)))

temp2 == ($heap$_{1032,1;1051,8}$.r2 * **static_cast<signed int>**(div2.rem)) $-$
($heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))

minof(signed int) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

$heap$_{1032,1;1054,8}$ == $heap$_{1032,1;1051,8}$.**_replace(this.$r $\rightarrow$
operator*(**heapIs** $heap$_{1032,1;1051,8}$, **this)._replace**(p2 $\rightarrow$
asType<P2Type>(($heap$_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $heap$_{1032,1;1051,8}$, **this**).p2) < **(int)**0))) + temp2)))

temp3 == ($heap$_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) $-$
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))

minof(signed int) $\leq$ temp3

temp3 $\leq$ **maxof(signed int)**

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<int>(**this.$r.value**(**heapIs** $heap$_{funcstart_1032,1}$).p1),
static_cast<int>($heap$_{funcstart_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, **static_cast<int>**($heap$_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\text{\$heap}$.**class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2),

static_cast<**int**>($heap$_{funcstart_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>($heap$_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) < **asType**<**integer**>($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>($heap$_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) && (**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2

[Take given term]

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[34.0] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<int>($\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
static_cast<int>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3),
static_cast<int>($\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**($\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**(heap_{init}.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast<int>**((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType<integer>**(**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3)) && (**asType<integer>**(**this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3) < **asType<integer>**(heap.**class** WHPrang $\in$
M3))

$\rightarrow$ *[simplify]*

[39.2] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<integer>(heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<integer>(heap_{init}.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<integer>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] $(-30323 < -\textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p3}) \wedge (0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p3})$

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 < \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p3}$

[Take given term]

[50.0] $((\$\text{heap}_{funcstart\_1032,1}.\text{r1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.rem})) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[const static or extern object]*

[50.1] $((\$\text{heap}_{init}.\text{r1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.rem})) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] $(((\textbf{int})171 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.rem})) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[simplify]*

[50.3] $((171 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.rem})) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$\$$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.4] $((171 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[simplify]*

[50.5] $((171 * \text{div}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (\$\text{heap}_{funcstart\_1032,1}.\text{b1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[const static or extern object]*

[50.6] $((171 * \text{div}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (\$\text{heap}_{init}.\text{b1} * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] $((171 * \text{div}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - ((\textbf{int})2 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[simplify]*

[50.8] $((171 * \text{div}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs}~\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (2 * \textbf{static\_cast}{<}\textbf{signed int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this.\$r.value(heapIs** *\$heap$_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast<signed int>**(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace(this.\$r** $\rightarrow$ **operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).**_replace**(p1 $\rightarrow$ **asType<P1Type>**((\$heap$_{funcstart\_1032,1}$.M1 * **asType<int>(static_cast<integer>(static_cast<signed int>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace(this.\$r** $\rightarrow$ **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType<P1Type>**((\$heap$_{funcstart\_1032,1}$.M1 * **asType<int>(static_cast<integer>(static_cast<signed int>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace(this.\$r** $\rightarrow$ **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType<P1Type>**((\$heap$_{init}$.M1 * **asType<int>(static_cast<integer>(static_cast<signed int>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] \$heap$_{1032,1;1051,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace(this.\$r** $\rightarrow$ **this.\$r.value(heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ **asType<P1Type>**(((**int**)30269 * **asType<int>(static_cast<integer>(static_cast<signed int>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.4] $\text{\$heap}_{1032,1;1051,8} == \text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\text{\$heap}_{1032,1;1051,8} == \text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\text{\$heap}_{1032,1;1051,8} == \text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala $< -$**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\text{\$heap}_{1032,1;1051,8} == \text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\text{\$heap}_{1032,1;1051,8} == \text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\text{\$heap}_{1032,1;1051,8} == \text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.15] $\text{\$heap}_{1032,1;1051,8} == \text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$

asType<P1Type>(0 + temp1)))

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.2] (($\$heap_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.3] (($\$heap_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) −
($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($heap_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176).rem)) −
($heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to
$heap_{funcstart\_1032,1}$._**replace(this.$r** → **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{funcstart\_1032,1}$._**replace(this.$r**
→ **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{funcstart\_1032,1}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($heap_{init}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ [simplify]

[54.12] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) == temp2

*→ [from term 18.6, div2 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this**.\$r.**value**(*\$heap$_{funcstart\_1032,1}$*).*p2, 176)]*

[54.13] ((172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ [simplify]

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] \$heap$_{1032,1;1054,8}$ == \$heap$_{1032,1;1051,8}$.**_replace**(**this**.\$r → **operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).**_replace**(p2 → **asType**<P2Type>((\$heap$_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

*→ [from term 53.19, \$heap$_{1032,1;1051,8}$ is equal to \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this**.\$r.**value**(**heapIs** *\$heap$_{funcstart\_1032,1}$*).*p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,* **this**.\$r.**value**(**heapIs** *\$heap$_{funcstart\_1032,1}$*).*p1, 177).rem)))]*

[57.2] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → **operator***(**heapIs** \$heap$_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))), **this**).**_replace**(p2 → **asType**<P2Type>((\$heap$_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** \$heap$_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ [expand definition of operator '' in class 'pointer' at built in declaration]*

[57.3] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** → ([**this.\$r** ==
this.\$r]: **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** → ([**this.\$r** ==
this.\$r]: **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r** ==
this.\$r)]: **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** →

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($\text{heap}_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to*
*$heap_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>(($\text{heap}_{funcstart\_1032,1}$.M2 *

asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[const static or extern object]*

[57.10] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**<P2Type>(($\$heap_{init}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**<P2Type>((((**int**)30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.12] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs***

$heap_{funcstart\_1032,1}$). _replace(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$. _**replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(static_cast<signed int>(operator*(**heapIs** $heap_{funcstart\_1032,1}$. _**replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$). _**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ [expand definition of operator '*' in class 'pointer' at built in declaration]

[57.14] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$. _**replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(static_cast<signed int>(**this.$r.value(heapIs** $heap_{funcstart\_1032,1}$. _**replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

→ [evaluate dereferenced pointer into modified heap]

[57.15] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$. _**replace**(this.$r → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(this.$r →

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r == **this**.$r)]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.23] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(0 < −**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this**.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp2)))

→ *[simplify]*

[57.25] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp2)))

→ *[simplify]*

[57.29] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r → this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r $\to$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ **asType**<P2Type>(0 + temp2)))

$\to$ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r $\to$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r $\to$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ **asType**<P2Type>(0 + ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))))

$\to$ *[simplify]*

[57.33] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r $\to$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r $\to$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] (($\$\text{heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\to$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r $\to$ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*

this.$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).*p1, 177).quot) + (171 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).*p1, 177).rem)))).*__replace__(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).*__replace__(*p1* → ((-2 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).*p1, 177).quot) + (171 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).*p1, 177).rem))).*__replace__(*p2* → (-35 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).*p2, 176).quot) + (172 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).*p2, 176).rem)))]*

[58.1] (($\$heap_{funcstart\_1032,1}$.__replace__(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.$r** → **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.3] (($\$heap_{funcstart\_1032,1}$.r3 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[const static or extern object]*

[58.4] (($\$heap_{init}$.r3 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] (((**int**)170 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[simplify]*

[58.6] ((170 * **static_cast<signed int>**(div3.rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[58.7] ((170 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) − ($\$heap_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ [simplify]

[58.8] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ [from term 57.33, $\$\text{heap}_{1032,1;1054,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))]

[58.9] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ [const member of object with modified fields]

[58.11] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ [const static or extern object]

[58.12] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\$\text{heap}_{init}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ [expand definition of constant 'b3' at prang.cpp (41,26)]

[58.13] ((170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ((**int**)63 * **static_cast<signed**

int>(div3.quot))) == temp3

→ *[simplify]*

[58.14] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[58.15] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

→ *[simplify]*

[58.20] 0 == (−temp3 + (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[60.0] temp3 ≤ **maxof**(**signed int**)

→ *[simplify]*

[60.9] -32768 < −temp3

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[60.10] -32768 < −((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))

→ *[simplify]*

[60.13] -32768 < ((63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (-170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))

[Take goal term]

[1.0] (($\$heap_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) ≤ **maxof**(**signed int**)

$\rightarrow$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$)._ **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._ **replace**(**this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._ **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._ **replace**(p2 $\rightarrow$ (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.1] (($\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r \rightarrow$ **this.**$r.**value(heapIs**
$\text{heap}_{funcstart\_1032,1}$)._ **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._ **replace**(**this.**$r \rightarrow$
this.$r.**value(heapIs** $\text{heap}_{funcstart\_1032,1}$)._ **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._ **replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value(heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).M3 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) $\leq$
maxof(signed int)

$\rightarrow$ *[const member of object with modified fields]*

[1.3] (($\text{heap}_{funcstart\_1032,1}$.M3 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) $\leq$
maxof(signed int)

$\rightarrow$ *[const static or extern object]*

[1.4] ((heap_{init}.M3 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) $\leq$
maxof(signed int)

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[1.5] (((**int**)30323 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) $\leq$
maxof(signed int)

→ *[simplify]*

[1.6] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3) ≤ **maxof(signed int)**

→ *[from term 57.33, $heap_{1032,1;1054,8}$ is equal to $heap_{funcstart\_1032,1}$.* **replace***(this.$r →* **this**.$r.**value**(*heapIs* $heap_{funcstart\_1032,1}$).* **replace***(p1 → ((-2 * div(***heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).* **replace***(this.$r →* **this**.$r.**value**(*heapIs* $heap_{funcstart\_1032,1}$).* **replace***(p1 → ((-2 * div(***heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).* **replace***(p2 → (-35 * div(***heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(***heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[1.7] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $heap_{funcstart\_1032,1}$.* **replace***(this.$r →* **this**.$r.**value**(*heapIs* $heap_{funcstart\_1032,1}$).* **replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).* **replace**(this.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).* **replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).* **replace**(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3) ≤ **maxof(signed int)**

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[1.8] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$.* **replace**(this.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).* **replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).* **replace**(this.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).* **replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).* **replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,

176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p3) < (**int**)0))) + temp3) ≤ **maxof**(**signed int**)

→ *[evaluate dereferenced pointer into modified heap]*

[1.9] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(([**this.\$r == this.\$r**]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), []: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3) ≤ **maxof**(**signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.10] ((30323 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(([**this.\$r == this.\$r**]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.\$r == this.\$r**)]: **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.18] ((30323 * **asType<int>**(**static_cast<integer>**(0 < −**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3))) + temp3) ≤ **maxof**(**signed int**)

→ *[from term 40.0, literala < −**this.\$r.value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

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[1.18.0] -2 < (0 + 0)

→ *[simplify]*

[1.18.2] **true**

[1.19] ((30323 * **asType<int>**(**static_cast<integer>**(**false**))) + temp3) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.20] ((30323 * **asType<int>**(([**false**]: 1, []: 0))) + temp3) ≤ **maxof**(**signed int**)

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[1.21] ((30323 * **asType<int>**(([**false**]: 1, [**true**]: 0))) + temp3) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.24] (0 + temp3) ≤ **maxof**(**signed int**)

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[1.25] (0 + ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))) ≤ **maxof**(**signed int**)

→ *[simplify]*

[1.41] -32768 < ((-170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) + (63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot))

→ *[from term 60.13, literala < ((-170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) + (63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot)) is true whenever (-1 + literala) < -32768]*

Proof of rule precondition:

[1.41.0] (-32768 + -1) < -32768

→ *[simplify]*

[1.41.2] **true**

[1.42] **true**

Proof of verification condition: Precondition of 'operator /' satisfied

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp
(88,30)

Condition defined at: built in declaration

To prove: $!(0.0 ==$
asType$<$double$>$(static_cast$<$real$>$($\$$heap$_{funcend\_1032,1}$.M1)))

Given:

$\$$heap$_{init}$.LIMIT $==$ (**int**)80

$\$$heap$_{init}$.**class** WHPrang $\in$ M1 $==$ (**int**)30269

$\$$heap$_{init}$.**class** WHPrang $\in$ r1 $==$ (**int**)171

$\$$heap$_{init}$.**class** WHPrang $\in$ a1 $==$ (**int**)177

$\$$heap$_{init}$.**class** WHPrang $\in$ b1 $==$ (**int**)2

$\$$heap$_{init}$.**class** WHPrang $\in$ M2 $==$ (**int**)30307

$\$$heap$_{init}$.**class** WHPrang $\in$ r2 $==$ (**int**)172

$\$$heap$_{init}$.**class** WHPrang $\in$ a2 $==$ (**int**)176

$\$$heap$_{init}$.**class** WHPrang $\in$ b2 $==$ (**int**)35

$\$$heap$_{init}$.**class** WHPrang $\in$ M3 $==$ (**int**)30323

$\$$heap$_{init}$.**class** WHPrang $\in$ r3 $==$ (**int**)170

$\$$heap$_{init}$.**class** WHPrang $\in$ a3 $==$ (**int**)178

$\$$heap$_{init}$.**class** WHPrang $\in$ b3 $==$ (**int**)63

div1 $==$ div(**heapIs** $\$$heap$_{funcstart\_1032,1}$,
static_cast$<$int$>$(operator*(heapIs $\$$heap$_{funcstart\_1032,1}$, **this**).p1),
static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))

(**asType$<$integer$>$(static_cast$<$int$>$(operator*(heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1)) /
asType$<$integer$>$(static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))) $==$
asType$<$integer$>$(div1.quot)

(**asType$<$integer$>$(static_cast$<$int$>$(operator*(heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1)) %
asType$<$integer$>$(static_cast$<$int$>$($\$$heap$_{funcstart\_1032,1}$.a1))) $==$
asType$<$integer$>$(div1.rem)

(**asType$<$integer$>$(operator*(heapIs** $\$$heap$_{funcstart\_1032,1}$, **this**).p1) $<$
asType$<$integer$>$($\$$heap$_{funcstart\_1032,1}$.a1)) $=>$
(**asType$<$integer$>$(div1.rem) $==$ asType$<$integer$>$(operator*(heapIs**
$\$$heap$_{funcstart\_1032,1}$, **this**).p1))

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a1}) \leq$
$\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1})) =>$
$!(0 == \textbf{asType}<\textbf{integer}>(\text{div1.quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div1.rem})) \ || \ !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div1.quot}))$

$\text{div2} == \text{div}(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}),$
$\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \ /$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.quot})$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \ \%$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.rem})$

$(\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}) <$
$\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}<\textbf{integer}>(\text{div2.rem}) == \textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}))$

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}<\textbf{integer}>(\text{div2.quot}))$

$!(0 == \textbf{asType}<\textbf{integer}>(\text{div2.rem})) \ || \ !(0 ==$
$\textbf{asType}<\textbf{integer}>(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}),$
$\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \ /$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div3.quot})$

$(\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \ \%$
$\textbf{asType}<\textbf{integer}>(\textbf{static\_cast}<\textbf{int}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}<\textbf{integer}>(\text{div3.rem})$

$(\textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs} \ \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}) <$
$\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) =>$
$(\textbf{asType}<\textbf{integer}>(\text{div3.rem}) == \textbf{asType}<\textbf{integer}>(\textbf{operator}^*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}))$

$(\textbf{asType}<\textbf{integer}>(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$

asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 $\rightarrow$
asType<**P1Type**>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) $\leq$ temp2

temp2 $\leq$ **maxof**(**signed int**)

$\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).**_replace**(p2 $\rightarrow$
asType<**P2Type**>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

minof(**signed int**) $\leq$ temp3

temp3 $\leq$ **maxof**(**signed int**)

$\$heap_{funcend\_1032,1}$ == $\$heap_{1032,1;1054,8}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).**_replace**(p3 $\rightarrow$
asType<**P3Type**>(($\$heap_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<int>(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1),
static_cast<int>($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\text{\$heap}_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**($\text{\$heap}_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, **static_cast<int>**((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType<integer>**(**this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType<integer>**(**this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType<integer>**(**\$heap.class** WHPrang $\in$
M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>(**\$heap.class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] (0 < **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>($\text{\$heap}_{init}$.**class** WHPrang $\in$ M1))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<integer>((**int**)30269))

$\rightarrow$ *[simplify]*

[7.10] (-30269 < $-$**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) $\wedge$ (0 <
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈
M2))

→ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap_{init}$.**class** WHPrang ∈ M2))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>((**int**)30307))

→ [simplify]

[23.10] (-30307 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) ∧ (0 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

→ [expand definition of operator '*' in class 'pointer' at built in declaration]

[34.1] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

→ [simplify]

[34.2] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

→ [const static or extern object]

[34.3] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$heap_{init}$.a3))

→ [expand definition of constant 'a3' at prang.cpp (40,26)]

[34.4] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

→ [simplify]

[34.6] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈
M3))

→ [simplify]

[39.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 <
asType<**integer**>($\$heap$.**class** WHPrang ∈ M3))

→ [const static or extern object]

[39.3] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 <

674

asType<**integer**>(heap_{init}.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 < $-$**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3) $\wedge$ (0 <
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] (($\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] ((heap_{init}.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) $-$
($\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\text{heap}_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) $-$ (heap_{init}.b1 * **static_cast**<**signed
int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] $((171 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - ((\textbf{int})2 * \textbf{static\_cast}{<}\textbf{signed}$
$\textbf{int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[simplify]*

[50.8] $((171 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (2 * \textbf{static\_cast}{<}\textbf{signed}$
$\textbf{int}{>}(\text{div1.quot}))) == \text{temp1}$

$\rightarrow$ *[from term 2.6, div1 is equal to div(***heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.***value**(***heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] $((171 * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}) - (2 * \textbf{static\_cast}{<}\textbf{signed}$
$\textbf{int}{>}(\text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}))) == \text{temp1}$

$\rightarrow$ *[simplify]*

[50.14] $0 == (-\text{temp1} + (\text{-2} * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$
$\text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}.\$r.\textbf{value}(\textbf{heapIs }$
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))$

[Take given term]

[53.0] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}{<}\text{P1Type}{>}((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$
$\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$
$\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}{<}\text{P1Type}{>}((\$\text{heap}_{funcstart\_1032,1}.\text{M1} *$
$\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$
$\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[const static or extern object]*

[53.2] $\$\text{heap}_{1032,1;1051,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
$\textbf{this}.\$r.\textbf{value}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow$
$\textbf{asType}{<}\text{P1Type}{>}((\$\text{heap}_{init}.\text{M1} *$
$\textbf{asType}{<}\textbf{int}{>}(\textbf{static\_cast}{<}\textbf{integer}{>}(\textbf{static\_cast}{<}\textbf{signed}$
$\textbf{int}{>}(\textbf{operator}^*(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p1}) < (\textbf{int})0))) +$
$\text{temp1})))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this**.$\$r \to$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 $\to$ **asType**<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp1)))

$\to$ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this**.$\$r \to$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 $\to$ **asType**<P1Type>(0 + temp1)))

$\to$ *[from term 50.14, temp1 is equal to (-2 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this**.$\$r \to$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 $\to$ **asType**<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\to$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$. **replace**(**this**.$\$r \to$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\to$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$. **replace***(***this**.$\$r \to$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace***(p1 $\to$ (-2 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$. **replace**(**this**.$\$r \to$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed int**>(div2.rem)) $-$ ($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\to$ *[const member of object with modified fields]*

[54.2] (($heap$_{funcstart_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.3] (($heap$_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((($\textbf{int}$)172 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to $heap$_{funcstart_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (\text{\$heap}_{init}.\text{b2} * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] $((172 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - ((\textbf{int})35 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.12] $((172 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (35 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this.\$r.value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p2, 176)]*

[54.13] $((172 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}) - (35 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.18] $0 == (-\text{temp2} + (\text{-35} * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1},$
$\textbf{this.\$r.value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{quot}) + (172 *$
$\text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}))$

[Take given term]

[57.0] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{operator}^*(\textbf{heapIs } \text{\$heap}_{1032,1;1051,8}, \textbf{this}).\_\textbf{replace}(\text{p2} \rightarrow$
$\textbf{asType}<\text{P2Type}>((\text{\$heap}_{1032,1;1051,8}.\text{M2} *$
$\textbf{asType}<\textbf{int}>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\textbf{operator}^*(\textbf{heapIs } \text{\$heap}_{1032,1;1051,8}, \textbf{this}).\text{p2}) < (\textbf{int})0))) + \text{temp2})))$

$\rightarrow$ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}.\_$**replace**(this.\$r $\rightarrow$ **this.\$r.value**(heapIs*
*$\text{\$heap}_{funcstart\_1032,1}).\_$**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this.\$r.value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.2] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
$177).\text{quot}) + (171 * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{operator}^*(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow (\text{-2} * \text{div}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1},$
$\textbf{this.\$r.value}(\textbf{heapIs } \text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$

div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).__replace__(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).__replace__(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**$r → ([**this.**$r ==
this.$r]: **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).__replace__(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**$r → ([**this.**$r ==
this.$r]: **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).__replace__(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.**$r ==

this.$r)]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((\$heap$_{funcstart\_1032,1}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\$heap_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$. **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((\$heap$_{init}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\$heap_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$. **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>(((**int**)30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\$heap_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$. **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to* $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.\$r $\rightarrow$ **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.13] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.\$r $\rightarrow$ **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.\$r $\rightarrow$ **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.\$r $\rightarrow$ **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.\$r $\rightarrow$ **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.\$r $\rightarrow$ **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 $\rightarrow$ **asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.\$r $\rightarrow$ **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p2) < (**int**)0))) + temp2)))

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→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $heap_{1032,1;1054,8} ==$ $heap_{funcstart\_1032,1}$.**_replace**(**this.$r** →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r**
== **this.$r**]: **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $heap_{1032,1;1054,8} ==$ $heap_{funcstart\_1032,1}$.**_replace**(**this.$r** →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r**
== **this.$r**]: **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r** ==
this.$r**)]: **this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

[57.23] $heap_{1032,1;1054,8} ==$ $heap_{funcstart\_1032,1}$.**_replace**(**this.$r** →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this**.r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ *[simplify]*

[57.25] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(this.$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(this.$r →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))).\_\textbf{replace}(\text{p2} \rightarrow$
$\textbf{asType}<\text{P2Type}>((30307 * \textbf{asType}<\textbf{int}>(([\textbf{false}]: 1, [\textbf{true}]: 0))) +$
temp2)))

$\rightarrow$ *[simplify]*

[57.29] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}\ \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))))\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}\ \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))).\_\textbf{replace}(\text{p2} \rightarrow \textbf{asType}<\text{P2Type}>(0 +$
temp2)))

$\rightarrow$ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.\$r.value(heapIs *$\text{\$heap}_{funcstart\_1032,1}).\text{p2, 176).quot}) + (172 *$*
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs***
$\text{\$heap}_{funcstart\_1032,1}).\text{p2, 176).rem}]$

[57.30] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}\ \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))))\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}\ \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))).\_\textbf{replace}(\text{p2} \rightarrow \textbf{asType}<\text{P2Type}>(0 +$
((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2, 176).quot}) + (172 * \text{div}(\textbf{heapIs}\ \text{\$heap}_{funcstart\_1032,1},$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\text{p2, 176).rem}))))$

$\rightarrow$ *[simplify]*

[57.33] $\text{\$heap}_{1032,1;1054,8} == \text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}\ \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))))\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}\ \text{\$heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem}))).\_\textbf{replace}(\text{p2} \rightarrow ((\text{-35} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}\ \text{\$heap}_{funcstart\_1032,1}).\text{p2},$
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2, 176).rem}))))$

[Take given term]

[58.0] (($heap$_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[from term 57.33, $heap$_{1032,1;1054,8}$ is equal to*
*$heap$_{funcstart_1032,1}$._**replace**(this.$r → this.$r.**value**(heapIs*
*$heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,*
this.$r.value**(heapIs *$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
*div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs*
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.value**(heapIs *$heap$_{funcstart\_1032,1}$)._replace**(p1 → ((-2 * div(**heapIs***
*$heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs *$heap$_{funcstart_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs*
*$heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs***
*$heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs *$heap$_{funcstart_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs*
$heap$_{funcstart_1032,1}$).p2, 176).rem)))]

[58.1] (($heap$_{funcstart_1032,1}$._**replace**(this.$r → this.$r.**value**(heapIs
$heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(heapIs $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(this.$r →
this.$r.value(heapIs $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs
$heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(heapIs
$heap$_{funcstart_1032,1}$).p2, 176).rem)))).r3 * **static_cast<signed
int>**(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed
int>**(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.3] (($heap$_{funcstart_1032,1}$.r3 * **static_cast<signed int>**(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[const static or extern object]*

[58.4] (($heap$_{init}$.r3 * **static_cast<signed int>**(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] ((**(int)**170 * **static_cast<signed int>**(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ *[simplify]*

[58.6] ((170 * **static_cast<signed int>**(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 *

static_cast<**signed int**>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[58.7] ((170 * static_cast<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) − ($\$heap_{1032,1;1054,8}$.b3 * static_cast<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.8] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{1032,1;1054,8}$.b3 * static_cast<**signed int**>(div3.quot))) == temp3

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$.__replace(this.$r → this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(this.$r → this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 → (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.9] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{funcstart\_1032,1}$.__replace(this.$r → this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace(this.$r → this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).__replace(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * static_cast<**signed int**>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.11] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) − ($\$heap_{funcstart\_1032,1}$.b3 * static_cast<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

689

[58.12] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\text{\$heap}_{init}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[58.13] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − ((**int**)63 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.14] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178)]*

[58.15] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

→ *[simplify]*

[58.20] 0 == (−temp3 + (-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[61.0] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{1032,1;1054,8}$._**replace**(**this**.\$r → **operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**)._**replace**(p3 → **asType**<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]*

[61.2] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\text{this.\$r} \rightarrow$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p1}$,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\text{this.\$r} \rightarrow$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p1}$,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))).\_\textbf{replace}(\text{p2} \rightarrow ((\text{-35} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem})))).\_\textbf{replace}(\text{this.\$r} \rightarrow \textbf{operator}^*(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\text{this.\$r} \rightarrow \textbf{this.\$r.value(heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs} \text{\$heap}_{funcstart\_1032,1},$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\text{this.\$r} \rightarrow$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p1}$,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))).\_\textbf{replace}(\text{p2} \rightarrow (\text{-35} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}))), \textbf{this}).\_\textbf{replace}(\text{p3} \rightarrow$
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}.\text{M3}$ *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.3] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\text{this.\$r} \rightarrow$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p1}$,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\text{this.\$r} \rightarrow$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p1}$,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))).\_\textbf{replace}(\text{p2} \rightarrow ((\text{-35} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p2}$,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem})))).\_\textbf{replace}(\text{this.\$r} \rightarrow$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}.\_\textbf{replace}(\text{this.\$r} \rightarrow$
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}).\text{p1}$,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\text{this.\$r} \rightarrow$

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * **div**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * **div**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))).**_replace**(p3 →
asType<P3Type>(($\text{heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.4] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * **div**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * **div**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * **div**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * **div**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p3 →
asType<P3Type>(($\text{heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.5] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * **div**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p3 →
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.7] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to*
$\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r.value(heapIs}$
*$\$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1},$*
*$\textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$*
$div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
*$\textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs}$*
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p1,$
*$177).quot) + (171 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$*
*$\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_\textbf{replace}(p2 \rightarrow (-35 * div(\textbf{heapIs}$*
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p2,$
*$176).quot) + (172 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$*
$\$heap_{funcstart_1032,1}).p2, 176).rem)))]

[61.8] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p1,$
$177).quot) + (171 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p1,$
$177).quot) + (171 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_\textbf{replace}(p2 \rightarrow ((-35 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p2,$
$176).quot) + (172 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p2, 176).rem)))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p1,$
$177).quot) + (171 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_\textbf{replace}(p2 \rightarrow ((-35 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p2,$
$176).quot) + (172 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p2, 176).rem))).\_\textbf{replace}(p3 \rightarrow$
$\textbf{asType}<P3Type>((\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p1,$
$177).quot) + (171 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
$\textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((-2 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p1,$
$177).quot) + (171 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_\textbf{replace}(p2 \rightarrow ((-35 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \$heap_{funcstart\_1032,1}).p2,$
$176).quot) + (172 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\$heap_{funcstart\_1032,1}).p2, 176).rem)))).M3 *$
$\textbf{asType}<int>(\textbf{static\_cast}<\textbf{integer}>(\textbf{static\_cast}<\textbf{signed}$

int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[const member of object with modified fields]*

[61.10] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$
asType<P3Type>(($\text{\$heap}_{funcstart\_1032,1}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[const static or extern object]*

[61.11] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$

asType<P3Type>(($heap$_{init}$.M3 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[61.12] $heap$_{funcend_1032,1}$ == $heap$_{funcstart_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$
asType<P3Type>(((**int**)30323 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[simplify]*

[61.13] $heap$_{funcend_1032,1}$ == $heap$_{funcstart_1032,1}$._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,

176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to
$\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[61.14] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.15] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))))).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.16] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.\$r == **this**.\$r]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), []: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) < (**int**)0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.17] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<int>(static_cast<integer>(static_cast<signed int>(([**this.\$r** == **this.\$r**]: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.\$r** == **this.\$r**)]: **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.25] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<int>(static_cast<integer>(0 < −**this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3))) + temp3)))

→ *[from term 40.0, literala < −**this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[61.25.0] -2 < (0 + 0)

→ *[simplify]*

[61.25.2] **true**

[61.26] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 →
asType<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp3)))

