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MODULE *wire*

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EXTENDS *Integers*

VARIABLES

*snd*,  
*rcv*,  
*acc*,  
*amount*,  
*pc*

*vars*  $\triangleq \langle \textit{snd}, \textit{rcv}, \textit{acc}, \textit{amount}, \textit{pc} \rangle$

*threads*  $\triangleq 1 \dots 2$

*Init*  $\triangleq$

$\wedge \textit{snd} = \text{"bob"}$   
 $\wedge \textit{rcv} = \text{"alice"}$   
 $\wedge \textit{acc} = [p \in \{\text{"bob"}, \text{"alice"}\} \mapsto 5]$   
 $\wedge \textit{amount} \in 1 \dots \textit{acc}[\textit{snd}]$   
 $\wedge \textit{pc} = [t \in \textit{threads} \mapsto \text{"init"}]$

*CheckAndWithdraw*(*t*)  $\triangleq$

$\wedge \textit{pc}[t] = \text{"init"}$   
 $\wedge \text{IF } \textit{amount} \leq \textit{acc}[\textit{snd}] \text{ THEN}$   
 $\quad \wedge \textit{acc}' = [\textit{acc} \text{ EXCEPT } ![\textit{snd}] = \textit{acc}[\textit{snd}] - \textit{amount}]$   
 $\quad \wedge \textit{pc}' = [\textit{pc} \text{ EXCEPT } ![t] = \text{"deposit"}]$   
 $\quad \wedge \text{UNCHANGED } \langle \textit{snd}, \textit{rcv}, \textit{amount} \rangle$   
 $\text{ELSE}$   
 $\quad \wedge \textit{pc}' = [\textit{pc} \text{ EXCEPT } ![t] = \text{"done"}]$   
 $\quad \wedge \text{UNCHANGED } \langle \textit{snd}, \textit{rcv}, \textit{acc}, \textit{amount} \rangle$

*Deposit*(*t*)  $\triangleq$

$\wedge \textit{pc}[t] = \text{"deposit"}$   
 $\wedge \textit{acc}' = [\textit{acc} \text{ EXCEPT } ![\textit{rcv}] = \textit{acc}[\textit{rcv}] + \textit{amount}]$   
 $\wedge \textit{pc}' = [\textit{pc} \text{ EXCEPT } ![t] = \text{"done"}]$   
 $\wedge \text{UNCHANGED } \langle \textit{snd}, \textit{rcv}, \textit{amount} \rangle$

*Done*(*t*)  $\triangleq$

$\wedge \textit{pc}[t] = \text{"done"}$   
 $\wedge \text{UNCHANGED } \textit{vars}$

*Next*  $\triangleq \exists t \in \textit{threads} :$

$\vee \textit{CheckAndWithdraw}(t)$   
 $\vee \textit{Deposit}(t)$   
 $\vee \textit{Done}(t)$

*Spec*  $\triangleq$

$$\begin{aligned}
& \wedge \textit{Init} \\
& \wedge \Box[\textit{Next}]_{vars} \\
& \wedge \text{WF}_{vars}(\textit{Next})
\end{aligned}$$

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$$\textit{NoOverdrafts} \triangleq \forall p \in \{ \text{"bob"}, \text{"alice"} \} : acc[p] \geq 0$$

$$\textit{EventuallyConsistent} \triangleq \Diamond \Box (acc[snd] + acc[rcv] = 10)$$


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