MODULE *DieHard*

EXTENDS *Integers*

VARIABLES *big*, *small*

$$TypeOK \triangleq big \in 0 \,..\, 5 \land small \in 0 \,..\, 3$$

$$\begin{aligned} Init \triangleq\ & \land big = 0 \\ & \land small = 0 \end{aligned}$$

$$\begin{aligned} FillSmall \triangleq\ & \land small' = 3 \\ & \land big' = big \end{aligned}$$

$$\begin{aligned} FillBig \triangleq\ & \land small' = small \\ & \land big' = 5 \end{aligned}$$

$$EmptySmall \triangleq small' = 0 \land big' = big$$

$$EmptyBig \triangleq big' = 0 \land small' = small$$

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

When pouring from small to big, we first ask if $big + small > 5$. If so, we make $big' = 5$ and $small' = small - (5 - big)$; if not, we make $big' = big + small$ and $small' = 0$. In the former case, the amount poured is $5 - big$; in the latter case, the amount poured is small, which equals $(big + small) - big$. In both cases, the amount poured is $Min(big + small, 5) - big$.

Symmetric reasoning applies to pouring from big to small.

$$\begin{aligned} SmallToBig \triangleq\ & \text{LET } poured \triangleq Min(big + small, 5) - big \\ & \text{IN} \quad \land big' = big + poured \\ & \qquad \land small' = small - poured \end{aligned}$$

$$\begin{aligned} BigToSmall \triangleq\ & \text{LET } poured \triangleq Min(big + small, 3) - small \\ & \text{IN} \quad \land big' = big - poured \\ & \qquad \land small' = small + poured \end{aligned}$$

$$\begin{aligned} Next \triangleq\ & \lor FillSmall \\ & \lor FillBig \\ & \lor EmptySmall \\ & \lor EmptyBig \\ & \lor SmallToBig \\ & \lor BigToSmall \end{aligned}$$

* Modification History
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