→ *[simplify]*

[61.27] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 →
asType<P3Type>((30323 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.28] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 →
asType<P3Type>((30323 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) +
temp3)))

→ *[simplify]*

[61.31] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(this.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 → **asType**<P3Type>(0 +

temp3)))

$\rightarrow$ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[61.32] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$ **asType**<P3Type>(0 + ((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)))))

$\rightarrow$ *[simplify]*

[61.35] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → ((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem))))

[Take goal term]

[1.0] !(0.0 ==
asType<**double**>(**static_cast**<**real**>($\text{\$heap}_{funcend\_1032,1}$.M1)))

→ *[from term 61.35, $\text{\$heap}_{funcend\_1032,1}$ is equal to*
$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r → **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(this.\$r →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)))]*

[1.1] !(0.0 ==
asType<**double**>(**static_cast**<**real**>($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r
→ **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.\$r
→ **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ ((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)))).M1)))

$\rightarrow$ *[const member of object with modified fields]*

[1.4] !(0.0 == **asType**<**double**>(**static_cast**<**real**>($\text{heap}_{funcstart\_1032,1}$.M1)))

$\rightarrow$ *[const static or extern object]*

[1.5] !(0.0 == **asType**<**double**>(**static_cast**<**real**>(heap_{init}.M1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[1.6] !(0.0 == **asType**<**double**>(**static_cast**<**real**>((**int**)30269)))

$\rightarrow$ *[simplify]*

[1.12] **true**

Proof of verification condition: Precondition of 'operator /' satisfied

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (89,30)

Condition defined at: built in declaration

To prove: !(0.0 == **asType**<**double**>(**static_cast**<**real**>($\text{heap}_{funcend\_1032,1}$.M2)))

Given:

heap_{init}.LIMIT == (**int**)80

heap_{init}.**class** WHPrang $\in$ M1 == (**int**)30269

heap_{init}.**class** WHPrang $\in$ r1 == (**int**)171

heap_{init}.**class** WHPrang $\in$ a1 == (**int**)177

heap_{init}.**class** WHPrang $\in$ b1 == (**int**)2

heap_{init}.**class** WHPrang $\in$ M2 == (**int**)30307

heap_{init}.**class** WHPrang $\in$ r2 == (**int**)172

$\$\text{heap}_{init}.$**class** WHPrang $\in$ a2 == (**int**)176

$\$\text{heap}_{init}.$**class** WHPrang $\in$ b2 == (**int**)35

$\$\text{heap}_{init}.$**class** WHPrang $\in$ M3 == (**int**)30323

$\$\text{heap}_{init}.$**class** WHPrang $\in$ r3 == (**int**)170

$\$\text{heap}_{init}.$**class** WHPrang $\in$ a3 == (**int**)178

$\$\text{heap}_{init}.$**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>

(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2) $\leq$ **asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) => !(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 == **asType**<**integer**>(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) / **asType**<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) % **asType**<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a3))) == **asType**<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3) < **asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a3)) => (**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a3) $\leq$ **asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) => !(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 == **asType**<**integer**>(div3.quot))

temp1 == ($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) $\leq$ temp1

temp1 $\leq$ **maxof**(**signed int**)

$\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.\$r $\to$ **operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\to$ **asType**<**P1Type**>(($\text{\$heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

temp2 == ($\text{\$heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) − ($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

$\$heap_{1032,1;1054,8} == \$heap_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
operator*(heapIs $\$heap_{1032,1;1051,8}$, **this)**.**_replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator*(heapIs** $\$heap_{1032,1;1051,8}$, **this)**.p2) < (**int**)0))) + temp2)))

temp3 == ($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

minof(signed int) $\leq$ temp3

temp3 $\leq$ **maxof(signed int)**

$\$heap_{funcend\_1032,1} == \$heap_{1032,1;1054,8}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow$
operator*(heapIs $\$heap_{1032,1;1054,8}$, **this)**.**_replace**(p3 $\rightarrow$
asType<P3Type>(($\$heap_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator*(heapIs** $\$heap_{1032,1;1054,8}$, **this)**.p3) < (**int**)0))) + temp3)))

raux1 == **asType**<**double**>(**static_cast**<**real**>(**operator*(heapIs**
$\$heap_{funcend\_1032,1}$, **this)**.p1)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M1))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator*(heapIs** $\$heap_{funcstart\_1032,1}$, **this)**.p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value(heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1) < **asType**<**integer**>(\$heap.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>(\$heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>($\text{\$heap}_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1) ∧ (0 <
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\text{\$heap}_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

$\rightarrow$ *[simplify]*

[18.6] div2 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[simplify]*

[23.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 < **asType**<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] (-30307 < $-$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $\wedge$ (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] 0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast**<**int**>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3), **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

→ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$heap_{init}$.a3))

→ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

→ *[simplify]*

[34.6] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M3))

→ *[simplify]*

[39.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M3))

→ *[const static or extern object]*

[39.3] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($\$heap_{init}$.**class** WHPrang ∈ M3))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3 < **asType**<**integer**>((**int**)30323))

→ *[simplify]*

[39.10] (-30323 < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3) ∧ (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] (($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) − ($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.1] (($heap$_{init}$.r1 * **static_cast<signed int>**(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast<signed int>**(div1.rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.3] ((171 * **static_cast<signed int>**(div1.rem)) − ($heap$_{funcstart_1032,1}$.b1
* **static_cast<signed int>**(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast<signed int>**(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)) −
($heap$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{funcstart\_1032,1}$.b1 *
static_cast<signed int>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$_{init}$.b1 * **static_cast<signed
int>**(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast<signed
int>**(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed
int>**(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed
int>**(div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.value(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *

div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *

asType\<int\>(static_cast\<integer\>(static_cast\<signed int\>(this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1) < (int)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$ **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType\<P1Type\>((30269 * asType\<int\>(static_cast\<integer\>(0 < $-$this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala $<$ $-$**this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$ **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType\<P1Type\>((30269 * asType\<int\>(static_cast\<integer\>(false)))) + temp1)))**

$\rightarrow$ *[simplify]*

[53.11] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$ **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType\<P1Type\>((30269 * asType\<int\>(([false]: 1, []: 0))) + temp1)))**

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$ **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType\<P1Type\>((30269 * asType\<int\>(([false]: 1, [true]: 0))) + temp1)))**

$\rightarrow$ *[simplify]*

[53.15] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$ **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType\<P1Type\>(0 + temp1)))**

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(this.$r \rightarrow$ **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ **asType\<P1Type\>(0 + ((-2 * div(heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$\text{heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace***(**this.\$r** $\rightarrow$ **this.\$r.value***(**heapIs***
*$\$heap_{funcstart\_1032,1}$).**_replace***(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.value(**heapIs** *$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[54.1] (($\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * **static_cast**<**signed
int**>(div2.rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.2] (($\$\text{heap}_{funcstart\_1032,1}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.3] (($\$\text{heap}_{init}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] (((**int**)172 * **static_cast**<**signed int**>(div2.rem)) −
($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.5] ((172 * **static_cast**<**signed int**>(div2.rem)) − ($\$\text{heap}_{1032,1;1051,8}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.value(**heapIs** *$\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * **static_cast**<**signed int**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) −

($heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.7] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 53.19, $heap$_{1032,1;1051,8}$ is equal to $heap$_{funcstart_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))).b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{funcstart\_1032,1}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ($heap$_{init}$.b2 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem) − (35 * **static_cast<signed int>**(div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot))) == temp2

$\rightarrow$ *[simplify]*

[54.18] $0 == (-\text{temp2} + (\text{-35} * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$ **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{quot}) + (172 *$ div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}).\text{p2}, 176).\text{rem}))$

[Take given term]

[57.0] $\$\text{heap}_{1032,1;1054,8} == \$\text{heap}_{1032,1;1051,8}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
operator*(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**)._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}.\text{M2} *$
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
*$\$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\text{-2} * div(\textbf{heapIs } \$heap_{funcstart\_1032,1},$*
*$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$*
$div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))]$

[57.2] $\$\text{heap}_{1032,1;1054,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{operator}*(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\text{-2} * \text{div}(\textbf{heapIs } \$\text{heap}_{funcstart\_1032,1},$
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{quot}) + (171 *$
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))$, **this**)._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}.\text{M2} *$
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$\text{heap}_{1032,1;1054,8} == \$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem})))).\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow$
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((\text{-2} * \text{div}(\textbf{heapIs}$
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}).\text{p1},$
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}).\text{p1}, 177).\text{rem}))))).\_\textbf{replace}(p2 \rightarrow$
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}.\text{M2} *$
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$ ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$))._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$ ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$))._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[simplify]*

[57.7] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*

$heap_{funcstart\_1032,1}._replace(this.\$r \rightarrow this.\$r.value(heapIs$
$heap_{funcstart\_1032,1})._replace(p1 \rightarrow (-2 * div(heapIs \$heap_{funcstart\_1032,1},$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$
$div(heapIs \$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))]$

[57.8] $\$heap_{1032,1;1054,8} == \$heap_{funcstart\_1032,1}._$**replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1})._$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1},$ this.\$r.**value(heapIs** $\$heap_{funcstart\_1032,1}).p1,$
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1},$ this.\$r.**value(heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem))))._$**replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1})._$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}).p1,$
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1},$ this.\$r.**value(heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))._$**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{funcstart\_1032,1}._$**replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1})._$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}).p1,$
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem))))).M2 *$
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8},$ **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ [const member of object with modified fields]

[57.9] $\$heap_{1032,1;1054,8} == \$heap_{funcstart\_1032,1}._$**replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1})._$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}).p1,$
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem))))._$**replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1})._$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}).p1,$
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))._$**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{funcstart\_1032,1}.M2 *$
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8},$ **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ [const static or extern object]

[57.10] $\$heap_{1032,1;1054,8} == \$heap_{funcstart\_1032,1}._$**replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1})._$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}).p1,$
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem))))._$**replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1})._$**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}).p1,$
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1},$ **this.\$r.value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(((**int**)30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to
$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.13] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(static_cast<**integer**>(static_cast<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.$r** →
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.$r** →
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.$r** →
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(static_cast<**integer**>(static_cast<**signed**
int>(**this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.$r** →
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.$r** →
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.$r** →
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(static_cast<**integer**>(static_cast<**signed int**>(([**this.$r**
== **this.$r**]: **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.\$r**
== **this.\$r**]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r** ==
this.\$r)]: **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

[57.23] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** →
this.\$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

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$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp2)))

→ *[simplify]*

[57.25] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** → **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** → **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp2)))

→ *[simplify]*

[57.29] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** → **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → **asType**<P2Type>(0 + temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace(this.\$r $\to$
this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.\$r $\to$
this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))))

$\to$ *[simplify]*

[57.33] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace(this.\$r $\to$
this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.\$r $\to$
this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] (($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) $-$
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\to$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to
$\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\to$ **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r $\to$
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\to$ (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.1] (($\$heap_{funcstart\_1032,1}$._**replace(this.\$r $\to$ this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,

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this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast**<**signed**
int>(div3.rem)) − (\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed**
int>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.3] ((\$heap$_{funcstart\_1032,1}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
(\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

[58.4] ((\$heap$_{init}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
(\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] (((**int**)170 * **static_cast**<**signed int**>(div3.rem)) −
(\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.6] ((170 * **static_cast**<**signed int**>(div3.rem)) − (\$heap$_{1032,1;1054,8}$.b3 *
static_cast<**signed int**>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(***heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value***(***heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178)]*

[58.7] ((170 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem)) −
(\$heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.8] ((170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178).rem) − (\$heap$_{1032,1;1054,8}$.b3 *
static_cast<**signed int**>(div3.quot))) == temp3

→ *[from term 57.33, \$heap$_{1032,1;1054,8}$ is equal to
\$heap$_{funcstart\_1032,1}$.**_replace***(***this**.\$r → **this**.\$r.**value***(***heapIs**
\$heap$_{funcstart\_1032,1}$).**_replace***(p1 → ((-2 * div(***heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value***(***heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(***heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value***(***heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace***(***this**.\$r →
this.\$r.**value***(***heapIs** \$heap$_{funcstart\_1032,1}$).**_replace***(p1 → ((-2 * div(***heapIs**

$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))]

[58.9] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − ($heap_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r** → **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ [const member of object with modified fields]

[58.11] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − ($heap_{funcstart\_1032,1}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ [const static or extern object]

[58.12] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − ($heap_{init}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

→ [expand definition of constant 'b3' at prang.cpp (41,26)]

[58.13] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − ((**int**)63 * **static_cast<signed int>**(div3.quot))) == temp3

→ [simplify]

[58.14] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast<signed int>**(div3.quot))) == temp3

→ [from term 34.6, div3 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178)]

[58.15] ((170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast<signed int>**(div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**

$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

→ *[simplify]*

[58.20] 0 == (−temp3 + (-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[61.0] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{1032,1;1054,8}$.**_replace(this.$r** → **operator*(heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this)._replace(p3** → **asType**<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator*(heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $heap_{1032,1;1054,8}$ is equal to $heap_{funcstart\_1032,1}$._replace(this.$r → this.$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs $heap_{funcstart\_1032,1}$, this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem))))._replace(this.$r → this.$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs $heap_{funcstart\_1032,1}$, this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(p2 → (-35 * div(heapIs $heap_{funcstart\_1032,1}$, this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(heapIs $heap_{funcstart\_1032,1}$, this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[61.2] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r** → **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** → **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.$r** → **operator*(heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.$r** → **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r** → **this.$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**). **_replace**(p3 → **asType**<P3Type>(($heap_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [expand definition of operator '*' in class 'pointer' at built in declaration]

[61.3] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$. **_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$. **_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))))). **_replace**(p3 → **asType**<P3Type>(($heap_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [evaluate dereferenced pointer into modified heap]

[61.4] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$. **_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r → ([**this**.\$r ==
this.\$r]: **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p3 →
asType<P3Type>((\$heap_{1032,1;1054,8}.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [explicitly assert falsehood of skipped guards in subsequent guards]

[61.5] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r → ([**this**.\$r ==
this.\$r]: **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this**.\$r ==
this.\$r)]: **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p3 $\rightarrow$
asType<P3Type>(($\$\text{heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[simplify]*

[61.7] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * **div**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * **div**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * **div**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * **div**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * **div**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * **div**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * **div**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$
asType<P3Type>(($\$\text{heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[from term 57.33, $\$\text{heap}_{1032,1;1054,8}$ is equal to*
*$\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,*
***this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r $\rightarrow$*
this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs
*$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ (-35 * div(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs***
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))]

[61.8] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * **div**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * **div**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 $\rightarrow$
asType<P3Type>((\$\text{heap}_{funcstart_1032,1}$.**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[const member of object with modified fields]*

[61.10] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>(($\text{heap}_{funcstart\_1032,1}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [const static or extern object]

[61.11] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((heap_{init}.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [expand definition of constant 'M3' at prang.cpp (38,26)]

[61.12] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>(((**int**)30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.13] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $\$\text{heap}_{1032,1;1054,8}$ is equal to* $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** *$\$\text{heap}_{funcstart\_1032,1}$*).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** *$\$\text{heap}_{funcstart\_1032,1}$*).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** *$\$\text{heap}_{funcstart\_1032,1}$*).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** *$\$\text{heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** *$\$\text{heap}_{funcstart\_1032,1}$*).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** *$\$\text{heap}_{funcstart\_1032,1}$*).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**

$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[61.14] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.15] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[61.16] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(p3 $\rightarrow$ **asType**<P3Type>((30323 *

asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed int**$>$((([**this.**r == **this.**r]: **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), []: **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$._**replace**(**this.**r $\rightarrow$ **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) $<$ (**int**)0))) + temp3)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.17] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$._**replace**(**this.**r $\rightarrow$ **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**r $\rightarrow$ **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.**r $\rightarrow$ **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$ **asType**$<$P3Type$>$((30323 * **asType**$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed int**$>$((([**this.**r == **this.**r]: **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.**r == **this.**r)]: **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$._**replace**(**this.**r $\rightarrow$ **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[simplify]*

[61.25] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(0 < $-$**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3))) + temp3)))

$\rightarrow$ *[from term 40.0, literala* < $-$**this***.\$r.***value**(*heapIs* $\$heap_{funcstart\_1032,1}$)*.p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[61.25.0] -2 < (0 + 0)

$\rightarrow$ *[simplify]*

[61.25.2] **true**

[61.26] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r $\rightarrow$

this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp3)))

→ *[simplify]*

[61.27] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.28] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp3)))

→ *[simplify]*

[61.31] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>(0 + temp3)))

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)]*

[61.32] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **replace**(p3 $\rightarrow$ **asType**<P3Type>(0 +
((-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)))))

$\rightarrow$ *[simplify]*

[61.35] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **replace**(p3 $\rightarrow$ ((-63 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))))

[Take goal term]

[1.0] !(0.0 ==
asType<**double**>(**static_cast**<**real**>($\$\text{heap}_{funcend\_1032,1}$.M2)))

$\rightarrow$ *[from term 61.35, $\$\text{heap}_{funcend\_1032,1}$ is equal to*
*$\$\text{heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r $\rightarrow$ **this**.\$r.**value**(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,*
***this**.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.\$r $\rightarrow$*

this.$r.**value***(***heapIs** $\$heap_{funcstart\_1032,1}$*)*._**replace***(p1 → ((-2 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p1, 177).quot) + (171 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p1, 177).rem)))*._**replace***(p2 → ((-35 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p2, 176).quot) + (172 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p2, 176).rem))))*._**replace***(***this.$r** → **this.$r**.**value***(***heapIs** $\$heap_{funcstart\_1032,1}$*)*._**replace***(p1 → ((-2 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p1, 177).quot) + (171 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p1, 177).rem)))*._**replace***(p2 → ((-35 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p2, 176).quot) + (172 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p2, 176).rem)))*._**replace***(p3 → (-63 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p3, 178).quot) + (170 * div(***heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(***heapIs** $\$heap_{funcstart\_1032,1}$*)*.p3, 178).rem)))]*

[1.1] !(0.0 ==

asType<**double**>(**static_cast**<**real**>($\$heap_{funcstart\_1032,1}$._**replace**(**this.$r**
→ **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r**
→ **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.$r**
→ **this.$r**.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 →
((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)))).M2)))

→ *[const member of object with modified fields]*

[1.4] !(0.0 ==

asType<**double**>(**static_cast**<**real**>($\$heap_{funcstart\_1032,1}$.M2)))

→ *[const static or extern object]*

[1.5] !(0.0 == **asType**<**double**>(**static_cast**<**real**>($heap$_{init}$.M2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[1.6] !(0.0 == **asType**<**double**>(**static_cast**<**real**>((**int**)30307)))

→ *[simplify]*

[1.12] **true**

Proof of verification condition: Precondition of 'operator /' satisfied

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (90,30)

Condition defined at: built in declaration

To prove: !(0.0 ==
asType<**double**>(**static_cast**<**real**>($heap$_{funcend_1032,1}$.M3)))

Given:

$heap$_{init}$.LIMIT == (**int**)80

$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $heap$_{funcstart_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1),
static_cast<**int**>($heap$_{funcstart_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$heap$_{funcstart_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($heap$_{funcstart_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) % **asType\<integer\>**(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a1))) == **asType\<integer\>**(div1.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < **asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a1)) => (**asType\<integer\>**(div1.rem) == **asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$ **asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) => !(0 == **asType\<integer\>**(div1.quot))

!(0 == **asType\<integer\>**(div1.rem)) || !(0 == **asType\<integer\>**(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast\<int\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2), **static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) / **asType\<integer\>**(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) == **asType\<integer\>**(div2.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) % **asType\<integer\>**(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a2))) == **asType\<integer\>**(div2.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) < **asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a2)) => (**asType\<integer\>**(div2.rem) == **asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType\<integer\>**($\text{\$heap}_{funcstart\_1032,1}$.a2) $\leq$ **asType\<integer\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) => !(0 == **asType\<integer\>**(div2.quot))

!(0 == **asType\<integer\>**(div2.rem)) || !(0 == **asType\<integer\>**(div2.quot))

div3 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **static_cast\<int\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3), **static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a3))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p3)) / **asType\<integer\>**(**static_cast\<int\>**($\text{\$heap}_{funcstart\_1032,1}$.a3))) == **asType\<integer\>**(div3.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**

$\$heap_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$heap_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$heap_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$heap_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r →
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 →
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

$\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$._**replace**(**this**.$r →
operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 →
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

minof(**signed int**) ≤ temp3

temp3 ≤ **maxof**(**signed int**)

$\$heap_{funcend\_1032,1}$ == $\$heap_{1032,1;1054,8}$._**replace**(**this**.$r →
operator*(**heapIs** $\$heap_{1032,1;1054,8}$, **this**)._**replace**(p3 →
asType<P3Type>(($\$heap_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

raux1 == **asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs** $\$heap_{funcend\_1032,1}$, **this**).p1)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M1))

raux2 == **asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs** $\$heap_{funcend\_1032,1}$, **this**).p2)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M2))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>($\$heap_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, **static_cast**<**int**>((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)) && (**asType**<**integer**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M1))

→ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 < **asType**<**integer**>($\$heap$.**class** WHPrang ∈ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 < \textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p1})$ &&
$(\textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p1} <$
$\textbf{asType}<\textbf{integer}>(\text{\$heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{M1}))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 < \textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p1})$ &&
$(\textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p1} <$
$\textbf{asType}<\textbf{integer}>((\textbf{int})30269))$

$\rightarrow$ *[simplify]*

[7.10] $(\text{-}30269 < -\textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p1}) \land (0 <$
$\textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p1})$

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 < \textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p1}$

[Take given term]

[18.0] $\text{div2} == \text{div}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{operator}^*(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}),$
$\textbf{static\_cast}<\textbf{int}>(\text{\$heap}_{funcstart\_1032,1}.\text{a2}))$

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] $\text{div2} == \text{div}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}<\textbf{int}>(\textbf{this.\$r.value}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}).\text{p2}),$
$\textbf{static\_cast}<\textbf{int}>(\text{\$heap}_{funcstart\_1032,1}.\text{a2}))$

$\rightarrow$ *[simplify]*

[18.2] $\text{div2} == \text{div}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, \textbf{static\_cast}<\textbf{int}>(\text{\$heap}_{funcstart\_1032,1}.\text{a2}))$

$\rightarrow$ *[const static or extern object]*

[18.3] $\text{div2} == \text{div}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, \textbf{static\_cast}<\textbf{int}>(\text{\$heap}_{init}.\text{a2}))$

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] $\text{div2} == \text{div}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, \textbf{static\_cast}<\textbf{int}>((\textbf{int})176))$

$\rightarrow$ *[simplify]*

[18.6] $\text{div2} == \text{div}(\textbf{heapIs} \text{ \$heap}_{funcstart\_1032,1}, \textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}, 176)$

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] $(0 < \textbf{asType}<\textbf{integer}>(\textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}))$ && $(\textbf{asType}<\textbf{integer}>(\textbf{this.\$r.value}(\textbf{heapIs}$
$\text{\$heap}_{funcstart\_1032,1}).\text{p2}) < \textbf{asType}<\textbf{integer}>(\text{\$heap}.\textbf{class} \text{ WHPrang} \in$

M2))

$\rightarrow$ *[simplify]*

[23.2] $(0 < $ **this.**$r.**value**(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2})$ &&
$(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2} <$
asType<**integer**>($heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] $(0 < $ **this.**$r.**value**(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2})$ &&
$(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2} <$
asType<**integer**>(heap_{init}.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 < $ **this.**$r.**value**(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2})$ &&
$(\textbf{this.}\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2} <$
asType<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] $(\text{-30307} < -\textbf{this.}\$r.\textbf{value}(\textbf{heapIs}\ \$\text{heap}_{funcstart_1032,1}).\text{p2}) \wedge (0 < $
this.$r.**value**(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2})$

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 < $ **this.**$r.**value**(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p2}$

[Take given term]

[34.0] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**this.**$r.**value**(\textbf{heapIs}\ \$\text{heap}_{funcstart\_1032,1}).\text{p3})$,
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast**<**int**>($\$\text{heap}_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) < **asType**<**integer**>($\$\text{heap}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[simplify]*

[39.2] (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($\$\text{heap}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3 < **asType**<**integer**>($\$\text{heap}_{init}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) && (**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3 < **asType**<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 < $-$**this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3) $\wedge$ (0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] 0 < **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] (($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\$\text{heap}_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] ((((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,*

this.$r.value(heapIs *$heap$$_{funcstart_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast<signed int>**(div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem)) − ($heap$$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.5] ((171 * div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$$_{funcstart_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem) − ($heap$$_{init}$.b1 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed int>**(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem) − (2 * **static_cast<signed int>**(div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$$_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap$$_{funcstart_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $heap$$_{1032,1;1051,8}$ == $heap$$_{funcstart_1032,1}$.**_replace(this.$r** → **operator***(**heapIs** $heap$$_{funcstart\_1032,1}$, **this**).**_replace(**p1 → **asType<P1Type>**(($heap$$_{funcstart_1032,1}$.M1 * **asType<int>**(**static_cast<integer>**(**static_cast<signed int>**(**operator***(**heapIs** $heap$$_{funcstart_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this**.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((\$heap_{funcstart_1032,1}.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\to$ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this**.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((\$heap_{init}.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\to$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this**.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>(((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\to$ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this**.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this**.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

$\to$ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}$._**replace**(**this**.$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\to$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

$\to$ *[from term 8.0, literala $<$ $-$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1*
is false whenever -2 $<$ (0 + literala)]

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(((**[false]**: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(((**[false]**: 1, **[true]**: 0))) +
temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.value(*heapIs $\$heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 *
*div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs*
$\$heap_{funcstart\_1032,1}$*).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(this.\$r →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}.\_\mathbf{replace}(\mathbf{this}.\$r \rightarrow \mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}$
*$\$heap_{funcstart\_1032,1}).\_\mathbf{replace}(p1 \rightarrow (-2 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$*
*$\mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$*
$div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))]$

[54.1] $(($\$heap_{funcstart_1032,1}$.\_\mathbf{replace}(\mathbf{this}.r \rightarrow \mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).\_\mathbf{replace}(p1 \rightarrow ((-2 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$
$div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).r2 * \mathbf{static\_cast}<\mathbf{signed}$
$\mathbf{int}>(div2.rem)) - (\$heap_{1032,1;1051,8}.b2 * \mathbf{static\_cast}<\mathbf{signed}$
$\mathbf{int}>(div2.quot))) == temp2$

$\rightarrow$ *[const member of object with modified fields]*

[54.2] $(($\$heap_{funcstart_1032,1}$.r2 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.rem)) -$
$(\$heap_{1032,1;1051,8}.b2 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.quot))) == temp2$

$\rightarrow$ *[const static or extern object]*

[54.3] $(($\$heap_{init}$.r2 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.rem)) -$
$(\$heap_{1032,1;1051,8}.b2 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.quot))) == temp2$

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] $(((\mathbf{int})172 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.rem)) -$
$(\$heap_{1032,1;1051,8}.b2 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.quot))) == temp2$

$\rightarrow$ *[simplify]*

[54.5] $((172 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.rem)) - (\$heap_{1032,1;1051,8}.b2 *$
$\mathbf{static\_cast}<\mathbf{signed\ int}>(div2.quot))) == temp2$

$\rightarrow$ *[from term 18.6, div2 is equal to $div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$*
$\mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p2, 176)]$

[54.6] $((172 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p2, 176).rem)) -$
$(\$heap_{1032,1;1051,8}.b2 * \mathbf{static\_cast}<\mathbf{signed\ int}>(div2.quot))) == temp2$

$\rightarrow$ *[simplify]*

[54.7] $((172 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p2, 176).rem) - (\$heap_{1032,1;1051,8}.b2 *$
$\mathbf{static\_cast}<\mathbf{signed\ int}>(div2.quot))) == temp2$

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}.\_\mathbf{replace}(\mathbf{this}.\$r \rightarrow \mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}$
*$\$heap_{funcstart\_1032,1}).\_\mathbf{replace}(p1 \rightarrow (-2 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$*
*$\mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$*
$div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this}.\$r.\mathbf{value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))]$

[54.8] ((172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − (\$$\text{heap}_{funcstart_1032,1}$._**replace**(**this**.\$r
→ **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − (\$$\text{heap}_{funcstart_1032,1}$.b2 *
static_cast<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − (\$$\text{heap}_{init}$.b2 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed
int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed
int**>(div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] \$$\text{heap}_{1032,1;1054,8}$ == \$$\text{heap}_{1032,1;1051,8}$._**replace**(**this**.\$r →
operator*(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**)._**replace**(p2 →
asType<P2Type>((\$$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r \rightarrow$ this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.2] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r \rightarrow$ this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$\$r \rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r \rightarrow$ this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem))), this)._**replace**(p2 $\rightarrow$ **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, this).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r \rightarrow$ this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$\$r \rightarrow$ this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r \rightarrow$ this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))))._**replace**(p2 $\rightarrow$ **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, this).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.$\$r \rightarrow$ this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.$\$r \rightarrow$ ([**this.**$\$r$ == **this.**$\$r$]: this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.$\$r$.**value**(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []:

