
MODULE *DieHard*

EXTENDS *Integers*

VARIABLES *small, big*

$$TypeOK \triangleq \begin{array}{l} \wedge small \in 0 \dots 3 \\ \wedge big \in 0 \dots 5 \end{array}$$

$$Init \triangleq \begin{array}{l} \wedge big = 0 \\ \wedge small = 0 \end{array}$$

$$FillSmall \triangleq \begin{array}{l} \wedge small' = 3 \\ \wedge big' = big \end{array}$$

$$FillBig \triangleq \begin{array}{l} \wedge big' = 5 \\ \wedge small' = small \end{array}$$

$$EmptySmall \triangleq \begin{array}{l} \wedge small' = 0 \\ \wedge big' = big \end{array}$$

$$EmptyBig \triangleq \begin{array}{l} \wedge big' = 0 \\ \wedge small' = small \end{array}$$

using IF - THEN - ELSE

$$SmallToBig \triangleq \begin{array}{l} \text{IF } big + small \leq 5 \\ \text{THEN } \wedge big' = big + small \\ \quad \wedge small' = 0 \\ \text{ELSE } \wedge big' = 5 \\ \quad \wedge small' = small - (5 - big) \end{array}$$

$$BigToSmall \triangleq \begin{array}{l} \text{IF } big + small \leq 3 \\ \text{THEN } \wedge big' = 0 \\ \quad \wedge small' = big + small \\ \text{ELSE } \wedge big' = small - (3 - big) \\ \quad \wedge small' = 3 \end{array}$$

using CNF

$$SmallToBig \triangleq \begin{array}{l} \vee \wedge big + small \leq 5 \\ \quad \wedge big' = big + small \\ \quad \wedge small' = 0 \\ \vee \wedge big + small > 5 \\ \quad \wedge big' = 5 \\ \quad \wedge small' = big + small - 5 \end{array}$$

$$BigToSmall \triangleq \begin{array}{l} \vee \wedge big + small \leq 3 \\ \quad \wedge small' = big + small \\ \quad \wedge big' = 0 \\ \vee \wedge big + small > 3 \\ \quad \wedge small' = 3 \\ \quad \wedge big' = big + small - 3 \end{array}$$

using LET /IN construct

$Min(m, n) \triangleq \text{IF } m < n \text{ THEN } m \text{ ELSE } n$

$SmallToBig \triangleq$
 LET $poured \triangleq Min(big + small, 5) - big$
 IN $\wedge big' = big + poured$
 $\wedge small' = small - poured$

$BigToSmall \triangleq$
 LET $poured \triangleq Min(big + small, 3) - small$
 IN $\wedge big' = big - poured$
 $\wedge small' = small + poured$

$Next \triangleq$ $\vee FillSmall$
 $\vee FillBig$
 $\vee EmptySmall$
 $\vee EmptyBig$
 $\vee SmallToBig$
 $\vee BigToSmall$

\ * Modification History
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