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MODULE *TPaxosAPWithVotes*

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EXTENDS *TPaxosAP*

VARIABLE *votes* *votes[q]*: the set of votes cast by  $q \in \text{Participant}$   
*varsV*  $\triangleq \langle \text{vars}, \text{votes} \rangle$

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*InitV*  $\triangleq$   
 $\wedge \text{Init}$   
 $\wedge \text{votes} = [q \in \text{Participant} \mapsto \{\}]$

*PrepareV*( $p, b$ )  $\triangleq$   
 $\wedge \text{Prepare}(p, b)$   
 $\wedge \text{votes}' = \text{votes}$

*AcceptV*( $p, b, v$ )  $\triangleq$   
 $\wedge \text{Accept}(p, b, v)$   
 $\wedge \text{votes}' = [\text{votes} \text{ EXCEPT } ![p] = @ \cup \{\langle b, v \rangle\}] \text{ collecting proposal } \langle b, v \rangle$

*OnMessageV*( $q$ )  $\triangleq$   
 $\wedge \text{OnMessage}(q)$   
 $\wedge \text{IF } \text{state}'[q][q].\text{maxVBal} \neq \text{state}[q][q].\text{maxVBal} \text{ accept}$   
 $\text{THEN } \text{votes}' = [\text{votes} \text{ EXCEPT } ![q] = @ \cup \text{collecting proposal}$   
 $\{\langle \text{state}'[q][q].\text{maxVBal}, \text{state}'[q][q].\text{maxVVal} \rangle\}]$   
 $\text{ELSE UNCHANGED } \text{votes}$

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*NextV*  $\triangleq \exists p \in \text{Participant} :$   
 $\vee \text{OnMessageV}(p)$   
 $\vee \exists b \in \text{Ballot} : \vee \text{PrepareV}(p, b)$   
 $\vee \exists v \in \text{Value} : \text{AcceptV}(p, b, v)$

*SpecV*  $\triangleq \text{InitV} \wedge \square[\text{NextV}]_{\text{varsV}}$

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To verify  $\text{Spec} \Rightarrow \text{Voting}$ , we should define *votes* and *maxBal*  
 $\text{votes}, \setminus * \text{votes}[a]$  is the set of votes cast by *Participant*  $a$   
 $\text{maxBal} \setminus * \text{maxBal}[a]$  is a ballot number. *Participant*  $a$  will cast  
 $\setminus * \text{further votes only in ballots numbered } \geq \text{maxBal}[a]$

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$\text{maxBal} \triangleq [p \in \text{Participant} \mapsto \text{state}[p][p].\text{maxBal}]$

$V \triangleq \text{INSTANCE } \text{EagerVoting} \text{ WITH } \text{Acceptor} \leftarrow \text{Participant}$   
 $\text{votes} \leftarrow \text{votes}, \text{maxBal} \leftarrow \text{maxBal}$

THEOREM  $\text{SpecV} \Rightarrow V! \text{Spec}$

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$\setminus *$  Modification History  
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