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$\text{heap}_{1032,1;1051,8}$ is equal to*
*$\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs***
*$\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($heap_{funcstart\_1032,1}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($heap_{init}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $heap_{1032,1;1054,8}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → **asType**<P2Type>(((**int**)30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.12] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{heap}_{1032,1;1051,8}$ is equal to $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.13] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** →

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<int>(static_cast<integer>(static_cast<signed
int>(**this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r
== **this**.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{heap}_{1032,1;1054,8}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r

== **this.\$r**]: **this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ (-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.\$r** ==
this.\$r)]: **this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

$\to$ *[simplify]*

[57.23] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\to$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\to$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
$-$**this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2))) + temp2)))

$\to$ *[from term 24.0, literala < $-$**this**.\$r.**value**(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p2
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

$\to$ *[simplify]*

[57.23.2] **true**

[57.24] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\to$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\to$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

$\to$ *[simplify]*

[57.25] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\to$
this.\$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\to$

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 **
*div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))))

→ [simplify]

[57.33] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] (($\text{\$heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ [from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to
$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]

[58.1] (($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast**<**signed
int**>(div3.rem)) − ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed**

int>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.3] (($heap$_{funcstart_1032,1}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

[58.4] (($heap$_{init}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] ((((**int**)170 * **static_cast**<**signed int**>(div3.rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.6] ((170 * **static_cast**<**signed int**>(div3.rem)) − ($heap$_{1032,1;1054,8}$.b3 *
static_cast<**signed int**>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(***heapIs*** $heap$_{funcstart_1032,1}$,
this.$r.**value**(***heapIs*** $heap$_{funcstart_1032,1}$).p3, 178)]*

[58.7] ((170 * **static_cast**<**signed int**>(div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p3, 178).rem)) −
($heap$_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[simplify]*

[58.8] ((170 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, 178).rem) − ($heap$_{1032,1;1054,8}$.b3 *
static_cast<**signed int**>(div3.quot))) == temp3

→ *[from term 57.33, $heap$_{1032,1;1054,8}$ is equal to
$heap$_{funcstart_1032,1}$.__replace(**this.**$r → **this.**$r.**value**(***heapIs***
$heap$_{funcstart_1032,1}$).__replace(p1 → ((-2 * div(***heapIs*** $heap$_{funcstart_1032,1}$,
this.$r.**value**(***heapIs*** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 *
div(***heapIs*** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(***heapIs***
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).__replace(**this.**$r →
this.$r.**value**(***heapIs*** $heap$_{funcstart_1032,1}$).__replace(p1 → ((-2 * div(***heapIs***
$heap$_{funcstart_1032,1}$, **this.**$r.**value**(***heapIs*** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(***heapIs*** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(***heapIs***
$heap$_{funcstart_1032,1}$).p1, 177).rem))).__replace(p2 → (-35 * div(***heapIs***
$heap$_{funcstart_1032,1}$, **this.**$r.**value**(***heapIs*** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(***heapIs*** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(***heapIs***
$heap$_{funcstart_1032,1}$).p2, 176).rem)))]*

[58.9] ((170 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p3, 178).rem) − ($heap$_{funcstart\_1032,1}$.__replace(**this.**$r
→ **this.**$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).__replace(p1 → ((-2 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this.**$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$,

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[const member of object with modified fields]*

[58.11] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[const static or extern object]*

[58.12] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\$heap_{init}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[58.13] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) $-$ ((**int**)63 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.14] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) $-$ (63 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178)]*

[58.15] ((170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem) $-$ (63 * **static_cast<signed int>**(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

$\rightarrow$ *[simplify]*

[58.20] 0 == ($-$temp3 + (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[61.0] $\$heap_{funcend\_1032,1}$ == $\$heap_{1032,1;1054,8}$.**_replace**(**this.**$r $\rightarrow$ **operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).**_replace**(p3 $\rightarrow$ **asType<P3Type>**(($\$heap_{1032,1;1054,8}$.M3 *

asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs $heap_{1032,1;1054,8}$, **this).p3) < (int)0))) + temp3)))**

→ *[from term 57.33,* $heap_{1032,1;1054,8}$ *is equal to* $heap_{funcstart\_1032,1}$.**_replace(this.\$r →** **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*)._replace(p1 → ((-2 * div(heapIs* $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(heapIs* $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).rem))))._replace(this.\$r →* **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*)._replace(p1 → ((-2 * div(heapIs* $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(heapIs* $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1, 177).rem)))._replace(p2 → (-35 * div(heapIs* $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p2, 176).quot) + (172 * div(heapIs* $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p2, 176).rem)))]*

[61.2] $heap_{funcend\_1032,1}$ **==** $heap_{funcstart\_1032,1}$.**_replace(this.\$r →** **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace(p1 → ((-2 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r →** **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace(p1 → ((-2 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace(p2 → ((-35 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.\$r → operator*(heapIs** $heap_{funcstart\_1032,1}$.**_replace(this.\$r → this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace(p1 → ((-2 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r →** **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).**_replace(p1 → ((-2 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace(p2 → (-35 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))), **this)._replace(p3 →** **asType<P3Type>((**$heap_{1032,1;1054,8}$.M3 * **asType<int>(static_cast<integer>(static_cast<signed int>(operator*(heapIs** $heap_{1032,1;1054,8}$, **this).p3) < (int)0))) + temp3)))**

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.3] $heap_{funcend\_1032,1}$ **==** $heap_{funcstart\_1032,1}$.**_replace(this.\$r →**

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this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))).**_replace**(p3 →
asType<P3Type>(($\$\text{heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.4] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\to$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ (-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(p3 $\to$
asType<P3Type>(($\$\text{heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.5] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\to$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\to$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r $\to$ ([**this.**$r ==
this.$r]: **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$
(-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.**$r ==
this.$r)]: **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\to$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ (-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).**_replace**(p3 $\to$
asType<P3Type>(($\$\text{heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\to$ *[simplify]*

[61.7] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\to$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\to$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))). **replace**(p3 →
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to*
$\text{\$heap}_{funcstart\_1032,1}$. **replace***(**this.\$r** → **this.\$r**.**value***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$). **replace***(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.\$r.**value***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace***(**this.\$r** →*
this.\$r.**value***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).* **replace***(p1 → ((-2 * div(**heapIs**
*$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace***(p2 → (-35 * div(**heapIs**
*$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]

[61.8] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((\$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[const member of object with modified fields]*

[61.10] $heap_{funcend\_1032,1}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((\$heap$_{funcstart\_1032,1}$.M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[const static or extern object]*

[61.11] $heap_{funcend\_1032,1}$ == \$heap$_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 $\rightarrow$ **asType**<P3Type>((heap_{init}.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[61.12] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$. **_replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace**(**this.$r** $\rightarrow$ **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 $\rightarrow$ **asType**<P3Type>((((**int**)30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[simplify]*

[61.13] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$. **_replace**(**this.$r** $\rightarrow$

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →*
this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs
*$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]

[61.14] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). __replace__(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$). __replace__(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))). __replace__(p2 → ((-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem))). __replace__(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$. __replace__(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$). __replace__(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))). __replace__(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$). __replace__(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))). __replace__(p2 → (-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.15] \$heap$_{funcend\_1032,1}$ == \$heap$_{funcstart\_1032,1}$. __replace__(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$). __replace__(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))). __replace__(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$). __replace__(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))). __replace__(p2 → ((-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem)))). __replace__(**this**.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$). __replace__(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem))). __replace__(p2 → ((-35 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176).rem))). __replace__(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$. __replace__(**this**.\$r →

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))))).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.16] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>((([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), []: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) < (**int**)0))) + temp3))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.17] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**replace**(this.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → (-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this**.$r == **this**.$r)]: **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$.**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.25] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**replace**(this.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3))) + temp3)))

→ *[from term 40.0, literala < −**this**.\$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

> **Proof of rule precondition:**
>
> *[61.25.0] -2 < (0 + 0)*
>
> → *[simplify]*
>
> *[61.25.2]* **true**

[61.26] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp3)))

→ *[simplify]*

[61.27] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p1, 177).rem)))).**_replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\rightarrow$ ((-2 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace(**p2 $\rightarrow$ ((-35 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p2, 176).rem)))).**_replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\rightarrow$ ((-2 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace(**p2 $\rightarrow$ ((-35 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p2, 176).rem))).**_replace(**p3 $\rightarrow$
asType<P3Type>((30323 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp3)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.28] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\rightarrow$ ((-2 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p1, 177).rem)))).**_replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\rightarrow$ ((-2 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace(**p2 $\rightarrow$ ((-35 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p2, 176).rem)))).**_replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\rightarrow$ ((-2 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace(**p2 $\rightarrow$ ((-35 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$**).**p2, 176).rem))).**_replace(**p3 $\rightarrow$
asType<P3Type>((30323 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp3)))

$\rightarrow$ *[simplify]*

[61.31] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**_replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$**)._replace(**p1 $\rightarrow$ ((-2 * **div(heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$**).**p1,

177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). _**replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). _**replace**(p3 → **asType**<P3Type>(0 + temp3)))

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,* **this.\$r.value(heapIs** *$\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 **
*div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,* **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem]

[61.32] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$. _**replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). _**replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). _**replace**(p3 → **asType**<P3Type>(0 + ((-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)))))

→ *[simplify]*

[61.35] $\$heap_{funcend\_1032,1} ==$ $\$heap_{funcstart\_1032,1}$.__**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 $\to$ ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).__**replace**(**this.**$r \to$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 $\to$ ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).__**replace**(p3 $\to$ ((-63 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem))))

[Take goal term]

[1.0] !(0.0 ==
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M3)))

$\to$ *[from term 61.35, $\$heap_{funcend\_1032,1}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.__**replace***(**this.**$r \to$ **this.**$r.**value**(**heapIs**
*$\$heap_{funcstart\_1032,1}$).__**replace***(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 **
div(**heapIs** *$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs**
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace***(**this.**$r \to$
this.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).__**replace***(p1 $\to$ ((-2 * div(**heapIs**
*$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** *$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs**
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace***(p2 $\to$ ((-35 * div(**heapIs**
*$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** *$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs**
*$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).__**replace***(**this.**$r \to$
this.$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).__**replace***(p1 $\to$ ((-2 * div(**heapIs**
*$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** *$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs**
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace***(p2 $\to$ ((-35 * div(**heapIs**
*$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs** *$\$heap_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** *$\$heap_{funcstart\_1032,1}$*, **this.**$r.**value**(**heapIs**

$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem)))]

[1.1] !(0.0 ==
asType<**double**>(**static_cast**<**real**>($\$heap_{funcstart\_1032,1}$.**_replace**(**this.\$r**
→ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r**
→ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.\$r**
→ **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)))).M3)))

→ [const member of object with modified fields]

[1.4] !(0.0 ==
asType<**double**>(**static_cast**<**real**>($\$heap_{funcstart\_1032,1}$.M3)))

→ [const static or extern object]

[1.5] !(0.0 == **asType**<**double**>(**static_cast**<**real**>($\$heap_{init}$.M3)))

→ [expand definition of constant 'M3' at prang.cpp (38,26)]

[1.6] !(0.0 == **asType**<**double**>(**static_cast**<**real**>((**int**)30323)))

→ [simplify]

[1.12] **true**

Proof of verification condition: Assertion valid

In the context of class: WHPrang, declared at:
C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp

(94,26)

To prove: asType<real>((double)0.0) < ((asType<real>(raux2) +
asType<real>(raux1)) + **asType<real>**(raux3))

Given:

$\$heap_{init}$.LIMIT == (**int**)80

$\$heap_{init}$.**class** WHPrang ∈ M1 == (**int**)30269

$\$heap_{init}$.**class** WHPrang ∈ r1 == (**int**)171

$\$heap_{init}$.**class** WHPrang ∈ a1 == (**int**)177

$\$heap_{init}$.**class** WHPrang ∈ b1 == (**int**)2

$\$heap_{init}$.**class** WHPrang ∈ M2 == (**int**)30307

$\$heap_{init}$.**class** WHPrang ∈ r2 == (**int**)172

$\$heap_{init}$.**class** WHPrang ∈ a2 == (**int**)176

$\$heap_{init}$.**class** WHPrang ∈ b2 == (**int**)35

$\$heap_{init}$.**class** WHPrang ∈ M3 == (**int**)30323

$\$heap_{init}$.**class** WHPrang ∈ r3 == (**int**)170

$\$heap_{init}$.**class** WHPrang ∈ a3 == (**int**)178

$\$heap_{init}$.**class** WHPrang ∈ b3 == (**int**)63

div1 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1),
static_cast<int>($\$heap_{funcstart\_1032,1}$.a1))

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) /
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.quot)

(**asType<integer>**(**static_cast<int>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1)) %
asType<integer>(**static_cast<int>**($\$heap_{funcstart\_1032,1}$.a1))) ==
asType<integer>(div1.rem)

(**asType<integer>**(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) <
asType<integer>($\$heap_{funcstart\_1032,1}$.a1)) =>
(**asType<integer>**(div1.rem) == **asType<integer>**(**operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**).p1))

(**asType<integer>**($\$heap_{funcstart\_1032,1}$.a1) ≤
asType<integer>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType<integer>**(div1.quot))

!(0 == **asType<integer>**(div1.rem)) || !(0 ==
asType<integer>(div1.quot))

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div2 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a2))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a2))) ==
asType\<integer\>(div2.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2) <
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a2)) =>
(**asType\<integer\>**(div2.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType\<integer\>**($\$\text{heap}_{funcstart\_1032,1}$.a2) ≤
asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType\<integer\>**(div2.quot))

!(0 == **asType\<integer\>**(div2.rem)) || !(0 ==
asType\<integer\>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast\<int\>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.quot)

(**asType\<integer\>**(**static_cast\<int\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType\<integer\>(**static_cast\<int\>**($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType\<integer\>(div3.rem)

(**asType\<integer\>**(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType\<integer\>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(**asType\<integer\>**(div3.rem) == **asType\<integer\>**(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType\<integer\>**($\$\text{heap}_{funcstart\_1032,1}$.a3) ≤
asType\<integer\>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType\<integer\>**(div3.quot))

!(0 == **asType\<integer\>**(div3.rem)) || !(0 ==
asType\<integer\>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast\<signed int\>**(div1.rem)) −

($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast<signed int>**(div1.quot))

minof(signed int) $\leq$ temp1

temp1 $\leq$ **maxof(signed int)**

$\text{\$heap}_{1032,1;1051,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 $\rightarrow$
asType<P1Type>(($\text{\$heap}_{funcstart\_1032,1}$.M1 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) < **(int)**0))) +
temp1)))

temp2 == ($\text{\$heap}_{1032,1;1051,8}$.r2 * **static_cast<signed int>**(div2.rem)) $-$
($\text{\$heap}_{1032,1;1051,8}$.b2 * **static_cast<signed int>**(div2.quot))

minof(signed int) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

$\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{1032,1;1051,8}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).**_replace**(p2 $\rightarrow$
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < **(int)**0))) + temp2)))

temp3 == ($\text{\$heap}_{1032,1;1054,8}$.r3 * **static_cast<signed int>**(div3.rem)) $-$
($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))

minof(signed int) $\leq$ temp3

temp3 $\leq$ **maxof(signed int)**

$\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{1032,1;1054,8}$.**_replace**(this.\$r $\rightarrow$
operator*(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).**_replace**(p3 $\rightarrow$
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < **(int)**0))) + temp3)))

raux1 == **asType<double>**(**static_cast<real>**(**operator***(**heapIs**
$\text{\$heap}_{funcend\_1032,1}$, **this**).p1)) /
asType<double>(**static_cast<real>**($\text{\$heap}_{funcend\_1032,1}$.M1))

raux2 == **asType<double>**(**static_cast<real>**(**operator***(**heapIs**
$\text{\$heap}_{funcend\_1032,1}$, **this**).p2)) /
asType<double>(**static_cast<real>**($\text{\$heap}_{funcend\_1032,1}$.M2))

raux3 == **asType<double>**(**static_cast<real>**(**operator***(**heapIs**
$\text{\$heap}_{funcend\_1032,1}$, **this**).p3)) /
asType<double>(**static_cast<real>**($\text{\$heap}_{funcend\_1032,1}$.M3))

asType<real>(**(double)**0.0) < **asType<real>**(raux1)

asType<real>(**(double)**0.0) < **asType<real>**(raux2)

asType\<real\>((double)0.0) < asType\<real\>(raux3)

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast\<int\>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1),
static_cast\<int\>(\$heap$_{funcstart\_1032,1}$.a1))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast\<int\>(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1),
static_cast\<int\>(\$heap$_{funcstart\_1032,1}$.a1))

→ *[simplify]*

[2.2] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, **static_cast\<int\>**(\$heap$_{funcstart\_1032,1}$.a1))

→ *[const static or extern object]*

[2.3] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, **static_cast\<int\>**(\$heap$_{init}$.a1))

→ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, **static_cast\<int\>**((**int**)177))

→ *[simplify]*

[2.6] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType\<integer\>**(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1)) && (**asType\<integer\>**(**this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1) < **asType\<integer\>**(\$heap.**class** WHPrang ∈
M1))

→ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType\<integer\>(\$heap.**class** WHPrang ∈ M1))

→ *[const static or extern object]*

[7.3] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 <
asType\<integer\>(\$heap$_{init}$.**class** WHPrang ∈ M1))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) &&

(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1 <
asType<**integer**>((**int**)30269))

→ *[simplify]*

[7.10] (-30269 < −**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) ∧ (0 <
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1)

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] 0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1

[Take given term]

[18.0] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[simplify]*

[18.2] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a2))

→ *[const static or extern object]*

[18.3] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>($\$heap_{init}$.a2))

→ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, **static_cast**<**int**>((**int**)176))

→ *[simplify]*

[18.6] div2 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] (0 < **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2)) && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2) < **asType**<**integer**>($\$heap$.**class** WHPrang ∈
M2))

→ *[simplify]*

[23.2] (0 < **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2) &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2 <
asType<**integer**>($\$heap$.**class** WHPrang ∈ M2))

→ *[const static or extern object]*

[23.3] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2)$ &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2 <$
asType<**integer**>($\$heap_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2)$ &&
(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2 <$
asType<**integer**>((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] $(-30307 < -$**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2) \wedge (0 <$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2)$

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2$

[Take given term]

[34.0] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}).p3)$,
static_cast<**int**>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p3$, **static_cast**<**int**>($\$heap_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p3$, **static_cast**<**int**>($\$heap_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p3$, **static_cast**<**int**>((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 == div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p3$, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] $(0 <$ **asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p3))$ && (**asType**<**integer**>(**this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p3) <$ **asType**<**integer**>($\$heap$.**class** WHPrang $\in$
M3))

$\rightarrow$ *[simplify]*

[39.2] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3 <
asType<**integer**>((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] $(-30323 < -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3) $\wedge$ $(0 <$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] ((\$heap$_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] ((\$heap$_{init}$.r1 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast**<**signed int**>(div1.rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast**<**signed int**>(div1.rem)) $-$ (\$heap$_{funcstart\_1032,1}$.b1
* **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)]*

[50.4] ((171 * **static_cast**<**signed int**>(div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)) $-$
(\$heap$_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem) $-$ (\$heap$_{funcstart\_1032,1}$.b1 *

static_cast<**signed int**>(div1.quot))) == temp1

→ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ($\$\text{heap}_{init}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − ((**int**)2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div1.quot))) == temp1

→ *[from term 2.6, div1 is equal to div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem) − (2 * **static_cast**<**signed int**>(div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

→ *[simplify]*

[50.14] 0 == (−temp1 + (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**)._**replace**(p1 → **asType**<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → **asType**<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) + temp1)))

→ *[const static or extern object]*

[53.2] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>(($\$heap_{init}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((((**int**)30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[simplify]*

[53.4] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1) < (**int**)0))) + temp1)))

→ *[simplify]*

[53.9] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1))) + temp1)))

→ *[from term 8.0, literala < −**this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1
is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 < (0 + 0)

→ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))

+ temp1)))

→ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

→ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(0 + temp1)))

→ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 →
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

→ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to
$\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.1] (($\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).$\_\textbf{replace}$(p1 $\rightarrow$ ((-2 * div($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).r2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.rem)) $-$ ($\$\text{heap}_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

$\rightarrow$ *[const member of object with modified fields]*

[54.2] (($\$\text{heap}_{funcstart\_1032,1}$.r2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.rem)) $-$ ($\$\text{heap}_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

$\rightarrow$ *[const static or extern object]*

[54.3] (($\$\text{heap}_{init}$.r2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.rem)) $-$ ($\$\text{heap}_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] ((($\textbf{int}$)172 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.rem)) $-$ ($\$\text{heap}_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.5] ((172 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.rem)) $-$ ($\$\text{heap}_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

$\rightarrow$ *[from term 18.6, div2 is equal to div($\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.6] ((172 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) $-$ ($\$\text{heap}_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

$\rightarrow$ *[simplify]*

[54.7] ((172 * div($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$\text{heap}_{1032,1;1051,8}$.b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.$\_\textbf{replace}$(this.\$r $\rightarrow$ this.\$r.value($\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).$\_\textbf{replace}$(p1 $\rightarrow$ (-2 * div($\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[54.8] ((172 * div($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem) $-$ ($\$\text{heap}_{funcstart\_1032,1}$.$\_\textbf{replace}$(this.\$r $\rightarrow$ this.\$r.value($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).$\_\textbf{replace}$(p1 $\rightarrow$ ((-2 * div($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$, $\textbf{this.\$r.value}$($\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * $\textbf{static\_cast}$<$\textbf{signed int}$>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$.**_replace**(**this**.$r → **operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).**_replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $heap_{1032,1;1051,8}$ is equal to $heap_{funcstart\_1032,1}$.**_replace**(this.$r → this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, this.$r.**value**(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.2] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r \rightarrow$ **operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$ **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).**_replace**(p2 $\rightarrow$
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p2 $\rightarrow$
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r \rightarrow$ ([**this**.$r ==$
this.$r]:$ **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**_replace**(p2 $\rightarrow$
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r \rightarrow$

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → ([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r == **this**.$r)]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$))._**replace**(p2 → **asType**<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$\text{heap}_{1032,1;1051,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.8] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(($\$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}).\text{p1, 177).rem)))).M2} *$
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[const member of object with modified fields]*

[57.9] $\text{\$heap}_{1032,1;1054,8}$ **==** $\text{\$heap}_{funcstart\_1032,1}.$**_replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1})$**._replace(p1** $\rightarrow$ **((-2 * div(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1})$**.p1,**
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1})$**.p1, 177).rem))))._replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1})$**._replace(p1** $\rightarrow$ **((-2 * div(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1})$**.p1,**
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1})$**.p1, 177).rem)))._replace(p2** $\rightarrow$
asType<P2Type>((\$heap$_{funcstart\_1032,1}$**.M2 ***
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[const static or extern object]*

[57.10] $\text{\$heap}_{1032,1;1054,8}$ **==** $\text{\$heap}_{funcstart\_1032,1}.$**_replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1})$**._replace(p1** $\rightarrow$ **((-2 * div(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1})$**.p1,**
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1})$**.p1, 177).rem))))._replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1})$**._replace(p1** $\rightarrow$ **((-2 * div(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1})$**.p1,**
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1})$**.p1, 177).rem)))._replace(p2** $\rightarrow$
asType<P2Type>((\$heap$_{init}$**.M2 ***
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ **==** $\text{\$heap}_{funcstart\_1032,1}.$**_replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1})$**._replace(p1** $\rightarrow$ **((-2 * div(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1})$**.p1,**
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1})$**.p1, 177).rem))))._replace(this.\$r** $\rightarrow$
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1})$**._replace(p1** $\rightarrow$ **((-2 * div(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1})$**.p1,**
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1})$**.p1, 177).rem)))._replace(p2** $\rightarrow$
asType<P2Type>(((int)30307 *
asType<int>(static_cast<integer>(static_cast<signed
int>(operator*(heapIs $\text{\$heap}_{1032,1;1051,8}$**, this).p2) < (int)0))) + temp2)))**

$\rightarrow$ *[simplify]*

[57.12] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r → **this.**\$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.13] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this.**\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**\$r →
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →

asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$._**replace**(this.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(this.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))))._**replace**(this.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.\$r
== this.\$r]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)), []:
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(this.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(this.\$r →
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
\$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.\$r
== this.\$r]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → (-2 *
div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.\$r ==
this.\$r)]: **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)).p2) < (**int**)0))) +
temp2)))

→ *[simplify]*

[57.23] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 <
−**this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this**.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2*
is false whenever -2 < (0 + literala)]

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp2)))

→ *[simplify]*

[57.25] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(((**[false]**: 1, **[]**: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →

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this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp2)))

→ *[simplify]*

[57.29] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(0 + temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)]*

[57.30] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>(0 + ((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)))))

→ *[simplify]*

[57.33] \$heap$_{1032,1;1054,8}$ == \$heap$_{funcstart\_1032,1}$._**replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r →

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] (($\$\text{heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[from term 57.33, $\$\text{heap}_{1032,1;1054,8}$ is equal to $\$\text{heap}_{funcstart\_1032,1}$.**replace**(this.$r → this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(this.$r → this.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → (-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.1] (($\$\text{heap}_{funcstart\_1032,1}$.**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast**<**signed int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.3] (($\$\text{heap}_{funcstart\_1032,1}$.r3 * **static_cast**<**signed int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

[58.4] (($\$\text{heap}_{init}$.r3 * **static_cast**<**signed int**>(div3.rem)) −

($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] (((**int**)170 * **static_cast<signed int>**(div3.rem)) −
($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.6] ((170 * **static_cast<signed int>**(div3.rem)) − ($\text{\$heap}_{1032,1;1054,8}$.b3 *
static_cast<signed int>(div3.quot))) == temp3

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.\$r.value(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$).*p3, 178)]*

[58.7] ((170 * **static_cast<signed int>**(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)) −
($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast<signed int>**(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.8] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\text{\$heap}_{1032,1;1054,8}$.b3 *
static_cast<signed int>(div3.quot))) == temp3

$\rightarrow$ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to*
$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(*heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(*p1* $\rightarrow$ *((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.\$r.value(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** $\rightarrow$
this.\$r.value(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(*p1* $\rightarrow$ *((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(*p2* $\rightarrow$ *(-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(*heapIs*
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))]*

[58.9] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r**
$\rightarrow$ **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r**
$\rightarrow$ **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$
((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).b3 *
static_cast<signed int>(div3.quot))) == temp3

$\rightarrow$ *[const member of object with modified fields]*

[58.11] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.b3 *
static_cast<signed int>(div3.quot))) == temp3

$\rightarrow$ *[const static or extern object]*

[58.12] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\text{\$heap}_{init}$.b3 * **static_cast<signed
int>**(div3.quot))) == temp3

$\rightarrow$ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[58.13] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ((**int**)63 * **static_cast<signed
int>**(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.14] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ (63 * **static_cast<signed
int>**(div3.quot))) == temp3

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178)]*

[58.15] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ (63 * **static_cast<signed
int>**(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

$\rightarrow$ *[simplify]*

[58.20] 0 == ($-$temp3 + (-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[61.0] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{1032,1;1054,8}$._**replace**(**this**.$r $\rightarrow$
operator*(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**)._**replace**(p3 $\rightarrow$
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 *
asType<int>(**static_cast<integer>**(**static_cast<signed
int>**(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **

$div(\textbf{heapIs } \$heap_{funcstart\_1032,1}$, **this.\$r.value**$(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_$**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**$(p1 \rightarrow ((-2 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}).p1,$
$177).quot) + (171 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p1, 177).rem))).\_$**replace**$(p2 \rightarrow (-35 * div(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}).p2,$
$176).quot) + (172 * div(\textbf{heapIs } \$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}).p2, 176).rem)))]$

[61.2] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**$(p1 \rightarrow ((-2 *$ div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**$(p1 \rightarrow ((-2 *$ div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**$(p2 \rightarrow ((-35 *$ div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** $\rightarrow$ **operator***(**heapIs**
$\$heap_{funcstart\_1032,1}.\_$**replace**(**this.\$r** $\rightarrow$ **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**$(p1 \rightarrow ((-2 *$ div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**$(p1 \rightarrow ((-2 *$ div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**$(p2 \rightarrow (-35 *$ div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**)._**replace**$(p3 \rightarrow$
asType<P3Type>(($\$heap_{1032,1;1054,8}$.M3 *
asType<int>(**static_cast**<integer>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.3] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}.\_$**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**$(p1 \rightarrow ((-2 *$ div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**$(p1 \rightarrow ((-2 *$ div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.\$r →**
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r →**
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r →**
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))).**_replace**(p3 →
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.4] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r →**
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r →**
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.\$r → ([this.\$r ==**
this.\$r]: this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r →**
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p3 →

asType<P3Type>(($heap$_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.5] $heap$_{funcend_1032,1}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$,
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))))).**_replace**(p3 →
asType<P3Type>(($heap$_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $heap$_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.7] $heap$_{funcend_1032,1}$ == $heap$_{funcstart_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this**.$r.**value**(**heapIs**
$heap$_{funcstart_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r →

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$ **asType**<P3Type>(($\$heap_{1032,1;1054,8}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[61.8] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$ **asType**<P3Type>(($\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [const member of object with modified fields]

[61.10] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>(($\text{\$heap}_{funcstart\_1032,1}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [const static or extern object]

[61.11] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** → **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>((\$\text{heap}_{init}$.M3 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[61.12] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → **asType**<P3Type>(((**int**)30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.13] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 → **asType**<P3Type>((30323 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ [from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$. **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]

