5.266 minimum_modulo

DESCRIPTION LINKS GRAPH

Origin Derived from minimum.

Constraint minimum_modulo(MIN, VARIABLES, M)

Arguments

MIN	:	dvar
VARIABLES	:	collection(var−dvar)
M	:	int

Restrictions

$|\texttt{VARIABLES}| > 0$
$\texttt{M} > 0$
required(VARIABLES, var)

Purpose MIN is a minimum value of the collection of domain variables VARIABLES according to the following partial ordering: $(X \bmod \texttt{M}) < (Y \bmod \texttt{M})$.

Example

$(6, \langle 9, 1, 7, 6, 5\rangle, 3)$
$(9, \langle 9, 1, 7, 6, 5\rangle, 3)$

The minimum_modulo constraints hold since MIN is respectively set to values 6 and 9, where $6 \bmod 3 = 0$ and $9 \bmod 3 = 0$ are both less than or equal to all the expressions $9 \bmod 3 = 0$, $1 \bmod 3 = 1$, $7 \bmod 3 = 1$, $6 \bmod 3 = 0$, and $5 \bmod 3 = 2$.

Typical

$|\texttt{VARIABLES}| > 1$
$\text{range}(\texttt{VARIABLES.var}) > 1$
$\texttt{M} > 1$
$\texttt{M} < \text{maxval}(\texttt{VARIABLES.var})$

Symmetry Items of VARIABLES are permutable.

Arg. properties

Functional dependency: MIN determined by VARIABLES and M.

See also

comparison swapped: maximum_modulo.

specialisation: minimum *(*variable mod constant *replaced by* variable*)*.

Keywords

characteristic of a constraint: modulo, maxint, minimum.

constraint arguments: pure functional dependency.

constraint type: order constraint.

modelling: functional dependency.

Arc input(s)	VARIABLES
Arc generator	$CLIQUE \mapsto$ collection(variables1, variables2)
Arc arity	2
Arc constraint(s)	$\bigvee \left(\begin{array}{l} \texttt{variables1.key} = \texttt{variables2.key}, \\ \texttt{variables1.var} \bmod \texttt{M} < \texttt{variables2.var} \bmod \texttt{M} \end{array} \right)$
Graph property(ies)	**ORDER**$(0, \texttt{MAXINT}, \texttt{var}) = \texttt{MIN}$

Graph model We use a similar definition that the one that was utilised for the minimum constraint. Within the arc constraint we replace the condition $X < Y$ by the condition $(X \bmod \texttt{M}) < (Y \bmod \texttt{M})$.

Parts (A) and (B) of Figure 5.587 respectively show the initial and final graph associated with the second example of the **Example** slot. Since we use the **ORDER** graph property, the vertex of rank 0 (without considering the loops) associated with value 9 is outlined with a thick circle.

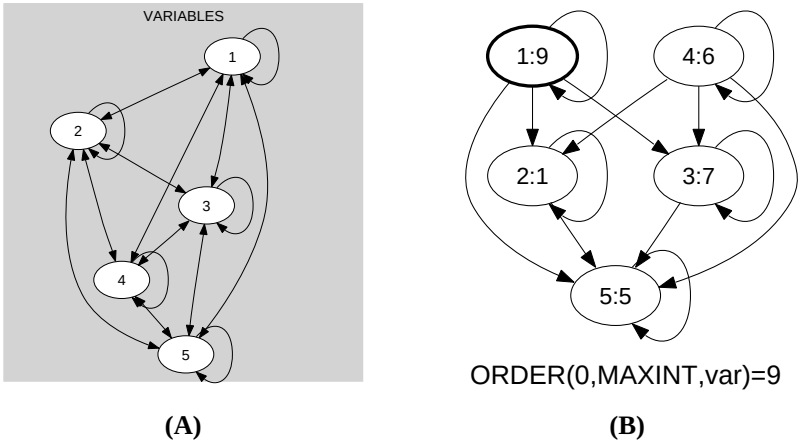

Figure 5.587: Initial and final graph of the minimum_modulo constraint