MODULE *elevator*

EXTENDS *Naturals*

CONSTANTS $N$, number of floors
$Up$, $Dn$ represents direction

ASSUME $N \in Nat$

VARIABLES $i$, $dir$

True when elevator is at floor $f$

$At(f) \triangleq i = 2 * f - 1$

True when elevator is between floors

$IsBetween \triangleq i\%2 = 0$

$$\begin{aligned} Init \triangleq\ & \land i = 1 \\ & \land dir \in \{Up, Dn\} \end{aligned}$$

move up when at a floor

$$\begin{aligned} UpFlr \triangleq\ & \land \exists f \in 1 \,..\, N-1 : At(f) \\ & \land i' = i + 1 \\ & \land dir' = Up \end{aligned}$$

move up when between floors

$$\begin{aligned} UpBetween \triangleq\ & \land IsBetween \\ & \land dir = Up \\ & \land i' = i + 1 \\ & \land \text{UNCHANGED } dir \end{aligned}$$

move down when at a floor

$$\begin{aligned} DnFlr \triangleq\ & \land \exists f \in 2 \,..\, N : At(f) \\ & \land i' = i - 1 \\ & \land dir' = Dn \end{aligned}$$

move down when between floors

$$\begin{aligned} DnBetween \triangleq\ & \land IsBetween \\ & \land dir = Dn \\ & \land i' = i - 1 \\ & \land \text{UNCHANGED } dir \end{aligned}$$

$$\begin{aligned} Next \triangleq\ & \lor UpFlr \\ & \lor UpBetween \\ & \lor DnFlr \\ & \lor DnBetween \end{aligned}$$

$v \triangleq \langle i, dir \rangle$

$$\begin{aligned} L \triangleq\ & \land \mathrm{WF}_v(UpBetween) \\ & \land \mathrm{WF}_v(DnBetween) \end{aligned}$$

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\begin{array}{l}
\quad \land \, \mathrm{WF}_v(\mathit{UpFlr} \land \mathit{At}(1)) \\
\quad \land \, \mathrm{WF}_v(\mathit{DnFlr} \land \mathit{At}(N)) \\
\quad \land \, \forall f \in 2 \,..\, N-1 : \\
\qquad \land \, \mathrm{SF}_v(\mathit{UpFlr} \land \mathit{At}(f)) \\
\qquad \land \, \mathrm{SF}_v(\mathit{DnFlr} \land \mathit{At}(f)) \\
\mathit{Spec} \;\triangleq\; \mathit{Init} \land \Box[\mathit{Next}]_v \land L
\end{array}
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