[61.14] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$. **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,

176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.15] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.16] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)), []: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) < (**int**)0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.17] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.\$r
== **this**.\$r]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2
* div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 →
(-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this**.\$r ==
this.\$r)]: **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → (-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.25] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$. **replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(0 < $-$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3))) + temp3)))

$\rightarrow$ *[from term 40.0, literala $< -$**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3 is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[61.25.0] -2 $<$ (0 + 0)

$\rightarrow$ *[simplify]*

[61.25.2] **true**

[61.26] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(false))) + temp3)))

$\rightarrow$ *[simplify]*

[61.27] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.$r** $\to$ **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\to$ **asType**<P3Type>((30323 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp3)))

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.28] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.$r** $\to$ **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** $\to$ **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.$r** $\to$ **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\to$ **asType**<P3Type>((30323 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) + temp3)))

$\to$ *[simplify]*

[61.31] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.$r** $\to$ **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** $\to$ **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>(0 + temp3)))

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)]*

[61.32] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>(0 + ((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)))))

→ *[simplify]*

[61.35] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → ((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))))

[Take given term]

[62.0] (**asType<double>**(**static_cast<real>**(**operator***(**heapIs** $\text{heap}_{funcend\_1032,1}$, **this**).p1)) / **asType<double>**(**static_cast<real>**($\text{heap}_{funcend\_1032,1}$.M1))) == raux1

→ *[from term 61.35, $\text{heap}_{funcend\_1032,1}$ is equal to $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)))]*

[62.1] (**asType<double>**(**static_cast<real>**(**operator***(**heapIs**

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$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \to \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \to ((\text{-2 * div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1},$
$\textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{quot}) + (171 *$
$\text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{rem})))).\_\textbf{replace}(\textbf{this.\$r} \to$
$\textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \to ((\text{-2 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177}).\text{quot}) + (171 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{rem}))).\_\textbf{replace}(\text{p2} \to ((\text{-35 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p2},$
$\text{176}).\text{quot}) + (172 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p2, 176}).\text{rem})))).\_\textbf{replace}(\textbf{this.\$r} \to$
$\textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \to ((\text{-2 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177}).\text{quot}) + (171 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{rem}))).\_\textbf{replace}(\text{p2} \to ((\text{-35 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p2},$
$\text{176}).\text{quot}) + (172 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p2, 176}).\text{rem}))).\_\textbf{replace}(\text{p3} \to (\text{-63 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p3},$
$\text{178}).\text{quot}) + (170 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p3, 178}).\text{rem}))), \textbf{this}).\text{p1})) /$
$\textbf{asType<double>(static\_cast<real>}(\text{heap}_{funcend\_1032,1}.\text{M1}))) == \text{raux1}$

$\to$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[62.2] $(\textbf{asType<double>(static\_cast<real>}(\textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \to \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \to ((\text{-2 * div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1},$
$\textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{quot}) + (171 *$
$\text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{rem})))).\_\textbf{replace}(\textbf{this.\$r} \to$
$\textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \to ((\text{-2 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177}).\text{quot}) + (171 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{rem}))).\_\textbf{replace}(\text{p2} \to ((\text{-35 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p2},$
$\text{176}).\text{quot}) + (172 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p2, 176}).\text{rem})))).\_\textbf{replace}(\textbf{this.\$r} \to$
$\textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\_\textbf{replace}(\text{p1} \to ((\text{-2 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p1},$
$\text{177}).\text{quot}) + (171 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p1, 177}).\text{rem}))).\_\textbf{replace}(\text{p2} \to ((\text{-35 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p2},$
$\text{176}).\text{quot}) + (172 * \text{div}(\textbf{heapIs } \text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs}$
$\text{heap}_{funcstart\_1032,1}).\text{p2, 176}).\text{rem}))).\_\textbf{replace}(\text{p3} \to ((\text{-63 * div}(\textbf{heapIs}$
$\text{heap}_{funcstart\_1032,1}, \textbf{this.\$r.value(heapIs } \text{heap}_{funcstart\_1032,1}).\text{p3},$

178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem))))).p1)) /
asType<**double**>(**static_cast**<**real**>($\text{\$heap}_{funcend\_1032,1}$.M1))) == raux1

→ *[evaluate dereferenced pointer into modified heap]*

[62.3] (**asType**<**double**>(**static_cast**<**real**>(([**this**.\$r == **this**.\$r]:
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)), []: **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p1)) /
asType<**double**>(**static_cast**<**real**>($\text{\$heap}_{funcend\_1032,1}$.M1))) == raux1

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[62.4] (**asType**<**double**>(**static_cast**<**real**>(([**this**.\$r == **this**.\$r]:
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)), [!(**this**.\$r == **this**.\$r)]:
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**

$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))).p1)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M1))) == raux1

→ *[simplify]*

[62.11] (**real**((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M1))) == raux1

→ *[from term 61.35, $\$heap_{funcend\_1032,1}$ is equal to*
$\$heap_{funcstart\_1032,1}$.**_replace**(this.$r → this.$r.value(heapIs
*$\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(heapIs $\$heap_{funcstart\_1032,1}$,*
*this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(this.$r →
*this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1,
*177).quot) + (171 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs*
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2,
*176).quot) + (172 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs*
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(this.$r →
*this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1,
*177).quot) + (171 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs*
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2,
*176).quot) + (172 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs*
*$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p3,
*178).quot) + (170 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.$r.value(heapIs*
$\$heap_{funcstart\_1032,1}$).p3, 178).rem)))]

[62.12] (**real**((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r
→ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.$r
$\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 $\rightarrow$ ((-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(p2 $\rightarrow$
((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this**.$r
$\rightarrow$ **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). **replace**(p1 $\rightarrow$ ((-2 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(p2 $\rightarrow$
((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(p3 $\rightarrow$
((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)))).M1))) == raux1

$\rightarrow$ *[const member of object with modified fields]*

[62.15] (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) /
asType<**double**>(**static_cast**<**real**>($\text{heap}_{funcstart\_1032,1}$.M1))) == raux1

$\rightarrow$ *[const static or extern object]*

[62.16] (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) /
asType<**double**>(**static_cast**<**real**>(heap_{init}.M1))) == raux1

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[62.17] (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) /
asType<**double**>(**static_cast**<**real**>((**int**)30269))) == raux1

$\rightarrow$ *[simplify]*

[62.22] 0.0 == ($-$raux1 + (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0))

[Take given term]

[63.0] (**asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs**
$\text{heap}_{funcend\_1032,1}$, **this**).p2)) /

asType<double>(static_cast<real>($heap$_{funcend_1032,1}$.M2))) == raux2

$\rightarrow$ *[from term 61.35, $heap_{funcend\_1032,1}$ is equal to*
$heap_{funcstart\_1032,1}$.**_replace(this.$r → this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$*).**_replace(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
this.$r.value(heapIs $heap_{funcstart\_1032,1}$*).p1, 177).quot) + (171 **
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$*).p1, 177).rem)))).**_replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$*).**_replace(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1,*
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$*).p1, 177).rem))).**_replace(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p2,*
*176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$*).p2, 176).rem)))).**_replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$*).**_replace(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p1,*
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$*).p1, 177).rem))).**_replace(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p2,*
*176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$*).p2, 176).rem))).**_replace(p3 → (-63 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$*).p3,*
*178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$*).p3, 178).rem)))]*

[63.1] (**asType<double>(static_cast<real>(operator*(heapIs**
$heap_{funcstart\_1032,1}$.**_replace(this.$r → this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3,

178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))), **this**).p2)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M2))) == raux2

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[63.2] (**asType**<**double**>(**static_cast**<**real**>(**this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ ((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))))).p2)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M2))) == raux2

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[63.3] (**asType**<**double**>(**static_cast**<**real**>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)), []: **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$ **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$\$r \to$
this.$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))).p2)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M2))) == raux2

$\to$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[63.4] (**asType**<**double**>(**static_cast**<**real**>((([**this.**$\$r ==$ **this.**$\$r$]:
this.$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\to$ (-63 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem)), [!(**this.**$\$r ==$ **this.**$\$r$)]:
this.$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$\$r \to$
this.$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$\$r \to$
this.$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\to$ (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))).p2)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M2))) == raux2

$\to$ *[simplify]*

[63.10] (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$\$r.$**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M2))) == raux2

$\to$ *[from term 61.35, $\$heap_{funcend\_1032,1}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$\$r \to$ **this.**$\$r.$**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\to$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**$\$r.$**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***

*div(***heapIs** *$heap$*$_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap$ $_{funcstart\_1032,1}$*).p1, 177).rem)))).*__**replace(this.$r** →
this.$r.value(heapIs *$heap$*$_{funcstart_1032,1}$*).*__**replace***(p1 → ((-2 * div(***heapIs**
$heap$ $_{funcstart\_1032,1}$, **this.$r.value(heapIs** *$heap$*$_{funcstart_1032,1}$*).p1,*
*177).quot) + (171 * div(***heapIs** *$heap$*$_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap$ $_{funcstart\_1032,1}$*).p1, 177).rem))).*__**replace***(p2 → ((-35 * div(***heapIs**
$heap$ $_{funcstart\_1032,1}$, **this.$r.value(heapIs** *$heap$*$_{funcstart_1032,1}$*).p2,*
*176).quot) + (172 * div(***heapIs** *$heap$*$_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap$ $_{funcstart\_1032,1}$*).p2, 176).rem)))).*__**replace(this.$r** →
this.$r.value(heapIs *$heap$*$_{funcstart_1032,1}$*).*__**replace***(p1 → ((-2 * div(***heapIs**
$heap$ $_{funcstart\_1032,1}$, **this.$r.value(heapIs** *$heap$*$_{funcstart_1032,1}$*).p1,*
*177).quot) + (171 * div(***heapIs** *$heap$*$_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap$ $_{funcstart\_1032,1}$*).p1, 177).rem))).*__**replace***(p2 → ((-35 * div(***heapIs**
$heap$ $_{funcstart\_1032,1}$, **this.$r.value(heapIs** *$heap$*$_{funcstart_1032,1}$*).p2,*
*176).quot) + (172 * div(***heapIs** *$heap$*$_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap$ $_{funcstart\_1032,1}$*).p2, 176).rem))).*__**replace***(p3 → (-63 * div(***heapIs**
$heap$ $_{funcstart\_1032,1}$, **this.$r.value(heapIs** *$heap$*$_{funcstart_1032,1}$*).p3,*
*178).quot) + (170 * div(***heapIs** *$heap$*$_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap$ $_{funcstart\_1032,1}$*).p3, 178).rem)))]*

[63.11] (**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176).rem)) /
asType<double>(static_cast<real>($heap_{funcstart\_1032,1}$.__**replace(this.$r**
→ **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace(this.$r**
→ **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 →
((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176).rem)))).__**replace(this.$r**
→ **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).__**replace**(p1 → ((-2 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 →
((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176).rem))).__**replace**(p3 →
((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p3, 178).rem)))).M2))) == raux2

→ *[const member of object with modified fields]*

[63.14] (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) /
asType<double>(static_cast<real>($\$heap_{funcstart\_1032,1}$.M2))) == raux2

$\rightarrow$ *[const static or extern object]*

[63.15] (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) /
asType<double>(static_cast<real>($\$heap_{init}$.M2))) == raux2

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[63.16] (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) /
asType<double>(static_cast<real>((**int**)30307))) == raux2

$\rightarrow$ *[simplify]*

[63.21] 0.0 == ($-$raux2 + (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0))

[Take given term]

[64.0] (**asType<double>(static_cast<real>(operator***(**heapIs**
$\$heap_{funcend\_1032,1}$, **this**).p3)) /
asType<double>(static_cast<real>($\$heap_{funcend\_1032,1}$.M3))) == raux3

$\rightarrow$ *[from term 61.35, $\$heap_{funcend\_1032,1}$ is equal to*
$\$heap_{funcstart\_1032,1}$._replace(this.\$r $\rightarrow$ this.\$r.value(heapIs
*$\$heap_{funcstart\_1032,1}$)._replace(p1 $\rightarrow$ ((-2 * div(heapIs $\$heap_{funcstart\_1032,1}$,*
*this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
div(heapIs $\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._replace(this.\$r $\rightarrow$
*this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._replace(p1 $\rightarrow$ ((-2 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1,
*177).quot) + (171 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs*
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(p2 $\rightarrow$ ((-35 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2,
*176).quot) + (172 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs*
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._replace(this.\$r $\rightarrow$
*this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$)._replace(p1 $\rightarrow$ ((-2 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1,
*177).quot) + (171 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs*
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(p2 $\rightarrow$ ((-35 * div(heapIs*
$\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p2,
*176).quot) + (172 * div(heapIs $\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs*

$heap_{funcstart\_1032,1}$).p2, 176).rem))). _**replace**_(p3 → (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)))]

[64.1] (**asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs** $heap_{funcstart\_1032,1}$. _**replace**_(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$). _**replace**_(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**_(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$). _**replace**_(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**_(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))). _**replace**_(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$). _**replace**_(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**_(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))). _**replace**_(p3 → (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))), **this**).p3)) / **asType**<**double**>(**static_cast**<**real**>($heap_{funcend\_1032,1}$.M3))) == raux3

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[64.2] (**asType**<**double**>(**static_cast**<**real**>(**this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$. _**replace**_(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$). _**replace**_(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**_(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$). _**replace**_(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**_(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))). _**replace**_(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$). _**replace**_(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → ((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))))).p3)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M3))) == raux3

→ *[evaluate dereferenced pointer into modified heap]*

[64.3] (**asType**<**double**>(**static_cast**<**real**>(([**this.**$r == **this.**$r]:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)), []: **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))).p3)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M3))) == raux3

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[64.4] (**asType**<**double**>(**static_cast**<**real**>(([**this.**$r == **this.**$r]:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,

178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)), [!(**this.**$r == **this.**$r)]:
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → (-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))).p3)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M3))) == raux3

→ *[simplify]*

[64.9] (**real**((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M3))) == raux3

→ *[from term 61.35, $\$heap_{funcend\_1032,1}$ is equal to*
*$\$heap_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this.**$r →
this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs***
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))). _**replace**(**this.**$r →
this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs***
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p2, 176).rem))). _**replace**(p3 → (-63 * div(**heapIs***
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,*
*178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p3, 178).rem)))]

[64.10] (**real**((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**

$\$heap_{funcstart\_1032,1}).p3, 178).quot) + (170 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p3, 178).rem)) /$
$\mathbf{asType}\mathbf{<double>}(\mathbf{static\_cast}\mathbf{<real>}(\$heap_{funcstart\_1032,1}.\_\mathbf{replace}(\mathbf{this.\$r}$
$\rightarrow \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\mathbf{replace}(p1 \rightarrow ((-2 *$
$div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1, 177).rem)))).\_\mathbf{replace}(\mathbf{this.\$r}$
$\rightarrow \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\mathbf{replace}(p1 \rightarrow ((-2 *$
$div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1, 177).rem))).\_\mathbf{replace}(p2 \rightarrow$
$((-35 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p2, 176).quot) + (172 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p2, 176).rem)))).\_\mathbf{replace}(\mathbf{this.\$r}$
$\rightarrow \mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).\_\mathbf{replace}(p1 \rightarrow ((-2 *$
$div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p1, 177).rem))).\_\mathbf{replace}(p2 \rightarrow$
$((-35 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p2, 176).quot) + (172 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p2, 176).rem))).\_\mathbf{replace}(p3 \rightarrow$
$((-63 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p3, 178).quot) + (170 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p3, 178).rem)))).M3))) == raux3$

$\rightarrow$ *[const member of object with modified fields]*

[64.13] $(\mathbf{real}((-63 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p3, 178).quot) + (170 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p3, 178).rem)) /$
$\mathbf{asType}\mathbf{<double>}(\mathbf{static\_cast}\mathbf{<real>}(\$heap_{funcstart\_1032,1}.M3))) == raux3$

$\rightarrow$ *[const static or extern object]*

[64.14] $(\mathbf{real}((-63 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p3, 178).quot) + (170 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p3, 178).rem)) /$
$\mathbf{asType}\mathbf{<double>}(\mathbf{static\_cast}\mathbf{<real>}(\$heap_{init}.M3))) == raux3$

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[64.15] $(\mathbf{real}((-63 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}, \mathbf{this.\$r.value}(\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p3, 178).quot) + (170 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p3, 178).rem)) /$
$\mathbf{asType}\mathbf{<double>}(\mathbf{static\_cast}\mathbf{<real>}((\mathbf{int})30323))) == raux3$

$\rightarrow$ *[simplify]*

[64.20] $0.0 == (-raux3 + (\mathbf{real}((-63 * div(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1},$
$\mathbf{this.\$r.value}(\mathbf{heapIs}\ \$heap_{funcstart\_1032,1}).p3, 178).quot) + (170 *$

div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0))

[Take goal term]

[1.0] **asType**<**real**>((**double**)0.0) < ((**asType**<**real**>(raux2) +
asType<**real**>(raux1)) + **asType**<**real**>(raux3))

$\rightarrow$ *[simplify]*

[1.2] 0.0 < ((**asType**<**real**>(raux2) + **asType**<**real**>(raux1)) +
asType<**real**>(raux3))

$\rightarrow$ *[from term 63.21, raux2 is equal to **real**((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0]*

[1.3] 0.0 < ((**asType**<**real**>(**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + **asType**<**real**>(raux1)) +
asType<**real**>(raux3))

$\rightarrow$ *[simplify]*

[1.4] 0.0 < (((**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + **asType**<**real**>(raux1)) +
asType<**real**>(raux3))

$\rightarrow$ *[from term 62.22, raux1 is equal to **real**((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0]*

[1.5] 0.0 < (((**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + **asType**<**real**>(**real**((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)) +
asType<**real**>(raux3))

$\rightarrow$ *[simplify]*

[1.6] 0.0 < (((**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)) + **asType\<real\>**(raux3))

$\rightarrow$ *[from term 64.20, raux3 is equal to* **real**(*(-63 * div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(***heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0]*

[1.7] 0.0 < (((**real**((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + (**real**((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0)) + **asType\<real\>**(**real**((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0))

$\rightarrow$ *[simplify]*

[1.9] 0.0 < ((**real**((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + (**real**((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0))

$\rightarrow$ *[negate goal and search for contradiction]*

[1.10] !(0.0 < ((**real**((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + (**real**((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0)))

$\rightarrow$ *[simplify]*

[1.17] 0.0 ≤ (−(**real**((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**

$heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + −(**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + −(**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0))

[Take given term]

[65.0] **asType**<**real**>((**double**)0.0) < **asType**<**real**>(raux1)

→ *[simplify]*

[65.2] 0.0 < **asType**<**real**>(raux1)

→ *[from term 62.22, raux1 is equal to* **real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0]

[65.3] 0.0 < **asType**<**real**>(**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)

→ *[simplify]*

[65.4] 0.0 < (**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)

[Take given term]

[66.0] **asType**<**real**>((**double**)0.0) < **asType**<**real**>(raux2)

→ *[simplify]*

[66.2] 0.0 < **asType**<**real**>(raux2)

→ *[from term 63.21, raux2 is equal to* **real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0]

[66.3] 0.0 < **asType**<**real**>(**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0)

→ *[simplify]*

[66.4] 0.0 < (**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0)

[Take given term]

[67.0] **asType<real>**((**double**)0.0) < **asType<real>**(raux3)

→ *[simplify]*

[67.2] 0.0 < **asType<real>**(raux3)

→ *[from term 64.20, raux3 is equal to **real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0]*

[67.3] 0.0 < **asType<real>**(**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0)

→ *[simplify]*

[67.4] 0.0 < (**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0)

[Create new term from terms 1.17, 67.4 using rule: transitivity 2b]

[110.0] (0.0 + 0.0) < (−(**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + −(**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0))

→ *[simplify]*

[110.1] 0.0 < (−(**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + −(**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0))

[Create new term from terms 110.1, 66.4 using rule: transitivity 2a]

[125.0] (0.0 + 0.0) < −(**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)

$\rightarrow$ *[simplify]*

[125.1] 0.0 < $-$(**real**((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)

$\rightarrow$ *[from term 65.4, literala < $-$(**real**((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) is false whenever -0.0 $\leq$ literala]*

Proof of rule precondition:

[125.1.0] -0.0 $\leq$ 0.0

$\rightarrow$ *[simplify]*

[125.1.1] **true**

[125.2] **false**

Proof of verification condition: Precondition of 'fmod' satisfied

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (95,21)

Condition defined at: C:\Escher\ecv\standard\math.h (84,16)

To prove: !(**asType**<**real**>((**double**)1.0) == **asType**<**real**>((**double**)0.0))

Given:

$\text{\$heap}_{init}$.LIMIT == (**int**)80

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

$\text{\$heap}_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

$\text{\$heap}_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

$\text{\$heap}_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

$\text{\$heap}_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

$\text{\$heap}_{init}.$**class** WHPrang $\in$ a3 == (**int**)178

$\text{\$heap}_{init}.$**class** WHPrang $\in$ b3 == (**int**)63

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))) ==
asType<**integer**>(div2.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2)) =>
(**asType**<**integer**>(div2.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p2))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a2) $\leq$
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2)) =>
!(0 == **asType**<**integer**>(div2.quot))

!(0 == **asType**<**integer**>(div2.rem)) || !(0 ==
asType<**integer**>(div2.quot))

div3 == div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3),
static_cast<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) /
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) %
asType<**integer**>(**static_cast**<**int**>($\$\text{heap}_{funcstart\_1032,1}$.a3))) ==
asType<**integer**>(div3.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3) <
asType<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a3)) =>
(**asType**<**integer**>(div3.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**).p3))

(**asType**<**integer**>($\$\text{heap}_{funcstart\_1032,1}$.a3) ≤
asType<**integer**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p3)) =>
!(0 == **asType**<**integer**>(div3.quot))

!(0 == **asType**<**integer**>(div3.rem)) || !(0 ==
asType<**integer**>(div3.quot))

temp1 == ($\$\text{heap}_{funcstart\_1032,1}$.r1 * **static_cast**<**signed int**>(div1.rem)) −
($\$\text{heap}_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))

minof(**signed int**) ≤ temp1

temp1 ≤ **maxof**(**signed int**)

$\$\text{heap}_{1032,1;1051,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
operator*(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).**_replace**(p1 →
asType<P1Type>(($\$\text{heap}_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$\text{heap}_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) −
($\$\text{heap}_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(**signed int**) ≤ temp2

temp2 ≤ **maxof**(**signed int**)

$\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{1032,1;1051,8}$.**_replace**(**this**.$r →
operator*(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).**_replace**(p2 →
asType<P2Type>(($\$\text{heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**

int$>$(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) $<$ (**int**)0))) + temp2)))

temp3 == ($\$heap_{1032,1;1054,8}$.r3 * **static_cast**$<$**signed int**$>$(div3.rem)) $-$ ($\$heap_{1032,1;1054,8}$.b3 * **static_cast**$<$**signed int**$>$(div3.quot))

minof(**signed int**) $\leq$ temp3

temp3 $\leq$ **maxof**(**signed int**)

$\$heap_{funcend\_1032,1}$ == $\$heap_{1032,1;1054,8}$.**replace**(**this**.\$r $\rightarrow$ **operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).**replace**(p3 $\rightarrow$ **asType**$<$P3Type$>$(($\$heap_{1032,1;1054,8}$.M3 * **asType**$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed int**$>$(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) $<$ (**int**)0))) + temp3)))

raux1 == **asType**$<$**double**$>$(**static_cast**$<$**real**$>$(**operator***(**heapIs** $\$heap_{funcend\_1032,1}$, **this**).p1)) / **asType**$<$**double**$>$(**static_cast**$<$**real**$>$($\$heap_{funcend\_1032,1}$.M1))

raux2 == **asType**$<$**double**$>$(**static_cast**$<$**real**$>$(**operator***(**heapIs** $\$heap_{funcend\_1032,1}$, **this**).p2)) / **asType**$<$**double**$>$(**static_cast**$<$**real**$>$($\$heap_{funcend\_1032,1}$.M2))

raux3 == **asType**$<$**double**$>$(**static_cast**$<$**real**$>$(**operator***(**heapIs** $\$heap_{funcend\_1032,1}$, **this**).p3)) / **asType**$<$**double**$>$(**static_cast**$<$**real**$>$($\$heap_{funcend\_1032,1}$.M3))

asType$<$**real**$>$((**double**)0.0) $<$ **asType**$<$**real**$>$(raux1)

asType$<$**real**$>$((**double**)0.0) $<$ **asType**$<$**real**$>$(raux2)

asType$<$**real**$>$((**double**)0.0) $<$ **asType**$<$**real**$>$(raux3)

asType$<$**real**$>$((**double**)0.0) $<$ ((**asType**$<$**real**$>$(raux2) + **asType**$<$**real**$>$(raux1)) + **asType**$<$**real**$>$(raux3))

Proof:

[Take goal term]

[1.0] !(**asType**$<$**real**$>$((**double**)1.0) == **asType**$<$**real**$>$((**double**)0.0))

$\rightarrow$ *[simplify]*

[1.6] **true**

Proof of verification condition: Postcondition satisfied when function 'GetRandom' returns

In the context of class: WHPrang, declared at: C:\Escher\Customers\prang-cpp\prang.cpp (18,1)

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (97,5)

Condition defined at: C:\Escher\Customers\prang-cpp\prang.cpp (25,33)

To prove: asType$<$**real**$>$(result) $<$ **asType**$<$**real**$>$((**double**)1.0)

Given:

$\text{\$heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

div1 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) /
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.quot)

(**asType**<**integer**>(**static_cast**<**int**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) %
asType<**integer**>(**static_cast**<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a1))) ==
asType<**integer**>(div1.rem)

(**asType**<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1) <
asType<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1)) =>
(**asType**<**integer**>(div1.rem) == **asType**<**integer**>(**operator***(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**).p1))

(**asType**<**integer**>($\text{\$heap}_{funcstart\_1032,1}$.a1) ≤
asType<**integer**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p1)) =>
!(0 == **asType**<**integer**>(div1.quot))

!(0 == **asType**<**integer**>(div1.rem)) || !(0 ==
asType<**integer**>(div1.quot))

div2 == div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>($\text{\$heap}_{funcstart\_1032,1}$.a2))

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \;/\;$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div2.quot})$

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) \;\%\;$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}))) ==$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div2.rem})$

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs} \;\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}) <$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2})) =>$
$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div2.rem}) == \textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2}))$

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a2}) \leq$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs} \;\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p2})) =>$
$!(0 == \textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div2.quot}))$

$!(0 == \textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div2.rem})) \;||\; !(0 ==$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div2.quot}))$

$\text{div3} == \text{div}(\textbf{heapIs} \;\$\text{heap}_{funcstart\_1032,1},$
$\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs} \;\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}),$
$\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))$

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \;/\;$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div3.quot})$

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) \;\%\;$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{static\_cast}\texttt{<}\textbf{int}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}))) ==$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div3.rem})$

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs} \;\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}) <$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3})) =>$
$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div3.rem}) == \textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs}$ $\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3}))$

$(\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\$\text{heap}_{funcstart\_1032,1}.\text{a3}) \leq$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\textbf{operator}\texttt{*}(\textbf{heapIs} \;\$\text{heap}_{funcstart\_1032,1}, \textbf{this}).\text{p3})) =>$
$!(0 == \textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div3.quot}))$

$!(0 == \textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div3.rem})) \;||\; !(0 ==$
$\textbf{asType}\texttt{<}\textbf{integer}\texttt{>}(\text{div3.quot}))$

$\text{temp1} == (\$\text{heap}_{funcstart\_1032,1}.\text{r1} \;\texttt{*}\; \textbf{static\_cast}\texttt{<}\textbf{signed int}\texttt{>}(\text{div1.rem})) -$
$(\$\text{heap}_{funcstart\_1032,1}.\text{b1} \;\texttt{*}\; \textbf{static\_cast}\texttt{<}\textbf{signed int}\texttt{>}(\text{div1.quot}))$

$\textbf{minof}(\textbf{signed int}) \leq \text{temp1}$

temp1 $\leq$ **maxof(signed int)**

$\$heap_{1032,1;1051,8} ==\$ heap_{funcstart\_1032,1}$._**replace**(**this**.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**)._**replace**(p1 $\rightarrow$
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

temp2 == ($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))

minof(signed int) $\leq$ temp2

temp2 $\leq$ **maxof(signed int)**

$\$heap_{1032,1;1054,8} ==\$ heap_{1032,1;1051,8}$._**replace**(**this**.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{1032,1;1051,8}$, **this**)._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

temp3 == ($\$heap_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) $-$
($\$heap_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))

minof(signed int) $\leq$ temp3

temp3 $\leq$ **maxof(signed int)**

$\$heap_{funcend\_1032,1} ==\$ heap_{1032,1;1054,8}$._**replace**(**this**.\$r $\rightarrow$
operator*(**heapIs** $\$heap_{1032,1;1054,8}$, **this**)._**replace**(p3 $\rightarrow$
asType<P3Type>(($\$heap_{1032,1;1054,8}$.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

raux1 == **asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs**
$\$heap_{funcend\_1032,1}$, **this**).p1)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M1))

raux2 == **asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs**
$\$heap_{funcend\_1032,1}$, **this**).p2)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M2))

raux3 == **asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs**
$\$heap_{funcend\_1032,1}$, **this**).p3)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M3))

asType<**real**>((**double**)0.0) < **asType**<**real**>(raux1)

asType<**real**>((**double**)0.0) < **asType**<**real**>(raux2)

asType<**real**>((**double**)0.0) < **asType**<**real**>(raux3)

asType<**real**>((**double**)0.0) < ((**asType**<**real**>(raux2) +
asType<**real**>(raux1)) + **asType**<**real**>(raux3))

result == fmod(**heapIs** \$heap$_{funcend\_1032,1}$, (raux1 + raux2) + raux3, (**double**)1.0)

