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MODULE *skeenAlgorithm*

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EXTENDS *TLC, Naturals*

CONSTANTS *PROCESS\_NUMBER*

VARIABLES *stamped, received, LC, deliverable, pc, sentM, sentTS*

*vars*  $\triangleq \langle \textit{stamped}, \textit{received}, \textit{LC}, \textit{deliverable}, \textit{pc}, \textit{sentM}, \textit{sentTS} \rangle$

*PC STATES:*

*BCAST* = *p* send *m* to destinations *WAITING* = *p* waiting

*Processes*  $\triangleq 1 \dots \textit{PROCESS\_NUMBER}$

*Message*  $\triangleq \{ \text{"MESSAGE"} \}$

*Init*  $\triangleq$

$\wedge \textit{stamped} = [i \in \textit{Processes} \mapsto \{\}]$   
 $\wedge \textit{received} = [i \in \textit{Processes} \mapsto \{\}]$   
 $\wedge \textit{deliverable} = [i \in \textit{Processes} \mapsto \{\}]$   
 $\wedge \textit{pc} \in [\textit{Processes} \rightarrow \{ \text{"BCAST"}, "" \}]$   
 $\wedge \textit{LC} \in [\textit{Processes} \rightarrow \{0\}]$   
 $\wedge \textit{sentM} = \{\}$   
 $\wedge \textit{sentTS} = \{\}$

*UponBCAST*(*self*)  $\triangleq$

$\wedge \textit{pc}[\textit{self}] = \text{"BCAST"}$   
 $\wedge \textit{sentM}' = \textit{sentM} \cup \{ \langle \textit{self}, \text{"MESSAGE"} \rangle \}$   
 $\wedge \textit{pc}' = [\textit{pc} \text{ EXCEPT } ![\textit{self}] = \text{"PENDING"}]$   
 $\wedge \textit{stamped}' = \textit{stamped}$   
 $\wedge \textit{deliverable}' = \textit{deliverable}$   
 $\wedge \textit{sentTS}' = \textit{sentTS}$   
 $\wedge \textit{LC}' = \textit{LC}$

*ReceivedMessageExpression*(*self*, *i*)  $\triangleq$

$\wedge \textit{received}' = [\textit{received} \text{ EXCEPT } ![\textit{self}] = \textit{received}[\textit{self}] \cup \{ \langle i[1], \textit{LC}[\textit{self}] \rangle \}]$   
 $\wedge \textit{sentTS}' = \textit{sentTS} \cup \{ \langle \textit{self}, \text{"MESSAGE"}, \textit{LC}[\textit{self}], i[1] \rangle \}$

*ReceivedMessage*(*self*)  $\triangleq$

$\wedge \forall i \in \textit{sentM} : \textit{ReceivedMessageExpression}(\textit{self}, i)$   
 $\wedge \textit{LC}' = [\textit{LC} \text{ EXCEPT } ![\textit{self}] = \textit{LC}[\textit{self}] + 1]$   
 $\wedge \textit{stamped}' = \textit{stamped}$   
 $\wedge \textit{pc}' = \textit{pc}$   
 $\wedge \textit{deliverable}' = \textit{deliverable}$   
 $\wedge \textit{sentM}' = \textit{sentM}$

*Step*(*self*)  $\triangleq$

$\wedge \textit{ReceivedMessage}(\textit{self})$

$$\begin{aligned}
& \wedge \vee \text{UpponBCAST}(\text{self}) \\
& \vee \text{UNCHANGED } \langle \text{stamped}, \text{received}, \text{pc}, \text{sentM}, \text{sentTS}, \text{deliverable} \rangle \\
\text{Next} & \triangleq (\exists p \in \text{Processes} : \text{Step}(p)) \\
\text{Spec} & \triangleq \text{Init} \wedge \Box[\text{Next}]_{\text{vars}} \\
& \wedge \text{WF}_{\text{vars}}(\exists p \in \text{Processes} : \wedge \text{ReceivedMessage}(p) \\
& \wedge \vee \text{UpponBCAST}(p) \\
& \vee \text{UNCHANGED } \langle \text{stamped}, \text{received}, \text{pc}, \text{LC}, \text{sentM}, \text{sentTS}, d
\end{aligned}$$


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