((**asType\<real\>**((**double**)0.0) $\leq$ **asType\<real\>**((raux1 + raux2) + raux3)) && (**asType\<real\>**((**double**)0.0) $\leq$ **asType\<real\>**((**double**)1.0))) => ((**asType\<real\>**((**double**)0.0) $\leq$ **asType\<real\>**(result)) && (**asType\<real\>**(result) < **asType\<real\>**((**double**)1.0)))

Proof:

[Take given term]

[2.0] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast\<int\>**(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p1), **static_cast\<int\>**(\$heap$_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[2.1] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **static_cast\<int\>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1), **static_cast\<int\>**(\$heap$_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[simplify]*

[2.2] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, **static_cast\<int\>**(\$heap$_{funcstart\_1032,1}$.a1))

$\rightarrow$ *[const static or extern object]*

[2.3] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, **static_cast\<int\>**(\$heap$_{init}$.a1))

$\rightarrow$ *[expand definition of constant 'a1' at prang.cpp (30,26)]*

[2.4] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, **static_cast\<int\>**((**int**)177))

$\rightarrow$ *[simplify]*

[2.6] div1 == div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177)

[Assume known post-assertion, class invariant or type constraint for term 2.6]

[7.0] (0 < **asType\<integer\>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1)) && (**asType\<integer\>**(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) < **asType\<integer\>**(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[simplify]*

[7.2] (0 < **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1) && (**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1 < **asType\<integer\>**(\$heap.**class** WHPrang $\in$ M1))

$\rightarrow$ *[const static or extern object]*

[7.3] $(0 <$ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1$)$ &&
$($**this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1 $<$
asType<**integer**>(\$heap$_{init}$.**class** WHPrang $\in$ M1$))$

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[7.4] $(0 <$ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1$)$ &&
$($**this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1 $<$
asType<**integer**>$(($**int**$)30269))$

$\rightarrow$ *[simplify]*

[7.10] $(-30269 < -$**this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1$) \wedge (0 <$
this.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1$)$

[Work on sub-term 2 of conjunction in term 7.10]

[8.0] $0 <$ **this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p1

[Take given term]

[18.0] div2 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p2),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[18.1] div2 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast<**int**>(**this**.$r.**value**(**heapIs** \$heap$_{funcstart_1032,1}$).p2),
static_cast<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[simplify]*

[18.2] div2 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{funcstart\_1032,1}$.a2))

$\rightarrow$ *[const static or extern object]*

[18.3] div2 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>(\$heap$_{init}$.a2))

$\rightarrow$ *[expand definition of constant 'a2' at prang.cpp (35,26)]*

[18.4] div2 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, **static_cast**<**int**>$(($**int**$)176))$

$\rightarrow$ *[simplify]*

[18.6] div2 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2, 176)

[Assume known post-assertion, class invariant or type constraint for term 18.6]

[23.0] $(0 <$ **asType**<**integer**>(**this**.$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2$)) $ && $($**asType**<**integer**>(**this**.$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p2$) <$ **asType**<**integer**>(\$heap.**class** WHPrang $\in$
M2$))$

$\rightarrow$ *[simplify]*

[23.2] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 $<$
asType$<$**integer**$>$(\$heap.**class** WHPrang $\in$ M2))

$\rightarrow$ *[const static or extern object]*

[23.3] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 $<$
asType$<$**integer**$>$(\$heap$_{init}$.**class** WHPrang $\in$ M2))

$\rightarrow$ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[23.4] $(0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) &&
(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2 $<$
asType$<$**integer**$>$((**int**)30307))

$\rightarrow$ *[simplify]*

[23.10] $(\text{-}30307 < -$**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2) $\wedge$ $(0 <$
this.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2)

[Work on sub-term 2 of conjunction in term 23.10]

[24.0] $0 <$ **this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2

[Take given term]

[34.0] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**operator***(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**).p3),
static_cast$<$**int**$>$(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[34.1] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$,
static_cast$<$**int**$>$(**this**.\$r.**value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3),
static_cast$<$**int**$>$(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[simplify]*

[34.2] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**$<$**int**$>$(\$heap$_{funcstart\_1032,1}$.a3))

$\rightarrow$ *[const static or extern object]*

[34.3] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**$<$**int**$>$(\$heap$_{init}$.a3))

$\rightarrow$ *[expand definition of constant 'a3' at prang.cpp (40,26)]*

[34.4] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, **static_cast**$<$**int**$>$((**int**)178))

$\rightarrow$ *[simplify]*

[34.6] div3 $==$ div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
\$heap$_{funcstart\_1032,1}$).p3, 178)

[Assume known post-assertion, class invariant or type constraint for term 34.6]

[39.0] $(0 <$ **asType$<$integer$>$**(this.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3)) && (**asType$<$integer$>$**(this.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3) $<$ **asType$<$integer$>$**($heap.**class** WHPrang $\in$
M3))

$\rightarrow$ *[simplify]*

[39.2] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 $<$
asType$<$integer$>$($heap.**class** WHPrang $\in$ M3))

$\rightarrow$ *[const static or extern object]*

[39.3] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 $<$
asType$<$integer$>$($\text{\$heap}_{init}$.**class** WHPrang $\in$ M3))

$\rightarrow$ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[39.4] $(0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) &&
(**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 $<$
asType$<$integer$>$((**int**)30323))

$\rightarrow$ *[simplify]*

[39.10] (-30323 $< -$**this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3) $\wedge$ $(0 <$
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3)

[Work on sub-term 2 of conjunction in term 39.10]

[40.0] $0 <$ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3

[Take given term]

[50.0] (($\text{\$heap}_{funcstart\_1032,1}$.r1 * **static_cast$<$signed int$>$**(div1.rem)) $-$
($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast$<$signed int$>$**(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.1] (($\text{\$heap}_{init}$.r1 * **static_cast$<$signed int$>$**(div1.rem)) $-$
($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast$<$signed int$>$**(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'r1' at prang.cpp (29,26)]*

[50.2] (((**int**)171 * **static_cast$<$signed int$>$**(div1.rem)) $-$
($\text{\$heap}_{funcstart\_1032,1}$.b1 * **static_cast$<$signed int$>$**(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.3] ((171 * **static_cast$<$signed int$>$**(div1.rem)) $-$ $\text{\$heap}_{funcstart\_1032,1}$.b1
* **static_cast$<$signed int$>$**(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177)]

[50.4] ((171 * **static_cast$<$signed int$>$**(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,

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this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) $-$
($\$heap_{funcstart\_1032,1}$.b1 * **static_cast**<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.5] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{funcstart\_1032,1}$.b1 *
static_cast<**signed int**>(div1.quot))) == temp1

$\rightarrow$ *[const static or extern object]*

[50.6] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ($\$heap_{init}$.b1 * **static_cast**<**signed
int**>(div1.quot))) == temp1

$\rightarrow$ *[expand definition of constant 'b1' at prang.cpp (31,26)]*

[50.7] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ ((**int**)2 * **static_cast**<**signed
int**>(div1.quot))) == temp1

$\rightarrow$ *[simplify]*

[50.8] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed
int**>(div1.quot))) == temp1

$\rightarrow$ *[from term 2.6, div1 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177)]*

[50.9] ((171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem) $-$ (2 * **static_cast**<**signed
int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot))) == temp1

$\rightarrow$ *[simplify]*

[50.14] 0 == ($-$temp1 + (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))

[Take given term]

[53.0] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$
operator*(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).**_replace**(p1 $\rightarrow$
asType<P1Type>(($\$heap_{funcstart\_1032,1}$.M1 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed
int**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**).p1) < (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.1] $\$heap_{1032,1;1051,8}$ == $\$heap_{funcstart\_1032,1}$.**_replace**(**this**.$r $\rightarrow$
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$

asType$<$P1Type$>$(($heap$_{funcstart_1032,1}$.M1 *
asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed
int**$>$(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) $<$ (**int**)0))) +
temp1)))

$\rightarrow$ *[const static or extern object]*

[53.2] $heap$_{1032,1;1051,8}$ $==$ $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\rightarrow$
asType$<$P1Type$>$(($heap$_{init}$.M1 *
asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed
int**$>$(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) $<$ (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[53.3] $heap$_{1032,1;1051,8}$ $==$ $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\rightarrow$
asType$<$P1Type$>$((((**int**)30269 *
asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed
int**$>$(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) $<$ (**int**)0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.4] $heap$_{1032,1;1051,8}$ $==$ $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\rightarrow$
asType$<$P1Type$>$((30269 *
asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed
int**$>$(**operator***(**heapIs** $heap$_{funcstart_1032,1}$, **this**).p1) $<$ (**int**)0))) +
temp1)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[53.5] $heap$_{1032,1;1051,8}$ $==$ $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\rightarrow$
asType$<$P1Type$>$((30269 *
asType$<$**int**$>$(**static_cast**$<$**integer**$>$(**static_cast**$<$**signed
int**$>$(**this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1) $<$ (**int**)0))) + temp1)))

$\rightarrow$ *[simplify]*

[53.9] $heap$_{1032,1;1051,8}$ $==$ $heap$_{funcstart_1032,1}$.**_replace**(**this**.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 $\rightarrow$
asType$<$P1Type$>$((30269 * **asType**$<$**int**$>$(**static_cast**$<$**integer**$>$(0 $<$
$-$**this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1))) + temp1)))

$\rightarrow$ *[from term 8.0, literala $<$ $-$**this**.\$r.**value**(**heapIs** $heap$_{funcstart_1032,1}$).p1
is false whenever -2 $<$ (0 + literala)]*

Proof of rule precondition:

[53.9.0] -2 $<$ (0 + 0)

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$\rightarrow$ *[simplify]*

[53.9.2] **true**

[53.10] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.$**_replace**(this.\$r $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>(**static_cast**<**integer**>(**false**)))
+ temp1)))

$\rightarrow$ *[simplify]*

[53.11] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.$**_replace**(this.\$r $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, []: 0))) + temp1)))

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[53.12] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.$**_replace**(this.\$r $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>((30269 * **asType**<**int**>((([**false**]: 1, [**true**]: 0))) +
temp1)))

$\rightarrow$ *[simplify]*

[53.15] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.$**_replace**(this.\$r $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>(0 + temp1)))

$\rightarrow$ *[from term 50.14, temp1 is equal to (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.\$r.value(*heapIs* $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
*div(**heapIs** $\$heap_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)]*

[53.16] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.$**_replace**(this.\$r $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$
asType<P1Type>(0 + ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))

$\rightarrow$ *[simplify]*

[53.19] $\$heap_{1032,1;1051,8} == \$heap_{funcstart\_1032,1}.$**_replace**(this.\$r $\rightarrow$
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))

[Take given term]

[54.0] (($\$heap_{1032,1;1051,8}$.r2 * **static_cast**<**signed int**>(div2.rem)) $-$
($\$heap_{1032,1;1051,8}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*

$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\textit{-2 * div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$
$div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))]$

[54.1] $((\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this}.\$r \rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow ((\text{-2} * div(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$
$div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))).r2 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\text{div2.rem})) - (\$heap_{1032,1;1051,8}.b2 * \textbf{static\_cast}<\textbf{signed}$
$\textbf{int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[const member of object with modified fields]*

[54.2] $((\$heap_{funcstart\_1032,1}.r2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.rem})) -$
$(\$heap_{1032,1;1051,8}.b2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[const static or extern object]*

[54.3] $((\$heap_{init}.r2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.rem})) -$
$(\$heap_{1032,1;1051,8}.b2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[expand definition of constant 'r2' at prang.cpp (34,26)]*

[54.4] $(((\textbf{int})172 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.rem})) -$
$(\$heap_{1032,1;1051,8}.b2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.5] $((172 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.rem})) - (\$heap_{1032,1;1051,8}.b2 *$
$\textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[from term 18.6, div2 is equal to div(*$\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2, 176)$*]*

[54.6] $((172 * \textbf{static\_cast}<\textbf{signed int}>(\text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p2, 176).rem)) -$
$(\$heap_{1032,1;1051,8}.b2 * \textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[simplify]*

[54.7] $((172 * \text{div}(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p2, 176).rem) - (\$heap_{1032,1;1051,8}.b2 *$
$\textbf{static\_cast}<\textbf{signed int}>(\text{div2.quot}))) == \text{temp2}$

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}.\_\textbf{replace}(\textbf{this.\$r} \rightarrow \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).\_\textbf{replace}(p1 \rightarrow (\textit{-2 * div}(\textbf{heapIs } \$heap_{funcstart\_1032,1},$
$\textbf{this.\$r}.\textbf{value}(\textbf{heapIs } \$heap_{funcstart\_1032,1}).p1, 177).quot) + (171 *$
$div(\textbf{heapIs } \$heap_{funcstart\_1032,1}, \textbf{this.\$r}.\textbf{value}(\textbf{heapIs}$
$\$heap_{funcstart\_1032,1}).p1, 177).rem)))]$

[54.8] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.**_replace**(**this**.\$r → **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const member of object with modified fields]*

[54.9] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{funcstart\_1032,1}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[const static or extern object]*

[54.10] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ($\$heap_{init}$.b2 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[expand definition of constant 'b2' at prang.cpp (36,26)]*

[54.11] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − ((**int**)35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[simplify]*

[54.12] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div2.quot))) == temp2

→ *[from term 18.6, div2 is equal to div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176)]*

[54.13] ((172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem) − (35 * **static_cast**<**signed int**>(div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot))) == temp2

→ *[simplify]*

[54.18] 0 == (−temp2 + (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))

[Take given term]

[57.0] $\$heap_{1032,1;1054,8}$ == $\$heap_{1032,1;1051,8}$.**_replace**(**this**.\$r → **operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).**_replace**(p2 → **asType**<P2Type>(($\$heap_{1032,1;1051,8}$.M2 * **asType**<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$._replace(this.\$r $\rightarrow$ this.\$r.value(heapIs
$\$heap_{funcstart\_1032,1}$)._replace(p1 $\rightarrow$ (-2 * div(heapIs $\$heap_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(heapIs $\$heap_{funcstart\_1032,1}$, this.\$r.value(heapIs
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.2] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r $\rightarrow$ **operator***(**heapIs**
$\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$ this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))), this)._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, this).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.3] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))))._**replace**(p2 $\rightarrow$
asType<P2Type>(($\$heap_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1051,8}$, this).p2) < (**int**)0))) + temp2)))

$\rightarrow$ *[evaluate dereferenced pointer into modified heap]*

[57.4] $\$heap_{1032,1;1054,8}$ == $\$heap_{funcstart\_1032,1}$._**replace**(this.\$r $\rightarrow$
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(this.\$r $\rightarrow$ ([**this.\$r** ==
this.\$r]: this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ (-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, this.\$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)), []:

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.5] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.7] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>(($\text{\$heap}_{1032,1;1051,8}$.M2 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[from term 53.19, $\text{\$heap}_{1032,1;1051,8}$ is equal to*
*$\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs***
*$\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,*
***this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))]

[57.8] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const member of object with modified fields]*

[57.9] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{funcstart\_1032,1}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[const static or extern object]*

[57.10] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(($\text{\$heap}_{init}$.M2 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1051,8}$, **this**).p2) < (**int**)0))) + temp2)))

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[57.11] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).⌴**replace**(p2 → **asType**<P2Type>(((**(int)**30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < **(int)**0))) + temp2)))

→ *[simplify]*

[57.12] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.⌴**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).⌴**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).⌴**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).⌴**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).⌴**replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1051,8}$, **this**).p2) < **(int)**0))) + temp2)))

→ *[from term 53.19, $\$heap_{1032,1;1051,8}$ is equal to $\$heap_{funcstart\_1032,1}$.⌴**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).⌴**replace**(p1 → (-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))]*

[57.13] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.⌴**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).⌴**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).⌴**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).⌴**replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).⌴**replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int**>(**operator***(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.⌴**replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).⌴**replace**(p1 → (-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))), **this**).p2) < **(int)**0))) + temp2)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[57.14] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.⌴**replace**(**this.\$r** →

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(static_cast<signed int>(**this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p2) < (**int**)0))) + temp2)))

→ *[evaluate dereferenced pointer into modified heap]*

[57.15] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), []: **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.16] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<int>(static_cast<integer>(static_cast<signed int>(([**this**.$r

== **this.$r**]: **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → (-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)), [!(**this.$r** == **this.$r**)]: **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)).p2) < (**int**)0))) + temp2)))

→ *[simplify]*

[57.23] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r** → **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2))) + temp2)))

→ *[from term 24.0, literala < −**this.$r**.**value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).p2 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[57.23.0] -2 < (0 + 0)

→ *[simplify]*

[57.23.2] **true**

[57.24] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r** → **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → **asType**<P2Type>((30307 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp2)))

→ *[simplify]*

[57.25] $\text{\$heap}_{1032,1;1054,8}$ == $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.$r** → **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r** →

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp2)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[57.26] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
asType<P2Type>((30307 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) +
temp2)))

→ *[simplify]*

[57.29] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
temp2)))

→ *[from term 54.18, temp2 is equal to (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
this.$r.**value**(*heapIs* $\$heap_{funcstart\_1032,1}$*).p2, 176).quot) + (172 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(*heapIs*
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)]

[57.30] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → **asType**<P2Type>(0 +
((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))))

$\rightarrow$ *[simplify]*

[57.33] $\$\text{heap}_{1032,1;1054,8}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))

[Take given term]

[58.0] (($\$\text{heap}_{1032,1;1054,8}$.r3 * **static_cast**<**signed int**>(div3.rem)) −
($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$
this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ (-35 * div(**heapIs***
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]

[58.1] (($\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).r3 * **static_cast**<**signed
int**>(div3.rem)) − ($\$\text{heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed**

int>(div3.quot))) == temp3

$\rightarrow$ *[const member of object with modified fields]*

[58.3] (($\text{\$heap}_{funcstart\_1032,1}$.r3 * **static_cast**<**signed int**>(div3.rem)) $-$ ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[const static or extern object]*

[58.4] (($\text{\$heap}_{init}$.r3 * **static_cast**<**signed int**>(div3.rem)) $-$ ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[expand definition of constant 'r3' at prang.cpp (39,26)]*

[58.5] ((**(int)**170 * **static_cast**<**signed int**>(div3.rem)) $-$ ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.6] ((170 * **static_cast**<**signed int**>(div3.rem)) $-$ ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[from term 34.6, div3 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p3, 178)]*

[58.7] ((170 * **static_cast**<**signed int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)) $-$ ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[simplify]*

[58.8] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\text{\$heap}_{1032,1;1054,8}$.b3 * **static_cast**<**signed int**>(div3.quot))) == temp3

$\rightarrow$ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ **this.\$r.value**(heapIs $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).rem)))).**_replace**(this.\$r $\rightarrow$ **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).rem))).**_replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(*heapIs* $\text{\$heap}_{funcstart\_1032,1}$*).p2, 176).rem)))]*

[58.9] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) $-$ ($\text{\$heap}_{funcstart\_1032,1}$.**_replace**(this.\$r $\rightarrow$ **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r
→ **this.**$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))).b3 *
static_cast<**signed int**>(div3.quot))) == temp3

→ *[const member of object with modified fields]*

[58.11] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\text{\$heap}_{funcstart\_1032,1}$.b3 *
static_cast<**signed int**>(div3.quot))) == temp3

→ *[const static or extern object]*

[58.12] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − ($\text{\$heap}_{init}$.b3 * **static_cast**<**signed
int**>(div3.quot))) == temp3

→ *[expand definition of constant 'b3' at prang.cpp (41,26)]*

[58.13] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − ((**int**)63 * **static_cast**<**signed
int**>(div3.quot))) == temp3

→ *[simplify]*

[58.14] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed
int**>(div3.quot))) == temp3

→ *[from term 34.6, div3 is equal to div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178)]*

[58.15] ((170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem) − (63 * **static_cast**<**signed
int**>(div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot))) == temp3

→ *[simplify]*

[58.20] 0 == (−temp3 + (-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem))

[Take given term]

[61.0] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{1032,1;1054,8}$.**_replace**(**this.**$r →
operator*(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).**_replace**(p3 →
asType<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 *

asType<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to $\$heap_{funcstart\_1032,1}$.__**replace**(**this**.$\$r \rightarrow$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(**this**.$\$r \rightarrow$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]*

[61.2] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.__**replace**(**this**.$\$r \rightarrow$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(**this**.$\$r \rightarrow$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).__**replace**(**this**.$\$r \rightarrow$ **operator***(**heapIs** $\$heap_{funcstart\_1032,1}$.__**replace**(**this**.$\$r \rightarrow$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__**replace**(**this**.$\$r \rightarrow$ **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__**replace**(p2 $\rightarrow$ (-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$\$r$.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))), **this**).__**replace**(p3 $\rightarrow$ **asType**<P3Type>(($\$heap_{1032,1;1054,8}$.M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

$\rightarrow$ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.3] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.__**replace**(**this**.$\$r \rightarrow$

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))))._**replace**(p3 → **asType**<P3Type>(($\text{heap}_{1032,1;1054,8}$.M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.4] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.$r → ([**this**.$r == **this**.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(p3 →
asType<P3Type>(($\$\text{heap}_{1032,1;1054,8}$.M3 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.5] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → ([**this**.$r ==
this.$r]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this**.$r ==
this.$r)]: **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))).**_replace**(p3 →
asType<P3Type>(($\$\text{heap}_{1032,1;1054,8}$.M3 *
asType<int>(**static_cast**<integer>(**static_cast**<signed
int>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.7] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))). **replace**(p3 → **asType**<P3Type>(($\text{\$heap}_{1032,1;1054,8}$.M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $\text{\$heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $\text{\$heap}_{1032,1;1054,8}$ is equal to $\text{\$heap}_{funcstart\_1032,1}$.* **replace**(*this.\$r* → *this.\$r.value(heapIs $\text{\$heap}_{funcstart\_1032,1}$).* **replace**(*p1* → ((-2 * *div*(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * *div*(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).rem)))). **replace**(*this.\$r* → *this.\$r.value*(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).* **replace**(*p1* → ((-2 * *div*(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).quot) + (171 * *div*(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p1, 177).rem))). **replace**(*p2* → (-35 * *div*(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p2, 176).quot) + (172 * *div*(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value**(**heapIs** *$\text{\$heap}_{funcstart\_1032,1}$*).p2, 176).rem)))]*

[61.8] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$. **replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>(($heap_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[const member of object with modified fields]*

[61.10] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → **asType**<P3Type>(($heap_{funcstart\_1032,1}$.M3 * **asType**<int>(**static_cast**<integer>(**static_cast**<signed int>(**operator***(**heapIs** $heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[const static or extern object]*

[61.11] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((\$heap_{init}.M3 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[61.12] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace(this.\$r** →
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>(((**int**)30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(**operator***(**heapIs** $\$\text{heap}_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.13] $\$\text{heap}_{funcend\_1032,1}$ == $\$\text{heap}_{funcstart\_1032,1}$.**_replace(this.\$r** →

this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).__replace__(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\$heap_{1032,1;1054,8}$, **this**).p3) < (**int**)0))) + temp3)))

→ *[from term 57.33, $\$heap_{1032,1;1054,8}$ is equal to*
$\$heap_{funcstart\_1032,1}$.__replace__(this.$r → this.$r.value(heapIs
*$\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(this.$r →
this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → (-35 * div(**heapIs***
*$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))]

[61.14] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**operator***(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))), **this**).p3) < (**int**)0))) + temp3)))

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[61.15] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed**
int>(**this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.\$r →

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))))).p3) < (**int**)0))) + temp3)))

→ *[evaluate dereferenced pointer into modified heap]*

[61.16] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this**.$r
== **this**.$r]: **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2
* div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
(-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)), []:
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → (-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) < (**int**)0))) + temp3))

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→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.17] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**replace**(this.$r →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.$r →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(this.$r →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 →
asType<P3Type>((30323 *
asType<**int**>(**static_cast**<**integer**>(**static_cast**<**signed int**>(([**this.$r**
== **this.$r**]: **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2
* div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 →
(-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)), [!(**this.$r** ==
this.$r**)]: **this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$.**replace**(this.$r →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → (-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))))).p3) < (**int**)0))) + temp3)))

→ *[simplify]*

[61.25] $heap_{funcend\_1032,1}$ == $heap_{funcstart\_1032,1}$.**replace**(this.$r →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(this.$r →
this.$r.value(**heapIs** $heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(0 < −**this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3))) + temp3)))

→ *[from term 40.0, literala < −**this**.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3 is false whenever -2 < (0 + literala)]*

Proof of rule precondition:

[61.25.0] -2 < (0 + 0)

→ *[simplify]*

[61.25.2] **true**

[61.26] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 → **asType**<P3Type>((30323 * **asType**<**int**>(**static_cast**<**integer**>(**false**))) + temp3)))

→ *[simplify]*

[61.27] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 →
asType<P3Type>((30323 * **asType**<**int**>(([**false**]: 1, []: 0))) + temp3)))

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[61.28] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 →
asType<P3Type>((30323 * **asType**<**int**>(([**false**]: 1, [**true**]: 0))) +
temp3)))

→ *[simplify]*

[61.31] $\text{heap}_{funcend\_1032,1}$ == $\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.\$r →
this.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace(this.\$r →** **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace(this.\$r →** **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 → **asType**<P3Type>(0 + temp3)))

→ *[from term 58.20, temp3 is equal to (-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value(heapIs** *$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 ** *div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,* **this.\$r.value(heapIs** *$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)]*

[61.32] $\text{\$heap}_{funcend\_1032,1}$ == $\text{\$heap}_{funcstart\_1032,1}$. **_replace(this.\$r →** **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **_replace(this.\$r →** **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **_replace(this.\$r →** **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$). **_replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))). **_replace**(p2 → ((-35 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 → **asType**<P3Type>(0 + ((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)))))

→ *[simplify]*

[61.35] $\$heap_{funcend\_1032,1}$ == $\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 → ((-63 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem))))

[Take given term]

[62.0] (**asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs**
$\$heap_{funcend\_1032,1}$, **this**).p1)) /
asType<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M1))) == raux1

→ *[from term 61.35, $\$heap_{funcend\_1032,1}$ is equal to*
*$\$heap_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,*
***this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** →*
this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs
*$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs***
*$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**replace**(**this.\$r** →*
this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs
*$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs***
*$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs***
*$\$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,*

*176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)))]*

[62.1] (**asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))), **this**).p1)) / **asType**<**double**>(**static_cast**<**real**>($\$heap_{funcend\_1032,1}$.M1))) == raux1

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[62.2] (**asType**<**double**>(**static_cast**<**real**>(**this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** → **this.\$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**

$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 → ((-63 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem))))).p1)) /
asType<**double**>(**static_cast**<**real**>($\text{\$heap}_{funcend\_1032,1}$.M1))) == raux1

→ *[evaluate dereferenced pointer into modified heap]*

[62.3] (**asType**<**double**>(**static_cast**<**real**>((([**this.\$r == this.\$r**]:
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 → (-63 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)), []: **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$.**replace**(**this.\$r** → **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → (-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p1)) /
asType<**double**>(**static_cast**<**real**>($\text{\$heap}_{funcend\_1032,1}$.M1))) == raux1

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[62.4] (**asType**<**double**>(**static_cast**<**real**>((([**this.\$r == this.\$r**]:
this.\$r.value(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 → (-63 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)), [!(**this.\$r** == **this.\$r**)]:
this.\$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p1)) /
asType<**double**>(**static_cast**<**real**>($\text{heap}_{funcend\_1032,1}$.M1))) == raux1

→ *[simplify]*

[62.11] (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) /
asType<**double**>(**static_cast**<**real**>($\text{heap}_{funcend\_1032,1}$.M1))) == raux1

→ *[from term 61.35, $\text{heap}_{funcend\_1032,1}$ is equal to*
*$\text{heap}_{funcstart\_1032,1}$._**replace***(**this.\$r** → **this.\$r.value***(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$)._**replace***(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,*
this.\$r.value*(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace***(**this.\$r** →*
this.\$r.value*(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace***(p1 → ((-2 * div(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace***(p2 → ((-35 * div(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace***(**this.\$r** →*
this.\$r.value*(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace***(p1 → ((-2 * div(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace***(p2 → ((-35 * div(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace***(p3 → (-63 * div(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,*
*178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value***(**heapIs***
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)))]

[62.12] ($\mathbf{real}$((-2 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) /
$\mathbf{asType}$<$\mathbf{double}$>($\mathbf{static\_cast}$<$\mathbf{real}$>($\$heap_{funcstart\_1032,1}$.$\mathbf{\_replace}$($\mathbf{this.\$r}$
$\rightarrow$ $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).$\mathbf{\_replace}$(p1 $\rightarrow$ ((-2 *
div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).$\mathbf{\_replace}$($\mathbf{this.\$r}$
$\rightarrow$ $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).$\mathbf{\_replace}$(p1 $\rightarrow$ ((-2 *
div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).$\mathbf{\_replace}$(p2 $\rightarrow$
((-35 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).$\mathbf{\_replace}$($\mathbf{this.\$r}$
$\rightarrow$ $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).$\mathbf{\_replace}$(p1 $\rightarrow$ ((-2 *
div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).$\mathbf{\_replace}$(p2 $\rightarrow$
((-35 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p2, 176).rem))).$\mathbf{\_replace}$(p3 $\rightarrow$
((-63 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p3, 178).rem)))).M1))) == raux1

$\rightarrow$ *[const member of object with modified fields]*

[62.15] ($\mathbf{real}$((-2 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) /
$\mathbf{asType}$<$\mathbf{double}$>($\mathbf{static\_cast}$<$\mathbf{real}$>($\$heap_{funcstart\_1032,1}$.M1))) == raux1

$\rightarrow$ *[const static or extern object]*

[62.16] ($\mathbf{real}$((-2 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) /
$\mathbf{asType}$<$\mathbf{double}$>($\mathbf{static\_cast}$<$\mathbf{real}$>($\$heap_{init}$.M1))) == raux1

$\rightarrow$ *[expand definition of constant 'M1' at prang.cpp (28,26)]*

[62.17] ($\mathbf{real}$((-2 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$, $\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,
$\mathbf{this.\$r}$.$\mathbf{value}$($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) /
$\mathbf{asType}$<$\mathbf{double}$>($\mathbf{static\_cast}$<$\mathbf{real}$>(($\mathbf{int}$)30269))) == raux1

$\rightarrow$ *[simplify]*

[62.22] 0.0 == ($-$raux1 + ($\mathbf{real}$((-2 * div($\mathbf{heapIs}$ $\$heap_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0))

[Take given term]

[63.0] (**asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs**
$\text{heap}_{funcend\_1032,1}$, **this**).p2)) /
asType<**double**>(**static_cast**<**real**>($\text{heap}_{funcend\_1032,1}$.M2))) == raux2

$\rightarrow$ *[from term 61.35, $heap_{funcend\_1032,1}$ is equal to*
*$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
***this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 ***
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$*
this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs
*$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs***
*$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r $\rightarrow$*
this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs
*$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs***
*$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 $\rightarrow$ (-63 * div(**heapIs***
*$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3,*
*178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs***
$heap_{funcstart\_1032,1}$).p3, 178).rem)))]

[63.1] (**asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs**
$\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.**$r $\rightarrow$ **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r $\rightarrow$
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace**(p2 → ((-35 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p2, 176).rem))).**_replace**(p3 → (-63 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p3,
178).quot) + (170 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p3, 178).rem))), **this**).p2)) /
asType<double>(static_cast<real>($\text{heap}_{funcend\_1032,1}$.M2))) == raux2

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[63.2] (**asType<double>(static_cast<real>(this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$.**_replace(this.\$r → this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).** **_replace**(p1 → ((-2 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$**).**p1, 177).quot) + (171 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p1, 177).rem)))).**_replace(this.\$r →**
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$**).** **_replace**(p1 → ((-2 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace**(p2 → ((-35 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p2, 176).rem)))).**_replace(this.\$r →**
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$**).** **_replace**(p1 → ((-2 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace**(p2 → ((-35 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p2, 176).rem))).**_replace**(p3 → ((-63 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p3,
178).quot) + (170 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p3, 178).rem)))))).p2)) /
asType<double>(static_cast<real>($\text{heap}_{funcend\_1032,1}$.M2))) == raux2

→ *[evaluate dereferenced pointer into modified heap]*

[63.3] (**asType<double>(static_cast<real>(([this.\$r == this.\$r]:**
this.\$r.value(heapIs $\text{heap}_{funcstart\_1032,1}$**).** **_replace**(p1 → ((-2 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p1,
177).quot) + (171 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p1, 177).rem))).**_replace**(p2 → ((-35 * **div(heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$**).**p2,
176).quot) + (172 * **div(heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\text{heap}_{funcstart\_1032,1}$**).**p2, 176).rem))).**_replace**(p3 → (-63 * **div(heapIs**

$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p3,
178).quot) + (170 * div(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**, this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p3, 178).rem)), []: this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**._replace(this.\$r $\rightarrow$ this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**)._replace(p1 $\rightarrow$ ((-2 * div(heapIs** $\$\text{heap}_{funcstart\_1032,1}$,
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$**).p1, 177).quot) + (171 ***
div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p1, 177).rem))))._replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$**)._replace(p1 $\rightarrow$ ((-2 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p1,**
177).quot) + (171 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p1, 177).rem)))._replace(p2 $\rightarrow$ (-35 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p2,**
176).quot) + (172 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p2, 176).rem))))).p2)) /**
asType<double>(static_cast<real>(static_cast<real>($\$\text{heap}_{funcend\_1032,1}$**.M2))) == raux2**

$\rightarrow$ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[63.4] (**asType<double>(static_cast<real>((([this.\$r == this.\$r]:**
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$**)._replace(p1 $\rightarrow$ ((-2 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p1,**
177).quot) + (171 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p1, 177).rem)))._replace(p2 $\rightarrow$ ((-35 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p2,**
176).quot) + (172 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p2, 176).rem)))._replace(p3 $\rightarrow$ (-63 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p3,**
178).quot) + (170 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p3, 178).rem)), [!(this.\$r == this.\$r)]:**
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$**._replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$**)._replace(p1 $\rightarrow$ ((-2 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p1,**
177).quot) + (171 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p1, 177).rem))))._replace(this.\$r $\rightarrow$**
this.\$r.value(heapIs $\$\text{heap}_{funcstart\_1032,1}$**)._replace(p1 $\rightarrow$ ((-2 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p1,**
177).quot) + (171 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p1, 177).rem)))._replace(p2 $\rightarrow$ (-35 * div(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs** $\$\text{heap}_{funcstart\_1032,1}$**).p2,**
176).quot) + (172 * div(heapIs $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p2, 176).rem))))).p2)) /**
asType<double>(static_cast<real>($\$\text{heap}_{funcend\_1032,1}$**.M2))) == raux2**

$\rightarrow$ *[simplify]*

[63.10] (**real((-35 * div(heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this.\$r.value(heapIs**
$\$\text{heap}_{funcstart\_1032,1}$**).p2, 176).quot) + (172 * div(heapIs** $\$\text{heap}_{funcstart\_1032,1}$,

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this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) /
asType<double>(**static_cast<real>**($\$heap_{funcend\_1032,1}$.M2))) == raux2

→ *[from term 61.35,* $\$heap_{funcend\_1032,1}$ *is equal to*
$\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r → **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).**_replace**(*p1* → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(*p1* → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(*p2* → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r →
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(*p1* → ((-2 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(*p2* → ((-35 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(*p3* → (-63 * div(**heapIs**
$\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p3, 178).rem)))]*

[63.11] (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) /
asType<double>(**static_cast<real>**($\$heap_{funcstart\_1032,1}$.**_replace**(**this.**$r
→ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$r
→ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$r
→ **this.**$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 *
div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 →
((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **_replace**(p3 → ((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)))).M2))) == raux2

→ *[const member of object with modified fields]*

[63.14] (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / **asType**<**double**>(**static_cast**<**real**>($\text{heap}_{funcstart\_1032,1}$.M2))) == raux2

→ *[const static or extern object]*

[63.15] (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / **asType**<**double**>(**static_cast**<**real**>(heap_{init}.M2))) == raux2

→ *[expand definition of constant 'M2' at prang.cpp (33,26)]*

[63.16] (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / **asType**<**double**>(**static_cast**<**real**>((**int**)30307))) == raux2

→ *[simplify]*

[63.21] 0.0 == (−raux2 + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0))

[Take given term]

[64.0] (**asType**<**double**>(**static_cast**<**real**>(**operator***(**heapIs** $\text{heap}_{funcend\_1032,1}$, **this**).p3)) / **asType**<**double**>(**static_cast**<**real**>($\text{heap}_{funcend\_1032,1}$.M3))) == raux3

→ *[from term 61.35, $heap_{funcend\_1032,1}$ is equal to $heap_{funcstart\_1032,1}$._replace(this.\$r → this.\$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem))))._replace(this.\$r → this.\$r.value(heapIs $heap_{funcstart\_1032,1}$)._replace(p1 → ((-2 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).rem)))._replace(p2 → ((-35 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(heapIs $heap_{funcstart\_1032,1}$, this.\$r.value(heapIs*

$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$)._**replace(p1 → ((-2 * div(heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs***
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace(p2 → ((-35 * div(heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2,
*176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs***
$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace(p3 → (-63 * div(heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3,
*178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs***
$heap_{funcstart\_1032,1}$).p3, 178).rem)))]*

[64.1] (**asType<double>(static_cast<real>(operator*(heapIs**
$heap_{funcstart\_1032,1}$._**replace(this.$r → this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).rem))), **this**).p3)) /
asType<double>(static_cast<real>($heap_{funcend\_1032,1}$.M3))) == raux3

→ *[expand definition of operator '*' in class 'pointer' at built in declaration]*

[64.2] (**asType<double>(static_cast<real>(this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$._**replace(this.$r → this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.value(heapIs $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.$r.value(heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.$r →**
this.$r.value(heapIs $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $heap_{funcstart\_1032,1}$).p1,

177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.$r** → **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → ((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))))).p3)) /
asType<**double**>(**static_cast**<**real**>($\text{heap}_{funcend\_1032,1}$.M3))) == raux3

→ *[evaluate dereferenced pointer into modified heap]*

[64.3] (**asType**<**double**>(**static_cast**<**real**>((([**this.$r** == **this.$r**]: **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)), []: **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this.$r** → **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** → **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → (-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p3)) /
asType<**double**>(**static_cast**<**real**>($\text{heap}_{funcend\_1032,1}$.M3))) == raux3

→ *[explicitly assert falsehood of skipped guards in subsequent guards]*

[64.4] (**asType**<**double**>(**static_cast**<**real**>((([**this.$r** == **this.$r**]: **this.$r.value(heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs**

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$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)), [!(**this.\$r** == **this.\$r**)]:
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → (-35 * div(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p2, 176).rem))))).p3)) /
asType<double>(**static_cast<real>**($\text{\$heap}_{funcend\_1032,1}$.M3))) == raux3

→ *[simplify]*

[64.9] (**real**((-63 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs**
$\text{\$heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$,
this.\$r.**value**(**heapIs** $\text{\$heap}_{funcstart\_1032,1}$).p3, 178).rem)) /
asType<double>(**static_cast<real>**($\text{\$heap}_{funcend\_1032,1}$.M3))) == raux3

→ *[from term 61.35, $heap_{funcend\_1032,1}$ is equal to*
*$heap_{funcstart\_1032,1}$._**replace**(**this.\$r** → **this.\$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,*
***this.\$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 **
*div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.\$r** →*
this.\$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs
*$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs***
*$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.\$r** →*
this.\$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs
*$heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,*
*177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r**.**value**(**heapIs***
*$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs***

$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).*p2, 176).quot) + (172 * div(***heapIs*** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).*__replace__(p3 → (-63 * div(***heapIs*** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(***heapIs*** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)))]*

[64.10] (**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / **asType**<**double**>(**static_cast**<**real**>($heap_{funcstart\_1032,1}$.__replace__(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).__replace__(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).__replace__(**this**.$r → **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).__replace__(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem))).__replace__(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).__replace__(p3 → ((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)))).M3))) == raux3

→ *[const member of object with modified fields]*

[64.13] (**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / **asType**<**double**>(**static_cast**<**real**>($heap_{funcstart\_1032,1}$.M3))) == raux3

→ *[const static or extern object]*

[64.14] (**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / **asType**<**double**>(**static_cast**<**real**>($heap_{init}$.M3))) == raux3

→ *[expand definition of constant 'M3' at prang.cpp (38,26)]*

[64.15] (**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / **asType<double>**(**static_cast<real>**((**int**)30323))) == raux3

→ *[simplify]*

[64.20] 0.0 == (−raux3 + (**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0))

[Take given term]

[68.0] **asType<real>**((**double**)0.0) < ((**asType<real>**(raux2) + **asType<real>**(raux1)) + **asType<real>**(raux3))

→ *[simplify]*

[68.2] 0.0 < ((**asType<real>**(raux2) + **asType<real>**(raux1)) + **asType<real>**(raux3))

→ *[from term 63.21, raux2 is equal to **real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0]*

[68.3] 0.0 < ((**asType<real>**(**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + **asType<real>**(raux1)) + **asType<real>**(raux3))

→ *[simplify]*

[68.4] 0.0 < (((**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + **asType<real>**(raux1)) + **asType<real>**(raux3))

→ *[from term 62.22, raux1 is equal to **real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0]*

[68.5] 0.0 < (((**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + **asType<real>**(**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)) + **asType<real>**(raux3))

$\rightarrow$ *[simplify]*

[68.6] $0.0 <$ (((**real**((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)) + **asType**<**real**>(raux3))

$\rightarrow$ *[from term 64.20, raux3 is equal to* **real***((-63 * div(***heapIs** *\$heap$_{funcstart\_1032,1}$,* **this.\$r.value***(***heapIs** *\$heap$_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(***heapIs** *\$heap$_{funcstart\_1032,1}$,* **this.\$r.value***(***heapIs** *\$heap$_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0]*

[68.7] $0.0 <$ (((**real**((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + (**real**((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0)) + **asType**<**real**>(**real**((-63 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0))

$\rightarrow$ *[simplify]*

[68.9] $0.0 <$ ((**real**((-63 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-2 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + (**real**((-35 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** \$heap$_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** \$heap$_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0))

[Take given term]

[69.0] result == fmod(**heapIs** \$heap$_{funcend\_1032,1}$, (raux1 + raux2) + raux3, (**double**)1.0)

$\rightarrow$ *[from term 61.35, \$heap$_{funcend\_1032,1}$ is equal to* \$heap$_{funcstart\_1032,1}$.**_replace***(***this.\$r** $\rightarrow$ **this.\$r.value***(***heapIs** *\$heap$_{funcstart\_1032,1}$).**_replace***(p1 $\rightarrow$ ((-2 * div(***heapIs** *\$heap$_{funcstart\_1032,1}$,* **this.\$r.value***(***heapIs** *\$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** *\$heap$_{funcstart\_1032,1}$,* **this.\$r.value***(***heapIs** *\$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace***(***this.\$r** $\rightarrow$*

this.$r.value(heapIs *$heap$$_{funcstart\_1032,1}$*).**\_replace**(*p1 → ((-2 * div(***heapIs** *$heap$$_{funcstart_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart\_1032,1}$*).*p1, 177).quot) + (171 * div(***heapIs** *$heap$$_{funcstart_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart\_1032,1}$*).*p1, 177).rem)))*.**\_replace**(*p2 → ((-35 * div(***heapIs** *$heap$$_{funcstart_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart\_1032,1}$*).*p2, 176).quot) + (172 * div(***heapIs** *$heap$$_{funcstart_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart\_1032,1}$*).*p2, 176).rem))))*.**\_replace(this.$r →
this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).**\_replace**(*p1 → ((-2 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p1, 177).quot) + (171 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p1, 177).rem)))*.**\_replace**(*p2 → ((-35 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p2, 176).quot) + (172 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p2, 176).rem)))*.**\_replace**(*p3 → (-63 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p3, 178).quot) + (170 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p3, 178).rem)))]*

[69.1] result == fmod(**heapIs** $heap$_{funcstart_1032,1}$.**\_replace(this.$r →
this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem)))).**\_replace(this.$r →
this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem)))).**\_replace(this.$r →
this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap$_{funcstart_1032,1}$, **this.$r.value(heapIs** $heap$_{funcstart_1032,1}$).p3, 178).rem))), (raux1 + raux2) + raux3, (**double**)1.0)

→ *[from term 62.22, raux1 is equal to* **real**(*(-2 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p1, 177).quot) + (171 * div(***heapIs** *$heap$$_{funcstart\_1032,1}$*, **this.$r.value(heapIs** *$heap$$_{funcstart_1032,1}$*).*p1, 177).rem)) / 30269.0]*

[69.2] result == fmod(**heapIs** $heap$_{funcstart_1032,1}$.**\_replace(this.$r →**

this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). _**replace**(p3 → (-63 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)), ((**real**((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + raux2) + raux3,
(**double**)1.0)

→ *[from term 63.21, raux2 is equal to **real**((-35 * div(**heapIs***
*$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**($\text{heap}_{funcstart_1032,1}$).p2,*
*176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs***
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0]

[69.3] result == fmod(**heapIs** $\text{heap}_{funcstart\_1032,1}$. _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). _**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$). _**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). _**replace**(p2 → ((-35 * div(**heapIs**

$\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3, 178).rem))), ((**real**((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + (**real**((-35 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0)) + raux3, (**double**)1.0)

→ *[from term 64.20, raux3 is equal to* **real**((-63 * div(**heapIs** *$\$$heap$_{funcstart\_1032,1}$,* **this.**$\$$r.**value**(**heapIs** *$\$$heap$_{funcstart\_1032,1}$*).p3, 178).quot) + (170 * div(**heapIs** *$\$$heap$_{funcstart\_1032,1}$,* **this.**$\$$r.**value**(**heapIs** *$\$$heap$_{funcstart\_1032,1}$*).p3, 178).rem)) / 30323.0]*

[69.4] result == fmod(**heapIs** $\$$heap$_{funcstart\_1032,1}$.**_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.**$\$$r → **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3, 178).rem))), ((**real**((-35 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0)) + (**real**((-63 * div(**heapIs** $\$$heap$_{funcstart\_1032,1}$, **this.**$\$$r.**value**(**heapIs** $\$$heap$_{funcstart\_1032,1}$).p3,

178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0), (**double**)1.0)

$\rightarrow$ *[simplify]*

[69.7] 0.0 == ($-$fmod(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.$r** $\rightarrow$
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.$r** $\rightarrow$
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.$r** $\rightarrow$
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 $\rightarrow$ ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 $\rightarrow$ ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 $\rightarrow$ (-63 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0) + result)

[Assume known post-assertion, class invariant or type constraint for term 69.7]

[72.0] ((**asType<real>**((**double**)0.0) $\leq$ **asType<real>**((**real**((-63 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) +
(**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) +
(**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,

this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0))) &&
(**asType<real>**((**double**)0.0) ≤ **asType<real>**(1.0))) =>
((**asType<real>**((**double**)0.0) ≤ **asType<real>**(fmod(**heapIs**
$heap_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0))) &&
(**asType<real>**(fmod(**heapIs** $heap_{funcstart\_1032,1}$._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r →
this.$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $heap_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs**
$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.**$r →

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this.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)) < **asType**<**real**>(1.0)))

→ *[simplify]*

[72.3] ((0.0 ≤ ((**real**((-63 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0))) &&
(**asType**<**real**>((**double**)0.0) ≤ **asType**<**real**>(1.0))) =>
((**asType**<**real**>((**double**)0.0) ≤ **asType**<**real**>(fmod(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**

$\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0))) &&
(**asType**<**real**>(fmod(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this.**$r → **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.**$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs**

$heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)) < **asType<real>**(1.0)))

→ *[from term 68.9, literala ≤ ((**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0) + (**real**((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0)) is true whenever literala ≤ 0.0]*

Proof of rule precondition:

[72.3.0] 0.0 ≤ 0.0

→ *[simplify]*

[72.3.1] **true**

[72.4] (**true** && (**asType<real>**((**double**)0.0) ≤ **asType<real>**(1.0))) => ((**asType<real>**((**double**)0.0) ≤ **asType<real>**(fmod(**heapIs** $heap_{funcstart\_1032,1}$.**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.\$r** → **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p1, 177).rem)).**_replace**(p2 → ((-35 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $heap_{funcstart\_1032,1}$, **this.\$r.value**(**heapIs** $heap_{funcstart\_1032,1}$).p3,

178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0))) &&
(**asType<real>**(fmod(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.$r** →
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this.$r** →
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**replace**(p3 → (-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)) < **asType<real>**(1.0)))

→ *[simplify]*

[72.21] (-1.0 < −fmod(**heapIs** $\text{heap}_{funcstart\_1032,1}$._**replace**(**this.$r** →
this.$r.value(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this.$r.value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this.$r** →

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this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,
178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)) ∧ (0.0 ≤ fmod(**heapIs**
$\text{heap}_{funcstart\_1032,1}$._**replace**(**this**.$r → **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$,
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 *
div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))))._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))))._**replace**(**this**.$r →
this.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1,
177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2,
176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**
$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))._**replace**(p3 → (-63 * div(**heapIs**
$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3,

178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0))

→ *[separate conjunction and work on first sub-term]*

[72.22] -1.0 < −fmod(**heapIs** $\text{heap}_{funcstart\_1032,1}$.**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).**_replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).**_replace**(p1 → ((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).**_replace**(p2 → ((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).**_replace**(p3 → (-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)

[Take goal term]

[1.0] **asType**<**real**>(result) < **asType**<**real**>((**double**)1.0)

→ *[from term 69.7, result is equal to fmod(***heapIs*** $\$heap_{funcstart\_1032,1}$._***replace(this.$r →*** ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$)._***replace**(p1 → ((-2 * div(***heapIs*** $\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._***replace(this.$r →*** ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$)._***replace**(p1 → ((-2 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._***replace**(p2 → ((-35 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._***replace(this.$r →*** ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$)._***replace**(p1 → ((-2 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._***replace**(p2 → ((-35 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p2, 176).rem)))._***replace**(p3 → (-63 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p3, 178).quot) + (170 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p3, 178).rem))), (***real***((-63 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p3, 178).quot) + (170 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (***real***((-35 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p2, 176).quot) + (172 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (***real***((-2 * div(***heapIs*** *$\$heap_{funcstart\_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart_1032,1}$).p1, 177).quot) + (171 * div(***heapIs*** *$\$heap_{funcstart_1032,1}$,* ***this.$r.value(heapIs*** *$\$heap_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)]*

[1.1] **asType**<**real**>(fmod(**heapIs** $\$heap_{funcstart\_1032,1}$._**replace(this.$r →** **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem))))._**replace(this.$r →** **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$)._**replace**(p1 → ((-2 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p1, 177).rem)))._**replace**(p2 → ((-35 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$heap_{funcstart\_1032,1}$, **this.$r.value(heapIs** $\$heap_{funcstart\_1032,1}$).p2, 176).rem))))._**replace(this.$r →**

this.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **replace**(p3 → (-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)) <
asType<**real**>((**double**)1.0)

→ *[simplify]*

[1.7] -1.0 < −fmod(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$. **replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))). **replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))). **replace**(**this**.$r → **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$). **replace**(p1 → ((-2 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))). **replace**(p2 → ((-35 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))). **replace**(p3 → (-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (**real**((-63 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(**heapIs** $\$\text{heap}_{funcstart\_1032,1}$, **this**.$r.**value**(**heapIs**

$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (**real**((-35 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (**real**((-2 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(**heapIs** $\text{heap}_{funcstart\_1032,1}$, **this**.\$r.**value**(**heapIs** $\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0)

$\rightarrow$ *[from term 72.22, literala* $< -fmod($**heapIs** *$\text{heap}_{funcstart\_1032,1}$.*_**replace***(***this**.\$r $\rightarrow$ **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).*_**replace***(p1 $\rightarrow$ ((-2 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)))).*_**replace***(***this**.\$r $\rightarrow$ **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).*_**replace***(p1 $\rightarrow$ ((-2 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).*_**replace***(p2 $\rightarrow$ ((-35 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)))).*_**replace***(***this**.\$r $\rightarrow$ **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).*_**replace***(p1 $\rightarrow$ ((-2 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem))).*_**replace***(p2 $\rightarrow$ ((-35 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem))).*_**replace***(p3 $\rightarrow$ (-63 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem))), (***real***((-63 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p3, 178).quot) + (170 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p3, 178).rem)) / 30323.0) + (***real***((-35 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p2, 176).quot) + (172 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p2, 176).rem)) / 30307.0) + (***real***((-2 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).quot) + (171 * div(***heapIs** *$\text{heap}_{funcstart\_1032,1}$,* **this**.\$r.**value***(***heapIs** *$\text{heap}_{funcstart\_1032,1}$).p1, 177).rem)) / 30269.0), 1.0) is true whenever literala* $\leq$ *-1.0]*

Proof of rule precondition:

[1.7.0] -1.0 $\leq$ -1.0

$\rightarrow$ *[simplify]*

[1.7.1] **true**

[1.8] **true**

Proof of verification condition: Loop initialisation establishes end condition or a valid variant

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (115,5)

Condition defined at: C:\Escher\Customers\prang-cpp\prang.cpp (117,20)

To prove: $0 \le (\textbf{asType}\textbf{<integer const>}(\text{limit}) - \textbf{asType}\textbf{<integer>}(\text{count}))$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M3} == (\textbf{int})30323$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r3} == (\textbf{int})170$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a3} == (\textbf{int})178$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b3} == (\textbf{int})63$

$\$\text{heap}_{1079,1;1081,13,m1} == \$\text{heap}_{funcstart\_1079,1}.\_\textbf{alloc}(\text{prang} \to \text{prang})$

$\$\text{heap}_{1079,1;1081,13} == \$\text{heap}_{1079,1;1081,13,m1}.\_\textbf{replace}((\&\$\text{heap}_{1079,1;1081,13,m1}.\text{prang}).\$\text{r} \to \text{writes\_1081\_5})$

$\text{limit} == \$\text{heap}_{1079,1;1081,13}.\text{LIMIT}$

$\textbf{minof}(\textbf{int const}) \le \text{limit}$

$\text{limit} \le \textbf{maxof}(\textbf{int const})$

$\text{count} == (\textbf{int})0$

$\textbf{minof}(\textbf{int}) \le \text{count}$

$\text{count} \le \textbf{maxof}(\textbf{int})$

$\$heap_{1079,1;1086,5} ==$
$\$heap_{1079,1;1081,13}.\_\textbf{replace}((\&\$heap_{1079,1;1081,13}.\_ecv\_files[1]).\$r \rightarrow writes\_1086\_5)$

count $<$ limit

Proof:

[Take given term]

[2.0] $\$heap_{1079,1;1081,13,m1} == \$heap_{funcstart\_1079,1}.\textbf{alloc}(prang \rightarrow prang)$

[Take given term]

[3.0] $\$heap_{1079,1;1081,13} ==$
$\$heap_{1079,1;1081,13,m1}.\_\textbf{replace}((\&\$heap_{1079,1;1081,13,m1}.prang).\$r \rightarrow writes\_1081\_5)$

$\rightarrow$ *[from term 2.0, $\$heap_{1079,1;1081,13,m1}$ is equal to $\$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \rightarrow prang)]$*

[3.1] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \rightarrow prang).\_\textbf{replace}((\&\$heap_{1079,1;1081,13,m1}.prang).\$r \rightarrow writes\_1081\_5)$

$\rightarrow$ *[simplify]*

[3.2] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \rightarrow prang).\_\textbf{replace}((\&\$heap.prang).\$r \rightarrow writes\_1081\_5)$

$\rightarrow$ *[attribute value is known from postcondition]*

[3.3] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \rightarrow prang).\_\textbf{replace}(\&\$heap.prang \rightarrow writes\_1081\_5)$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[3.4] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \rightarrow prang).\_\textbf{replace}(prang \rightarrow writes\_1081\_5)$

[Take given term]

[4.0] $\$heap_{1079,1;1081,13}.LIMIT == limit$

$\rightarrow$ *[from term 3.4, $\$heap_{1079,1;1081,13}$ is equal to $\$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \rightarrow prang).\_\textbf{replace}(prang \rightarrow writes\_1081\_5)]$*

[4.1] $\$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \rightarrow prang).\_\textbf{replace}(prang \rightarrow writes\_1081\_5).LIMIT == limit$

$\rightarrow$ *[const member of object with modified fields]*

[4.3] $\$heap_{funcstart\_1079,1}.LIMIT == limit$

$\rightarrow$ *[const static or extern object]*

[4.4] $\$heap_{init}.LIMIT == limit$

$\rightarrow$ *[expand definition of constant 'LIMIT' at prang.cpp (13,18)]*

[4.5] $(\textbf{int})80 == limit$

$\rightarrow$ *[simplify]*

[4.6] $80 == \text{limit}$

[Take given term]

[5.0] $(\textbf{int})0 == \text{count}$

$\rightarrow$ *[simplify]*

[5.1] $0 == \text{count}$

[Take goal term]

[1.0] $0 \le (\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}))$

$\rightarrow$ *[from term 4.6, limit is equal to 80]*

[1.1] $0 \le (\textbf{asType}<\textbf{integer const}>(80) - \textbf{asType}<\textbf{integer}>(\text{count}))$

$\rightarrow$ *[simplify]*

[1.2] $0 \le (80 - \textbf{asType}<\textbf{integer}>(\text{count}))$

$\rightarrow$ *[from term 5.1, count is equal to 0]*

[1.3] $0 \le (80 - \textbf{asType}<\textbf{integer}>(0))$

$\rightarrow$ *[simplify]*

[1.6] **true**

Proof of verification condition: Loop body establishes end condition or decreases variant

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (118,5)

Condition defined at: C:\Escher\Customers\prang-cpp\prang.cpp (117,5)

To prove: $(\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}_{loopend})) < (\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}_{loopstart\_1088,5}))$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class WHPrang} \in \text{a2} == (\textbf{int})176$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in b2 == (\textbf{int})35$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in M3 == (\textbf{int})30323$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in r3 == (\textbf{int})170$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in a3 == (\textbf{int})178$

$\text{\$heap}_{init}.\textbf{class WHPrang} \in b3 == (\textbf{int})63$

$\text{\$heap}_{1079,1;1081,13,m1} == \text{\$heap}_{funcstart\_1079,1}.\textbf{\_alloc}(prang \to prang)$

$\text{\$heap}_{1079,1;1081,13} ==$
$\text{\$heap}_{1079,1;1081,13,m1}.\textbf{\_replace}((\&\text{\$heap}_{1079,1;1081,13,m1}.prang).\text{\$r} \to$
$writes\_1081\_5)$

$limit == \text{\$heap}_{1079,1;1081,13}.\text{LIMIT}$

$\textbf{minof(int const)} \leq limit$

$limit \leq \textbf{maxof(int const)}$

$count == (\textbf{int})0$

$\textbf{minof(int)} \leq count$

$count \leq \textbf{maxof(int)}$

$\text{\$heap}_{1079,1;1086,5} ==$
$\text{\$heap}_{1079,1;1081,13}.\textbf{\_replace}((\&\text{\$heap}_{1079,1;1081,13}.\_ecv\_files[1]).\text{\$r} \to$
$writes\_1086\_5)$

$\text{\$heap}_{loopstart\_1088,5} == \text{\$heap}_{1079,1;1086,5}.\textbf{\_replace}(prang \to$
$writes\_1089\_12).\textbf{\_replace}(\_ecv\_files \to writes\_1089\_12)$

$\#writes\_1089\_12 == \#\text{\$heap}_{1079,1;1086,5}.\_ecv\_files$

$\textbf{minof(int)} \leq count_{loopstart\_1088,5}$

$count_{loopstart\_1088,5} \leq \textbf{maxof(int)}$

$count_{loopstart\_1088,5} < limit$

$0 \leq (\textbf{asType<integer const>}(limit) -$
$\textbf{asType<integer>}(count_{loopstart\_1088,5}))$

$(\textbf{asType<integer const>}(limit) - \textbf{asType<integer>}(count_{loopstart\_1088,5}))$
$\leq (\textbf{asType<integer const>}(limit) - \textbf{asType<integer>}(count))$

$(++count_{loopstart\_1088,5} == count_{loopend}) \wedge (\text{\$heap}_{1092,16} ==$
$\text{\$heap}_{loopstart\_1088,5}.\textbf{\_replace}((\&\text{\$heap}_{loopstart\_1088,5}.prang).\text{\$r} \to$
$\textbf{operator}^*(\textbf{heapIs } \text{\$heap}_{loopstart\_1088,5},$
$\&\text{\$heap}_{loopstart\_1088,5}.prang).\textbf{\_replace}(p1 \to$
$writes\_1092\_31)).\textbf{\_replace}((\&\text{\$heap}_{loopstart\_1088,5}.prang).\text{\$r} \to$
$\textbf{operator}^*(\textbf{heapIs } \text{\$heap}_{loopstart\_1088,5},$
$\&\text{\$heap}_{loopstart\_1088,5}.prang).\textbf{\_replace}(p2 \to$
$writes\_1092\_31)).\textbf{\_replace}((\&\text{\$heap}_{loopstart\_1088,5}.prang).\text{\$r} \to$
$\textbf{operator}^*(\textbf{heapIs } \text{\$heap}_{loopstart\_1088,5},$

$\&\$heap_{loopstart\_1088,5}.prang)._\textbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend}$
$== \$heap_{1092,16}._\textbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge$
$(\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$result\_1092\_31)) \wedge$
$(\textbf{asType}<\textbf{real}>(\$result\_1092\_31) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\text{count}_{loopend} < \text{limit}$

Proof:

[Take given term]

[2.0] $\$heap_{1079,1;1081,13,m1} == \$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow prang)$

[Take given term]

[3.0] $\$heap_{1079,1;1081,13} ==$
$\$heap_{1079,1;1081,13,m1}._\textbf{replace}((\&\$heap_{1079,1;1081,13,m1}.prang).\$r \rightarrow$
$writes\_1081\_5)$

$\rightarrow$ *[from term 2.0, $\$heap_{1079,1;1081,13,m1}$ is equal to*
$\$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow prang)]$

[3.1] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow$
$prang)._\textbf{replace}((\&\$heap_{1079,1;1081,13,m1}.prang).\$r \rightarrow writes\_1081\_5)$

$\rightarrow$ *[simplify]*

[3.2] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow$
$prang)._\textbf{replace}((\&\$heap.prang).\$r \rightarrow writes\_1081\_5)$

$\rightarrow$ *[attribute value is known from postcondition]*

[3.3] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow$
$prang)._\textbf{replace}(\&\$heap.prang \rightarrow writes\_1081\_5)$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[3.4] $\$heap_{1079,1;1081,13} == \$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow$
$prang)._\textbf{replace}(prang \rightarrow writes\_1081\_5)$

[Take given term]

[4.0] $\$heap_{1079,1;1081,13}.\text{LIMIT} == \text{limit}$

$\rightarrow$ *[from term 3.4, $\$heap_{1079,1;1081,13}$ is equal to*
$\$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow prang)._\textbf{replace}(prang \rightarrow writes\_1081\_5)]$

[4.1] $\$heap_{funcstart\_1079,1}._\textbf{alloc}(prang \rightarrow prang)._\textbf{replace}(prang \rightarrow$
$writes\_1081\_5).\text{LIMIT} == \text{limit}$

$\rightarrow$ *[const member of object with modified fields]*

[4.3] $\$heap_{funcstart\_1079,1}.\text{LIMIT} == \text{limit}$

$\rightarrow$ *[const static or extern object]*

[4.4] $\$heap_{init}.\text{LIMIT} == \text{limit}$

$\rightarrow$ *[expand definition of constant 'LIMIT' at prang.cpp (13,18)]*

[4.5] (**int**)80 == limit

→ *[simplify]*

[4.6] 80 == limit

[Take given term]

[13.0] (++count$_{loopstart\_1088,5}$ == count$_{loopend}$) ∧ ($heap$_{1092,16}$ ==
$heap$_{loopstart_1088,5}$._**replace**((&$heap$_{loopstart\_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p1 →
writes_1092_31))._**replace**((&$heap$_{loopstart_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p2 →
writes_1092_31))._**replace**((&$heap$_{loopstart_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p3 → writes_1092_31))) ∧ ($heap$_{loopend}$
== $heap$_{1092,16}$._**replace**((&$heap$_{1092,16}$._ecv_files[1]).$r → writes_1092_9)) ∧
(**asType<real>**((**double**)0.0) < **asType<real>**($result_1092_31)) ∧
(**asType<real>**($result_1092_31) < **asType<real>**((**double**)1.0))

→ *[simplify]*

[13.8] (1 == (count$_{loopend}$ + −count$_{loopstart\_1088,5}$)) ∧ ($heap$_{1092,16}$ ==
$heap$_{loopstart_1088,5}$._**replace**((&$heap$_{loopstart\_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p1 →
writes_1092_31))._**replace**((&$heap$_{loopstart_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p2 →
writes_1092_31))._**replace**((&$heap$_{loopstart_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p3 → writes_1092_31))) ∧ ($heap$_{loopend}$
== $heap$_{1092,16}$._**replace**((&$heap$_{1092,16}$._ecv_files[1]).$r → writes_1092_9)) ∧
(**asType<real>**((**double**)0.0) < **asType<real>**($result_1092_31)) ∧
(**asType<real>**($result_1092_31) < **asType<real>**((**double**)1.0))

→ *[Dereference address-of object]*

[13.9] (1 == (−count$_{loopstart\_1088,5}$ + count$_{loopend}$)) ∧ ($heap$_{1092,16}$ ==
$heap$_{loopstart_1088,5}$._**replace**((&$heap$_{loopstart\_1088,5}$.prang).$r →
$heap$_{loopstart_1088,5}$.prang._**replace**(p1 →
writes_1092_31))._**replace**((&$heap$_{loopstart_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p2 →
writes_1092_31))._**replace**((&$heap$_{loopstart_1088,5}$.prang).$r →
operator*(**heapIs** $heap$_{loopstart_1088,5}$,
&$heap$_{loopstart_1088,5}$.prang)._**replace**(p3 → writes_1092_31))) ∧ ($heap$_{loopend}$
== $heap$_{1092,16}$._**replace**((&$heap$_{1092,16}$._ecv_files[1]).$r → writes_1092_9)) ∧

$(\mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})0.0) < \mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31)) \wedge$
$(\mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31) < \mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.10] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$heap_{1092,16} ==$
$\$heap_{loopstart\_1088,5}.\_\mathbf{replace}((\&\$heap.prang).\$r \rightarrow$
$\$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p1 \rightarrow$
$writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$heap_{loopstart\_1088,5},$
$\&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p2 \rightarrow$
$writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$heap_{loopstart\_1088,5},$
$\&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend}$
$== \$heap_{1092,16}.\_\mathbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge$
$(\mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})0.0) < \mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31)) \wedge$
$(\mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31) < \mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})1.0))$

$\rightarrow$ *[attribute value is known from postcondition]*

[13.11] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$heap_{1092,16} ==$
$\$heap_{loopstart\_1088,5}.\_\mathbf{replace}((\&\$heap.prang) \rightarrow$
$\$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p1 \rightarrow$
$writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$heap_{loopstart\_1088,5},$
$\&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p2 \rightarrow$
$writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$heap_{loopstart\_1088,5},$
$\&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend}$
$== \$heap_{1092,16}.\_\mathbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge$
$(\mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})0.0) < \mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31)) \wedge$
$(\mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31) < \mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})1.0))$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[13.12] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$heap_{1092,16} ==$
$\$heap_{loopstart\_1088,5}.\_\mathbf{replace}(prang \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p1$
$\rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$heap_{loopstart\_1088,5},$
$\&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p2 \rightarrow$
$writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$heap_{loopstart\_1088,5},$
$\&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend}$
$== \$heap_{1092,16}.\_\mathbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge$
$(\mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})0.0) < \mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31)) \wedge$
$(\mathbf{asType}\!<\!\mathbf{real}\!>\!(\$result\_1092\_31) < \mathbf{asType}\!<\!\mathbf{real}\!>\!((\mathbf{double})1.0))$

$\rightarrow$ *[Dereference address-of object]*

[13.13] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$heap_{1092,16} ==$

$heap_{loopstart\_1088,5}.\_\mathbf{replace}(prang \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p1 \rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p2 \rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow \mathbf{operator}^*(\mathbf{heapIs} \$heap_{loopstart\_1088,5}, \&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend} == \$heap_{1092,16}.\_\mathbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge (\mathbf{asType{<}real{>}}((\mathbf{double})0.0) < \mathbf{asType{<}real{>}}(\$result\_1092\_31)) \wedge (\mathbf{asType{<}real{>}}(\$result\_1092\_31) < \mathbf{asType{<}real{>}}((\mathbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.14] $(1 == (-count_{loopstart\_1088,5} + count_{loopend})) \wedge (\$heap_{1092,16} ==$
$heap_{loopstart\_1088,5}.\_\mathbf{replace}(prang \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p1 \rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap.prang).\$r \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p2 \rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow \mathbf{operator}^*(\mathbf{heapIs} \$heap_{loopstart\_1088,5}, \&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend} == \$heap_{1092,16}.\_\mathbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge (\mathbf{asType{<}real{>}}((\mathbf{double})0.0) < \mathbf{asType{<}real{>}}(\$result\_1092\_31)) \wedge (\mathbf{asType{<}real{>}}(\$result\_1092\_31) < \mathbf{asType{<}real{>}}((\mathbf{double})1.0))$

$\rightarrow$ *[attribute value is known from postcondition]*

[13.15] $(1 == (-count_{loopstart\_1088,5} + count_{loopend})) \wedge (\$heap_{1092,16} ==$
$heap_{loopstart\_1088,5}.\_\mathbf{replace}(prang \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p1 \rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap.prang) \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p2 \rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow \mathbf{operator}^*(\mathbf{heapIs} \$heap_{loopstart\_1088,5}, \&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend} == \$heap_{1092,16}.\_\mathbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge (\mathbf{asType{<}real{>}}((\mathbf{double})0.0) < \mathbf{asType{<}real{>}}(\$result\_1092\_31)) \wedge (\mathbf{asType{<}real{>}}(\$result\_1092\_31) < \mathbf{asType{<}real{>}}((\mathbf{double})1.0))$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[13.16] $(1 == (-count_{loopstart\_1088,5} + count_{loopend})) \wedge (\$heap_{1092,16} ==$
$heap_{loopstart\_1088,5}.\_\mathbf{replace}(prang \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p1 \rightarrow writes\_1092\_31)).\_\mathbf{replace}(prang \rightarrow \$heap_{loopstart\_1088,5}.prang.\_\mathbf{replace}(p2 \rightarrow writes\_1092\_31)).\_\mathbf{replace}((\&\$heap_{loopstart\_1088,5}.prang).\$r \rightarrow \mathbf{operator}^*(\mathbf{heapIs} \$heap_{loopstart\_1088,5}, \&\$heap_{loopstart\_1088,5}.prang).\_\mathbf{replace}(p3 \rightarrow writes\_1092\_31))) \wedge (\$heap_{loopend} == \$heap_{1092,16}.\_\mathbf{replace}((\&\$heap_{1092,16}.\_ecv\_files[1]).\$r \rightarrow writes\_1092\_9)) \wedge (\mathbf{asType{<}real{>}}((\mathbf{double})0.0) < \mathbf{asType{<}real{>}}(\$result\_1092\_31)) \wedge (\mathbf{asType{<}real{>}}(\$result\_1092\_31) < \mathbf{asType{<}real{>}}((\mathbf{double})1.0))$

$\rightarrow$ *[Dereference address-of object]*

[13.17] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \land (\$\text{heap}_{1092,16} ==$
$\$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow$
$\$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \land (\$\text{heap}_{loopend}$
$== \$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \land$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31})) \land$
$(\textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.18] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \land (\$\text{heap}_{1092,16} ==$
$\$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}((\&\$\text{heap}.\text{prang}).\$\text{r} \rightarrow$
$\$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \land (\$\text{heap}_{loopend}$
$== \$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \land$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31})) \land$
$(\textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[attribute value is known from postcondition]*

[13.19] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \land (\$\text{heap}_{1092,16} ==$
$\$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\&\$\text{heap}.\text{prang} \rightarrow$
$\$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \land (\$\text{heap}_{loopend}$
$== \$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \land$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31})) \land$
$(\textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[13.20] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \land (\$\text{heap}_{1092,16} ==$
$\$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3}$
$\rightarrow \text{writes\_1092\_31}))) \land (\$\text{heap}_{loopend} ==$
$\$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \land$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31})) \land$
$(\textbf{asType}\textbf{<real>}(\$\text{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.21] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \land (\$\text{heap}_{1092,16} ==$
$\$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2}$
$\rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3}$
$\rightarrow \text{writes\_1092\_31}))) \land (\$\text{heap}_{loopend} ==$
$\$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \land$

($\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)0.0) < $\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$)) $\wedge$ ($\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$) < $\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)1.0))

$\rightarrow$ [attribute value is known from postcondition]

[13.22] (1 == ($-\mathrm{count}_{loopstart\_1088,5}$ + $\mathrm{count}_{loopend}$)) $\wedge$ ($\$heap_{1092,16}$ ==
$\$heap_{loopstart\_1088,5}$.$\mathbf{\_replace}$(prang $\rightarrow$ $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{\_replace}$(p1
$\rightarrow$ writes_1092_31)).$\mathbf{\_replace}$(prang $\rightarrow$ $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{\_replace}$(p2
$\rightarrow$ writes_1092_31)).$\mathbf{\_replace}$(prang $\rightarrow$ $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{\_replace}$(p3
$\rightarrow$ writes_1092_31))) $\wedge$ ($\$heap_{loopend}$ ==
$\$heap_{1092,16}$.$\mathbf{\_replace}$(&$\$heap.\_ecv\_files$[1] $\rightarrow$ writes_1092_9)) $\wedge$
($\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)0.0) < $\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$)) $\wedge$
($\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$) < $\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)1.0))

$\rightarrow$ [simplify]

[13.31] (1 == ($-\mathrm{count}_{loopstart\_1088,5}$ + $\mathrm{count}_{loopend}$)) $\wedge$ ($\$heap_{1092,16}$ ==
$\$heap_{loopstart\_1088,5}$.$\mathbf{\_replace}$(prang $\rightarrow$ $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{\_replace}$(p1
$\rightarrow$ writes_1092_31)).$\mathbf{\_replace}$(prang $\rightarrow$ $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{\_replace}$(p2
$\rightarrow$ writes_1092_31)).$\mathbf{\_replace}$(prang $\rightarrow$ $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{\_replace}$(p3
$\rightarrow$ writes_1092_31))) $\wedge$ ($\$heap_{loopend}$ ==
$\$heap_{1092,16}$.$\mathbf{\_replace}$(&$\$heap.\_ecv\_files$[1] $\rightarrow$ writes_1092_9)) $\wedge$ (0.0 <
$\$result\_1092\_31$) $\wedge$ (-1.0 < $-\$result\_1092\_31$)

$\rightarrow$ [separate conjunction and work on first sub-term]

[13.32] 1 == ($-\mathrm{count}_{loopstart\_1088,5}$ + $\mathrm{count}_{loopend}$)

[Take goal term]

[1.0] ($\mathbf{asType}$<$\mathbf{integer\ const}$>(limit) $-$ $\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopend}$)) <
($\mathbf{asType}$<$\mathbf{integer\ const}$>(limit) $-$ $\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopstart\_1088,5}$))

$\rightarrow$ [from term 4.6, limit is equal to 80]

[1.1] ($\mathbf{asType}$<$\mathbf{integer\ const}$>(80) $-$ $\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopend}$)) <
($\mathbf{asType}$<$\mathbf{integer\ const}$>(limit) $-$ $\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopstart\_1088,5}$))

$\rightarrow$ [simplify]

[1.2] (80 $-$ $\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopend}$)) < ($\mathbf{asType}$<$\mathbf{integer}$
$\mathbf{const}$>(limit) $-$ $\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopstart\_1088,5}$))

$\rightarrow$ [from term 13.32, $\mathrm{count}_{loopend}$ is equal to 1 + $\mathrm{count}_{loopstart\_1088,5}$]

[1.3] (80 $-$ $\mathbf{asType}$<$\mathbf{integer}$>(1 + $\mathrm{count}_{loopstart\_1088,5}$)) <
($\mathbf{asType}$<$\mathbf{integer\ const}$>(limit) $-$ $\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopstart\_1088,5}$))

$\rightarrow$ [simplify]

[1.9] (79 + $-\mathrm{count}_{loopstart\_1088,5}$) < ($\mathbf{asType}$<$\mathbf{integer\ const}$>(limit) $-$
$\mathbf{asType}$<$\mathbf{integer}$>($\mathrm{count}_{loopstart\_1088,5}$))

$\rightarrow$ [from term 4.6, limit is equal to 80]

[1.10] (79 + $-\mathrm{count}_{loopstart\_1088,5}$) < ($\mathbf{asType}$<$\mathbf{integer\ const}$>(80) $-$

asType\<integer\>(count$_{loopstart\_1088,5}$))

$\rightarrow$ [simplify]

[1.22] **true**

Proof of verification condition: Loop body establishes end condition or preserves validity of variant

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (118,5)

Condition defined at: C:\Escher\Customers\prang-cpp\prang.cpp (117,20)

To prove: $0 \leq$ (**asType\<integer const\>**(limit) $-$ **asType\<integer\>**(count$_{loopend}$))

Given:

\$heap$_{init}$.LIMIT == (**int**)80

\$heap$_{init}$.**class** WHPrang $\in$ M1 == (**int**)30269

\$heap$_{init}$.**class** WHPrang $\in$ r1 == (**int**)171

\$heap$_{init}$.**class** WHPrang $\in$ a1 == (**int**)177

\$heap$_{init}$.**class** WHPrang $\in$ b1 == (**int**)2

\$heap$_{init}$.**class** WHPrang $\in$ M2 == (**int**)30307

\$heap$_{init}$.**class** WHPrang $\in$ r2 == (**int**)172

\$heap$_{init}$.**class** WHPrang $\in$ a2 == (**int**)176

\$heap$_{init}$.**class** WHPrang $\in$ b2 == (**int**)35

\$heap$_{init}$.**class** WHPrang $\in$ M3 == (**int**)30323

\$heap$_{init}$.**class** WHPrang $\in$ r3 == (**int**)170

\$heap$_{init}$.**class** WHPrang $\in$ a3 == (**int**)178

\$heap$_{init}$.**class** WHPrang $\in$ b3 == (**int**)63

\$heap$_{1079,1;1081,13,m1}$ == \$heap$_{funcstart\_1079,1}$.**_alloc**(prang $\rightarrow$ prang)

\$heap$_{1079,1;1081,13}$ == \$heap$_{1079,1;1081,13,m1}$.**_replace**((&\$heap$_{1079,1;1081,13,m1}$.prang).\$r $\rightarrow$ writes_1081_5)

limit == \$heap$_{1079,1;1081,13}$.LIMIT

minof(int const) $\leq$ limit

limit $\leq$ **maxof(int const)**

count == (**int**)0

minof(int) $\leq$ count

$\text{count} \leq \mathbf{maxof}(\mathbf{int})$

$\$\text{heap}_{1079,1;1086,5} ==$
$\$\text{heap}_{1079,1;1081,13}.\_\mathbf{replace}((\&\$\text{heap}_{1079,1;1081,13}.\_\text{ecv\_files}[1]).\$r \rightarrow$
$\text{writes\_1086\_5})$

$\$\text{heap}_{loopstart\_1088,5} == \$\text{heap}_{1079,1;1086,5}.\_\mathbf{replace}(\text{prang} \rightarrow$
$\text{writes\_1089\_12}).\_\mathbf{replace}(\_\text{ecv\_files} \rightarrow \text{writes\_1089\_12})$

$\#\text{writes\_1089\_12} == \#\$\text{heap}_{1079,1;1086,5}.\_\text{ecv\_files}$

$\mathbf{minof}(\mathbf{int}) \leq \text{count}_{loopstart\_1088,5}$

$\text{count}_{loopstart\_1088,5} \leq \mathbf{maxof}(\mathbf{int})$

$\text{count}_{loopstart\_1088,5} < \text{limit}$

$0 \leq (\mathbf{asType}\mathbf{<integer\ const>}(\text{limit}) -$
$\mathbf{asType}\mathbf{<integer>}(\text{count}_{loopstart\_1088,5}))$

$(\mathbf{asType}\mathbf{<integer\ const>}(\text{limit}) - \mathbf{asType}\mathbf{<integer>}(\text{count}_{loopstart\_1088,5}))$
$\leq (\mathbf{asType}\mathbf{<integer\ const>}(\text{limit}) - \mathbf{asType}\mathbf{<integer>}(\text{count}))$

$(++\text{count}_{loopstart\_1088,5} == \text{count}_{loopend}) \wedge (\$\text{heap}_{1092,16} ==$
$\$\text{heap}_{loopstart\_1088,5}.\_\mathbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\_\mathbf{replace}(\text{p1} \rightarrow$
$\text{writes\_1092\_31})).\_\mathbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\_\mathbf{replace}(\text{p2} \rightarrow$
$\text{writes\_1092\_31})).\_\mathbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\_\mathbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend}$
$== \$\text{heap}_{1092,16}.\_\mathbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$r \rightarrow \text{writes\_1092\_9})) \wedge$
$(\mathbf{asType}\mathbf{<real>}((\mathbf{double})0.0) < \mathbf{asType}\mathbf{<real>}(\$\text{result\_1092\_31})) \wedge$
$(\mathbf{asType}\mathbf{<real>}(\$\text{result\_1092\_31}) < \mathbf{asType}\mathbf{<real>}((\mathbf{double})1.0))$

$\text{count}_{loopend} < \text{limit}$

Proof:

[Take given term]

[2.0] $\$\text{heap}_{1079,1;1081,13,m1} == \$\text{heap}_{funcstart\_1079,1}.\_\mathbf{alloc}(\text{prang} \rightarrow \text{prang})$

[Take given term]

[3.0] $\$\text{heap}_{1079,1;1081,13} ==$
$\$\text{heap}_{1079,1;1081,13,m1}.\_\mathbf{replace}((\&\$\text{heap}_{1079,1;1081,13,m1}.\text{prang}).\$r \rightarrow$
$\text{writes\_1081\_5})$

$\rightarrow$ *[from term 2.0, $\$heap_{1079,1;1081,13,m1}$ is equal to*
$\$heap_{funcstart\_1079,1}.\_\mathbf{alloc}(prang \rightarrow prang)]$

[3.1] $\$\text{heap}_{1079,1;1081,13} == \$\text{heap}_{funcstart\_1079,1}.\_\mathbf{alloc}(\text{prang} \rightarrow$

prang).**replace**((&\$heap$_{1079,1;1081,13,m1}$.prang).\$r $\rightarrow$ writes_1081_5)

$\rightarrow$ *[simplify]*

[3.2] \$heap$_{1079,1;1081,13}$ == \$heap$_{funcstart\_1079,1}$.**alloc**(prang $\rightarrow$ prang).**replace**((&\$heap.prang).\$r $\rightarrow$ writes_1081_5)

$\rightarrow$ *[attribute value is known from postcondition]*

[3.3] \$heap$_{1079,1;1081,13}$ == \$heap$_{funcstart\_1079,1}$.**alloc**(prang $\rightarrow$ prang).**replace**(&\$heap.prang $\rightarrow$ writes_1081_5)

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[3.4] \$heap$_{1079,1;1081,13}$ == \$heap$_{funcstart\_1079,1}$.**alloc**(prang $\rightarrow$ prang).**replace**(prang $\rightarrow$ writes_1081_5)

[Take given term]

[4.0] \$heap$_{1079,1;1081,13}$.LIMIT == limit

$\rightarrow$ *[from term 3.4, \$heap$_{1079,1;1081,13}$ is equal to \$heap$_{funcstart\_1079,1}$.**alloc**(prang $\rightarrow$ prang).**replace**(prang $\rightarrow$ writes_1081_5)]*

[4.1] \$heap$_{funcstart\_1079,1}$.**alloc**(prang $\rightarrow$ prang).**replace**(prang $\rightarrow$ writes_1081_5).LIMIT == limit

$\rightarrow$ *[const member of object with modified fields]*

[4.3] \$heap$_{funcstart\_1079,1}$.LIMIT == limit

$\rightarrow$ *[const static or extern object]*

[4.4] \$heap$_{init}$.LIMIT == limit

$\rightarrow$ *[expand definition of constant 'LIMIT' at prang.cpp (13,18)]*

[4.5] (**int**)80 == limit

$\rightarrow$ *[simplify]*

[4.6] 80 == limit

[Take given term]

[13.0] (++count$_{loopstart\_1088,5}$ == count$_{loopend}$) $\wedge$ (\$heap$_{1092,16}$ == \$heap$_{loopstart\_1088,5}$.**replace**((&\$heap$_{loopstart\_1088,5}$.prang).\$r $\rightarrow$ **operator***(**heapIs** \$heap$_{loopstart\_1088,5}$, &\$heap$_{loopstart\_1088,5}$.prang).**replace**(p1 $\rightarrow$ writes_1092_31)).**replace**((&\$heap$_{loopstart\_1088,5}$.prang).\$r $\rightarrow$ **operator***(**heapIs** \$heap$_{loopstart\_1088,5}$, &\$heap$_{loopstart\_1088,5}$.prang).**replace**(p2 $\rightarrow$ writes_1092_31)).**replace**((&\$heap$_{loopstart\_1088,5}$.prang).\$r $\rightarrow$ **operator***(**heapIs** \$heap$_{loopstart\_1088,5}$, &\$heap$_{loopstart\_1088,5}$.prang).**replace**(p3 $\rightarrow$ writes_1092_31))) $\wedge$ (\$heap$_{loopend}$ == \$heap$_{1092,16}$.**replace**((&\$heap$_{1092,16}$.ecv_files[1]).\$r $\rightarrow$ writes_1092_9)) $\wedge$ (**asType**<**real**>((**double**)0.0) < **asType**<**real**>(\$result_1092_31)) $\wedge$

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($\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$) < $\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)1.0))

→ [simplify]

[13.8] (1 == ($count_{loopend}$ + $-count_{loopstart\_1088,5}$)) ∧ ($\$heap_{1092,16}$ == $\$heap_{loopstart\_1088,5}$.$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\mathbf{operator}^*$($\mathbf{heapIs}$ $\$heap_{loopstart\_1088,5}$, &$\$heap_{loopstart\_1088,5}$.prang).$\mathbf{replace}$(p1 → writes_1092_31)).$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\mathbf{operator}^*$($\mathbf{heapIs}$ $\$heap_{loopstart\_1088,5}$, &$\$heap_{loopstart\_1088,5}$.prang).$\mathbf{replace}$(p2 → writes_1092_31)).$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\mathbf{operator}^*$($\mathbf{heapIs}$ $\$heap_{loopstart\_1088,5}$, &$\$heap_{loopstart\_1088,5}$.prang).$\mathbf{replace}$(p3 → writes_1092_31))) ∧ ($\$heap_{loopend}$ == $\$heap_{1092,16}$.$\mathbf{replace}$((&$\$heap_{1092,16}$._ecv_files[1]).$\$r$ → writes_1092_9)) ∧ ($\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)0.0) < $\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$)) ∧ ($\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$) < $\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)1.0))

→ [Dereference address-of object]

[13.9] (1 == ($-count_{loopstart\_1088,5}$ + $count_{loopend}$)) ∧ ($\$heap_{1092,16}$ == $\$heap_{loopstart\_1088,5}$.$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{replace}$(p1 → writes_1092_31)).$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\mathbf{operator}^*$($\mathbf{heapIs}$ $\$heap_{loopstart\_1088,5}$, &$\$heap_{loopstart\_1088,5}$.prang).$\mathbf{replace}$(p2 → writes_1092_31)).$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\mathbf{operator}^*$($\mathbf{heapIs}$ $\$heap_{loopstart\_1088,5}$, &$\$heap_{loopstart\_1088,5}$.prang).$\mathbf{replace}$(p3 → writes_1092_31))) ∧ ($\$heap_{loopend}$ == $\$heap_{1092,16}$.$\mathbf{replace}$((&$\$heap_{1092,16}$._ecv_files[1]).$\$r$ → writes_1092_9)) ∧ ($\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)0.0) < $\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$)) ∧ ($\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$) < $\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)1.0))

→ [simplify]

[13.10] (1 == ($-count_{loopstart\_1088,5}$ + $count_{loopend}$)) ∧ ($\$heap_{1092,16}$ == $\$heap_{loopstart\_1088,5}$.$\mathbf{replace}$((&$\$heap$.prang).$\$r$ → $\$heap_{loopstart\_1088,5}$.prang.$\mathbf{replace}$(p1 → writes_1092_31)).$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\mathbf{operator}^*$($\mathbf{heapIs}$ $\$heap_{loopstart\_1088,5}$, &$\$heap_{loopstart\_1088,5}$.prang).$\mathbf{replace}$(p2 → writes_1092_31)).$\mathbf{replace}$((&$\$heap_{loopstart\_1088,5}$.prang).$\$r$ → $\mathbf{operator}^*$($\mathbf{heapIs}$ $\$heap_{loopstart\_1088,5}$, &$\$heap_{loopstart\_1088,5}$.prang).$\mathbf{replace}$(p3 → writes_1092_31))) ∧ ($\$heap_{loopend}$ == $\$heap_{1092,16}$.$\mathbf{replace}$((&$\$heap_{1092,16}$._ecv_files[1]).$\$r$ → writes_1092_9)) ∧ ($\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)0.0) < $\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$)) ∧ ($\mathbf{asType}$<$\mathbf{real}$>($\$result\_1092\_31$) < $\mathbf{asType}$<$\mathbf{real}$>(($\mathbf{double}$)1.0))

→ [attribute value is known from postcondition]

[13.11] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{\_replace}((\&\$\text{heap.prang}) \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{\_replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs} \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{\_replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs} \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{\_replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{\_replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \wedge (\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31})) \wedge (\textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31}) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[13.12] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{\_replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{\_replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs} \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{\_replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs} \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{\_replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{\_replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \wedge (\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31})) \wedge (\textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31}) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\rightarrow$ *[Dereference address-of object]*

[13.13] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{\_replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{\_replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{\_replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs} \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{\_replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{\_replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \rightarrow \text{writes\_1092\_9})) \wedge (\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31})) \wedge (\textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31}) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.14] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{\_replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{\_replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap.prang}).\$\text{r} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{\_replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{\_replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \rightarrow \textbf{operator}^*(\textbf{heapIs} \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{\_replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend}$

$== \$\mathrm{heap}_{1092,16} . \textbf{\_replace}((\&\$\mathrm{heap}_{1092,16} . \_\mathrm{ecv\_files}[1]).\$r \rightarrow \mathrm{writes\_1092\_9})) \wedge$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31})) \wedge$
$(\textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[attribute value is known from postcondition]*

[13.15] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$\mathrm{heap}_{1092,16} ==$
$\$\mathrm{heap}_{loopstart\_1088,5} . \textbf{\_replace}(\mathrm{prang} \rightarrow \$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p1}$
$\rightarrow \mathrm{writes\_1092\_31})) . \textbf{\_replace}((\&\$\mathrm{heap.prang}) \rightarrow$
$\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p2} \rightarrow$
$\mathrm{writes\_1092\_31})) . \textbf{\_replace}((\&\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang}).\$r \rightarrow$
$\textbf{operator}^{*}(\textbf{heapIs } \$\mathrm{heap}_{loopstart\_1088,5},$
$\&\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang}) . \textbf{\_replace}(\mathrm{p3} \rightarrow \mathrm{writes\_1092\_31}))) \wedge (\$\mathrm{heap}_{loopend}$
$== \$\mathrm{heap}_{1092,16} . \textbf{\_replace}((\&\$\mathrm{heap}_{1092,16} . \_\mathrm{ecv\_files}[1]).\$r \rightarrow \mathrm{writes\_1092\_9})) \wedge$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31})) \wedge$
$(\textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[13.16] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$\mathrm{heap}_{1092,16} ==$
$\$\mathrm{heap}_{loopstart\_1088,5} . \textbf{\_replace}(\mathrm{prang} \rightarrow \$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p1}$
$\rightarrow \mathrm{writes\_1092\_31})) . \textbf{\_replace}(\mathrm{prang} \rightarrow \$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p2}$
$\rightarrow \mathrm{writes\_1092\_31})) . \textbf{\_replace}((\&\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang}).\$r \rightarrow$
$\textbf{operator}^{*}(\textbf{heapIs } \$\mathrm{heap}_{loopstart\_1088,5},$
$\&\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang}) . \textbf{\_replace}(\mathrm{p3} \rightarrow \mathrm{writes\_1092\_31}))) \wedge (\$\mathrm{heap}_{loopend}$
$== \$\mathrm{heap}_{1092,16} . \textbf{\_replace}((\&\$\mathrm{heap}_{1092,16} . \_\mathrm{ecv\_files}[1]).\$r \rightarrow \mathrm{writes\_1092\_9})) \wedge$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31})) \wedge$
$(\textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[Dereference address-of object]*

[13.17] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$\mathrm{heap}_{1092,16} ==$
$\$\mathrm{heap}_{loopstart\_1088,5} . \textbf{\_replace}(\mathrm{prang} \rightarrow \$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p1}$
$\rightarrow \mathrm{writes\_1092\_31})) . \textbf{\_replace}(\mathrm{prang} \rightarrow \$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p2}$
$\rightarrow \mathrm{writes\_1092\_31})) . \textbf{\_replace}((\&\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang}).\$r \rightarrow$
$\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p3} \rightarrow \mathrm{writes\_1092\_31}))) \wedge (\$\mathrm{heap}_{loopend}$
$== \$\mathrm{heap}_{1092,16} . \textbf{\_replace}((\&\$\mathrm{heap}_{1092,16} . \_\mathrm{ecv\_files}[1]).\$r \rightarrow \mathrm{writes\_1092\_9})) \wedge$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31})) \wedge$
$(\textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.18] $(1 == (-\mathrm{count}_{loopstart\_1088,5} + \mathrm{count}_{loopend})) \wedge (\$\mathrm{heap}_{1092,16} ==$
$\$\mathrm{heap}_{loopstart\_1088,5} . \textbf{\_replace}(\mathrm{prang} \rightarrow \$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p1}$
$\rightarrow \mathrm{writes\_1092\_31})) . \textbf{\_replace}(\mathrm{prang} \rightarrow \$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p2}$
$\rightarrow \mathrm{writes\_1092\_31})) . \textbf{\_replace}((\&\$\mathrm{heap.prang}).\$r \rightarrow$
$\$\mathrm{heap}_{loopstart\_1088,5} . \mathrm{prang} . \textbf{\_replace}(\mathrm{p3} \rightarrow \mathrm{writes\_1092\_31}))) \wedge (\$\mathrm{heap}_{loopend}$
$== \$\mathrm{heap}_{1092,16} . \textbf{\_replace}((\&\$\mathrm{heap}_{1092,16} . \_\mathrm{ecv\_files}[1]).\$r \rightarrow \mathrm{writes\_1092\_9})) \wedge$
$(\textbf{asType}\textbf{<real>}((\textbf{double})0.0) < \textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31})) \wedge$
$(\textbf{asType}\textbf{<real>}(\$\mathrm{result\_1092\_31}) < \textbf{asType}\textbf{<real>}((\textbf{double})1.0))$

$\rightarrow$ *[attribute value is known from postcondition]*

[13.19] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\&\$\text{heap}.\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$r \rightarrow \text{writes\_1092\_9})) \wedge (\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31})) \wedge (\textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31}) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[13.20] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$r \rightarrow \text{writes\_1092\_9})) \wedge (\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31})) \wedge (\textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31}) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.21] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}.\_\text{ecv\_files}[1]).\$r \rightarrow \text{writes\_1092\_9})) \wedge (\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31})) \wedge (\textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31}) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\rightarrow$ *[attribute value is known from postcondition]*

[13.22] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{replace}(\&\$\text{heap}.\_\text{ecv\_files}[1] \rightarrow \text{writes\_1092\_9})) \wedge (\textbf{asType}<\textbf{real}>((\textbf{double})0.0) < \textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31})) \wedge (\textbf{asType}<\textbf{real}>(\$\text{result\_1092\_31}) < \textbf{asType}<\textbf{real}>((\textbf{double})1.0))$

$\rightarrow$ *[simplify]*

[13.31] $(1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})) \wedge (\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p1} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p2} \rightarrow \text{writes\_1092\_31})).\textbf{replace}(\text{prang} \rightarrow \$\text{heap}_{loopstart\_1088,5}.\text{prang}.\textbf{replace}(\text{p3} \rightarrow \text{writes\_1092\_31}))) \wedge (\$\text{heap}_{loopend} ==$

$\text{\$heap}_{1092,16}.\_$**replace**$(\&\text{\$heap}.\_\text{ecv\_files}[1] \to \text{writes\_1092\_9})) \wedge (0.0 < \text{\$result\_1092\_31}) \wedge (-1.0 < -\text{\$result\_1092\_31})$

$\to$ *[separate conjunction and work on first sub-term]*

[13.32] $1 == (-\text{count}_{loopstart\_1088,5} + \text{count}_{loopend})$

[Take given term]

[26.0] $\text{count}_{loopend} < \text{limit}$

$\to$ *[from term 13.32, $\text{count}_{loopend}$ is equal to $1 + \text{count}_{loopstart\_1088,5}$]*

[26.1] $(1 + \text{count}_{loopstart\_1088,5}) < \text{limit}$

$\to$ *[from term 4.6, limit is equal to 80]*

[26.2] $(1 + \text{count}_{loopstart\_1088,5}) < 80$

$\to$ *[simplify]*

[26.9] $\text{-79} < -\text{count}_{loopstart\_1088,5}$

[Take goal term]

[1.0] $0 \leq (\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}_{loopend}))$

$\to$ *[from term 4.6, limit is equal to 80]*

[1.1] $0 \leq (\textbf{asType}<\textbf{integer const}>(80) - \textbf{asType}<\textbf{integer}>(\text{count}_{loopend}))$

$\to$ *[simplify]*

[1.2] $0 \leq (80 - \textbf{asType}<\textbf{integer}>(\text{count}_{loopend}))$

$\to$ *[from term 13.32, $\text{count}_{loopend}$ is equal to $1 + \text{count}_{loopstart\_1088,5}$]*

[1.3] $0 \leq (80 - \textbf{asType}<\textbf{integer}>(1 + \text{count}_{loopstart\_1088,5}))$

$\to$ *[simplify]*

[1.13] $\text{-80} < -\text{count}_{loopstart\_1088,5}$

$\to$ *[from term 26.9, $literala < -\text{count}_{loopstart\_1088,5}$ is true whenever $(-1 + literala) < -79$]*

Proof of rule precondition:

[1.13.0] $(-80 + -1) < -79$

$\to$ *[simplify]*

[1.13.2] **true**

[1.14] **true**

Proof of verification condition: Arithmetic result of operator '++' is within limit of type 'int'

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp

(120,9)

Condition defined at:

To prove: minof(int) $\leq$ ++count$_{loopstart\_1088,5}$

Given:

$\$heap_{init}.$LIMIT $==$ (**int**)80

$\$heap_{init}.$**class** WHPrang $\in$ M1 $==$ (**int**)30269

$\$heap_{init}.$**class** WHPrang $\in$ r1 $==$ (**int**)171

$\$heap_{init}.$**class** WHPrang $\in$ a1 $==$ (**int**)177

$\$heap_{init}.$**class** WHPrang $\in$ b1 $==$ (**int**)2

$\$heap_{init}.$**class** WHPrang $\in$ M2 $==$ (**int**)30307

$\$heap_{init}.$**class** WHPrang $\in$ r2 $==$ (**int**)172

$\$heap_{init}.$**class** WHPrang $\in$ a2 $==$ (**int**)176

$\$heap_{init}.$**class** WHPrang $\in$ b2 $==$ (**int**)35

$\$heap_{init}.$**class** WHPrang $\in$ M3 $==$ (**int**)30323

$\$heap_{init}.$**class** WHPrang $\in$ r3 $==$ (**int**)170

$\$heap_{init}.$**class** WHPrang $\in$ a3 $==$ (**int**)178

$\$heap_{init}.$**class** WHPrang $\in$ b3 $==$ (**int**)63

$\$heap_{1079,1;1081,13,m1} ==$ $\$heap_{funcstart\_1079,1}.$**alloc**(prang $\to$ prang)

$\$heap_{1079,1;1081,13} ==$
$\$heap_{1079,1;1081,13,m1}.$**replace**((&$\$heap_{1079,1;1081,13,m1}.$prang).$r $\to$
writes_1081_5)

limit $==$ $\$heap_{1079,1;1081,13}.$LIMIT

minof(int const) $\leq$ limit

limit $\leq$ **maxof(int const)**

count $==$ (**int**)0

minof(int) $\leq$ count

count $\leq$ **maxof(int)**

$\$heap_{1079,1;1086,5} ==$
$\$heap_{1079,1;1081,13}.$**replace**((&$\$heap_{1079,1;1081,13}.$_ecv_files[1]).$r $\to$
writes_1086_5)

$\$heap_{loopstart\_1088,5} ==$ $\$heap_{1079,1;1086,5}.$**replace**(prang $\to$
writes_1089_12).**replace**(_ecv_files $\to$ writes_1089_12)

#writes_1089_12 $==$ #$\$heap_{1079,1;1086,5}.$_ecv_files

minof(int) $\leq$ count$_{loopstart\_1088,5}$

$\text{count}_{loopstart\_1088,5} \leq \mathbf{maxof}(\mathbf{int})$

$\text{count}_{loopstart\_1088,5} < \text{limit}$

$0 \leq (\mathbf{asType{<}integer\ const{>}}(\text{limit}) - \mathbf{asType{<}integer{>}}(\text{count}_{loopstart\_1088,5}))$

$(\mathbf{asType{<}integer\ const{>}}(\text{limit}) - \mathbf{asType{<}integer{>}}(\text{count}_{loopstart\_1088,5}))$
$\leq (\mathbf{asType{<}integer\ const{>}}(\text{limit}) - \mathbf{asType{<}integer{>}}(\text{count}))$

$\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\_\mathbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$r$
$\rightarrow \mathbf{operator}^*(\mathbf{heapIs}\ \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\_\mathbf{replace}(p1 \rightarrow$
$\text{writes\_1092\_31})).\_\mathbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\_\mathbf{replace}(p2 \rightarrow$
$\text{writes\_1092\_31})).\_\mathbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$r \rightarrow$
$\mathbf{operator}^*(\mathbf{heapIs}\ \$\text{heap}_{loopstart\_1088,5},$
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\_\mathbf{replace}(p3 \rightarrow \text{writes\_1092\_31}))$

$\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\_\mathbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$r \rightarrow$
$\text{writes\_1092\_9})$

$\mathbf{asType{<}real{>}}((\mathbf{double})0.0) < \mathbf{asType{<}real{>}}(\$\text{result\_1092\_31})$

$\mathbf{asType{<}real{>}}(\$\text{result\_1092\_31}) < \mathbf{asType{<}real{>}}((\mathbf{double})1.0)$

Proof:

[Take given term]

[2.0] $\$\text{heap}_{1079,1;1081,13,m1} == \$\text{heap}_{funcstart\_1079,1}.\mathbf{alloc}(\text{prang} \rightarrow \text{prang})$

[Take given term]

[3.0] $\$\text{heap}_{1079,1;1081,13} ==$
$\$\text{heap}_{1079,1;1081,13,m1}.\_\mathbf{replace}((\&\$\text{heap}_{1079,1;1081,13,m1}.\text{prang}).\$r \rightarrow$
$\text{writes\_1081\_5})$

$\rightarrow$ *[from term 2.0, $\$heap_{1079,1;1081,13,m1}$ is equal to*
$\$heap_{funcstart\_1079,1}.\mathbf{alloc}(prang \rightarrow prang)$]

[3.1] $\$\text{heap}_{1079,1;1081,13} == \$\text{heap}_{funcstart\_1079,1}.\mathbf{alloc}(\text{prang} \rightarrow$
$\text{prang}).\_\mathbf{replace}((\&\$\text{heap}_{1079,1;1081,13,m1}.\text{prang}).\$r \rightarrow \text{writes\_1081\_5})$

$\rightarrow$ *[simplify]*

[3.2] $\$\text{heap}_{1079,1;1081,13} == \$\text{heap}_{funcstart\_1079,1}.\mathbf{alloc}(\text{prang} \rightarrow$
$\text{prang}).\_\mathbf{replace}((\&\$\text{heap}.\text{prang}).\$r \rightarrow \text{writes\_1081\_5})$

$\rightarrow$ *[attribute value is known from postcondition]*

[3.3] $\$\text{heap}_{1079,1;1081,13} == \$\text{heap}_{funcstart\_1079,1}.\mathbf{alloc}(\text{prang} \rightarrow$
$\text{prang}).\_\mathbf{replace}(\&\$\text{heap}.\text{prang} \rightarrow \text{writes\_1081\_5})$

$\rightarrow$ *[replacing contents of address-of object is same as replacing object]*

[3.4] $\$heap_{1079,1;1081,13}$ == $\$heap_{funcstart\_1079,1}.\_\textbf{alloc}(\text{prang} \to \text{prang}).\_\textbf{replace}(\text{prang} \to \text{writes\_1081\_5})$

[Take given term]

[4.0] $\$heap_{1079,1;1081,13}.\text{LIMIT}$ == limit

$\to$ *[from term 3.4, $\$heap_{1079,1;1081,13}$ is equal to*
$\$heap_{funcstart\_1079,1}.\_\textbf{alloc}(prang \to prang).\_\textbf{replace}(prang \to writes\_1081\_5)$]

[4.1] $\$heap_{funcstart\_1079,1}.\_\textbf{alloc}(\text{prang} \to \text{prang}).\_\textbf{replace}(\text{prang} \to \text{writes\_1081\_5}).\text{LIMIT}$ == limit

$\to$ *[const member of object with modified fields]*

[4.3] $\$heap_{funcstart\_1079,1}.\text{LIMIT}$ == limit

$\to$ *[const static or extern object]*

[4.4] $\$heap_{init}.\text{LIMIT}$ == limit

$\to$ *[expand definition of constant 'LIMIT' at prang.cpp (13,18)]*

[4.5] $(\textbf{int})80$ == limit

$\to$ *[simplify]*

[4.6] 80 == limit

[Take given term]

[5.0] $(\textbf{int})0$ == count

$\to$ *[simplify]*

[5.1] 0 == count

[Take given term]

[12.0] $(\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}_{loopstart\_1088,5})) \leq (\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}))$

$\to$ *[from term 4.6, limit is equal to 80]*

[12.1] $(\textbf{asType}<\textbf{integer const}>(80) - \textbf{asType}<\textbf{integer}>(\text{count}_{loopstart\_1088,5})) \leq (\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}))$

$\to$ *[simplify]*

[12.4] $(80 + -\text{count}_{loopstart\_1088,5}) \leq (\textbf{asType}<\textbf{integer const}>(\text{limit}) - \textbf{asType}<\textbf{integer}>(\text{count}))$

$\to$ *[from term 4.6, limit is equal to 80]*

[12.5] $(80 + -\text{count}_{loopstart\_1088,5}) \leq (\textbf{asType}<\textbf{integer const}>(80) - \textbf{asType}<\textbf{integer}>(\text{count}))$

$\to$ *[simplify]*

[12.6] $(80 + -\text{count}_{loopstart\_1088,5}) \leq (80 - \textbf{asType}\langle\textbf{integer}\rangle(\text{count}))$

$\rightarrow$ *[from term 5.1, count is equal to 0]*

[12.7] $(80 + -\text{count}_{loopstart\_1088,5}) \leq (80 - \textbf{asType}\langle\textbf{integer}\rangle(0))$

$\rightarrow$ *[simplify]*

[12.20] $-1 < \text{count}_{loopstart\_1088,5}$

[Take goal term]

[1.0] $\textbf{minof}(\textbf{int}) \leq ++\text{count}_{loopstart\_1088,5}$

$\rightarrow$ *[simplify]*

[1.6] $-32770 < \text{count}_{loopstart\_1088,5}$

$\rightarrow$ *[from term 12.20, literala $<$ count$_{loopstart\_1088,5}$ is true whenever (-1 + literala) $<$ -1]*

Proof of rule precondition:

[1.6.0] $(-32770 + -1) < -1$

$\rightarrow$ *[simplify]*

[1.6.2] **true**

[1.7] **true**

Proof of verification condition: Arithmetic result of operator '++' is within limit of type 'int'

Condition generated at: C:\Escher\Customers\prang-cpp\prang.cpp (120,9)

Condition defined at:

To prove: $++\text{count}_{loopstart\_1088,5} \leq \textbf{maxof}(\textbf{int})$

Given:

$\$\text{heap}_{init}.\text{LIMIT} == (\textbf{int})80$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{M1} == (\textbf{int})30269$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{r1} == (\textbf{int})171$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{a1} == (\textbf{int})177$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{b1} == (\textbf{int})2$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{M2} == (\textbf{int})30307$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{r2} == (\textbf{int})172$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{a2} == (\textbf{int})176$

$\$\text{heap}_{init}.\textbf{class} \text{ WHPrang} \in \text{b2} == (\textbf{int})35$

$\$\text{heap}_{init}.\textbf{class}$ WHPrang $\in$ M3 $==$ (**int**)30323

$\$\text{heap}_{init}.\textbf{class}$ WHPrang $\in$ r3 $==$ (**int**)170

$\$\text{heap}_{init}.\textbf{class}$ WHPrang $\in$ a3 $==$ (**int**)178

$\$\text{heap}_{init}.\textbf{class}$ WHPrang $\in$ b3 $==$ (**int**)63

$\$\text{heap}_{1079,1;1081,13,m1} == \$\text{heap}_{funcstart\_1079,1}.\textbf{alloc}(\text{prang} \to \text{prang})$

$\$\text{heap}_{1079,1;1081,13} ==$
$\$\text{heap}_{1079,1;1081,13,m1}.\textbf{replace}((\&\$\text{heap}_{1079,1;1081,13,m1}.\text{prang}).\$\text{r} \to$
writes_1081_5)

limit $== \$\text{heap}_{1079,1;1081,13}.$LIMIT

minof(int const) $\leq$ limit

limit $\leq$ **maxof(int const)**

count $==$ (**int**)0

minof(int) $\leq$ count

count $\leq$ **maxof(int)**

$\$\text{heap}_{1079,1;1086,5} ==$
$\$\text{heap}_{1079,1;1081,13}.\textbf{replace}((\&\$\text{heap}_{1079,1;1081,13}.\_\text{ecv\_files}[1]).\$\text{r} \to$
writes_1086_5)

$\$\text{heap}_{loopstart\_1088,5} == \$\text{heap}_{1079,1;1086,5}.\textbf{replace}(\text{prang} \to$
writes_1089_12).$\textbf{replace}(\_\text{ecv\_files} \to$ writes_1089_12)

#writes_1089_12 $== \#\$\text{heap}_{1079,1;1086,5}.\_\text{ecv\_files}$

minof(int) $\leq \text{count}_{loopstart\_1088,5}$

$\text{count}_{loopstart\_1088,5} \leq$ **maxof(int)**

$\text{count}_{loopstart\_1088,5} <$ limit

$0 \leq$ (**asType<integer const>**(limit) $-$
asType<integer>($\text{count}_{loopstart\_1088,5}$))

(**asType<integer const>**(limit) $-$ **asType<integer>**($\text{count}_{loopstart\_1088,5}$))
$\leq$ (**asType<integer const>**(limit) $-$ **asType<integer>**(count))

$\$\text{heap}_{1092,16} == \$\text{heap}_{loopstart\_1088,5}.\textbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r}$
$\to$ **operator***(**heapIs** $\$\text{heap}_{loopstart\_1088,5}$,
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{replace}(\text{p1} \to$
writes_1092_31)).$\textbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \to$
operator*(**heapIs** $\$\text{heap}_{loopstart\_1088,5}$,
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{replace}(\text{p2} \to$
writes_1092_31)).$\textbf{replace}((\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\$\text{r} \to$
operator*(**heapIs** $\$\text{heap}_{loopstart\_1088,5}$,
$\&\$\text{heap}_{loopstart\_1088,5}.\text{prang}).\textbf{replace}(\text{p3} \to$ writes_1092_31))

$\$\text{heap}_{loopend} == \$\text{heap}_{1092,16}.\textbf{replace}((\&\$\text{heap}_{1092,16}.\_\text{ecv\_files}[1]).\$\text{r} \to$

writes_1092_9)

asType<real>((double)0.0) < asType<real>($result_1092_31)

asType<real>($result_1092_31) < asType<real>((double)1.0)

Proof:

[Take given term]

[2.0] $\$heap_{1079,1;1081,13,m1}$ == $\$heap_{funcstart\_1079,1}$.**alloc**(prang → prang)

[Take given term]

[3.0] $\$heap_{1079,1;1081,13}$ ==
$\$heap_{1079,1;1081,13,m1}$.**replace**((&$\$heap_{1079,1;1081,13,m1}$.prang).\$r →
writes_1081_5)

→ *[from term 2.0, $\$heap_{1079,1;1081,13,m1}$ is equal to
$\$heap_{funcstart\_1079,1}$.**alloc**(prang → prang)]*

[3.1] $\$heap_{1079,1;1081,13}$ == $\$heap_{funcstart\_1079,1}$.**alloc**(prang →
prang).**replace**((&$\$heap_{1079,1;1081,13,m1}$.prang).\$r → writes_1081_5)

→ *[simplify]*

[3.2] $\$heap_{1079,1;1081,13}$ == $\$heap_{funcstart\_1079,1}$.**alloc**(prang →
prang).**replace**((&\$heap.prang).\$r → writes_1081_5)

→ *[attribute value is known from postcondition]*

[3.3] $\$heap_{1079,1;1081,13}$ == $\$heap_{funcstart\_1079,1}$.**alloc**(prang →
prang).**replace**(&\$heap.prang → writes_1081_5)

→ *[replacing contents of address-of object is same as replacing object]*

[3.4] $\$heap_{1079,1;1081,13}$ == $\$heap_{funcstart\_1079,1}$.**alloc**(prang →
prang).**replace**(prang → writes_1081_5)

[Take given term]

[4.0] $\$heap_{1079,1;1081,13}$.LIMIT == limit

→ *[from term 3.4, $\$heap_{1079,1;1081,13}$ is equal to
$\$heap_{funcstart\_1079,1}$.**alloc**(prang → prang).**replace**(prang → writes_1081_5)]*

[4.1] $\$heap_{funcstart\_1079,1}$.**alloc**(prang → prang).**replace**(prang →
writes_1081_5).LIMIT == limit

→ *[const member of object with modified fields]*

[4.3] $\$heap_{funcstart\_1079,1}$.LIMIT == limit

→ *[const static or extern object]*

[4.4] $\$heap_{init}$.LIMIT == limit

→ *[expand definition of constant 'LIMIT' at prang.cpp (13,18)]*

[4.5] (**int**)80 == limit

$\rightarrow$ *[simplify]*

[4.6] $80 ==$ limit

[Take given term]

[11.0] $\text{count}_{loopstart\_1088,5} <$ limit

$\rightarrow$ *[from term 4.6, limit is equal to 80]*

[11.1] $\text{count}_{loopstart\_1088,5} < 80$

$\rightarrow$ *[simplify]*

[11.4] $\text{-80} < -\text{count}_{loopstart\_1088,5}$

[Take goal term]

[1.0] $++\text{count}_{loopstart\_1088,5} \leq \textbf{maxof(int)}$

$\rightarrow$ *[simplify]*

[1.9] $\text{-32767} < -\text{count}_{loopstart\_1088,5}$

$\rightarrow$ *[from term 11.4, literala $< -\text{count}_{loopstart\_1088,5}$ is true whenever (-1 + literala) < -80]*

Proof of rule precondition:

[1.9.0] $(\text{-32767 + -1}) < \text{-80}$

$\rightarrow$ *[simplify]*

[1.9.2] **true**

[1.10] **true**

End of proofs for file C:\Escher\Customers\prang-cpp\prang.cpp