MODULE *paxos*

EXTENDS *Integers*

$Maximum(S) \triangleq$

Probably a bit mind breaking than it needs to be

Essentially takes the maximum in the set S

```
LET Max[T ∈ SUBSET S] ≜
      IF T = {} THEN -1
                ELSE LET n    ≜ CHOOSE n ∈ T : TRUE
                         rmax ≜ Max[T \ {n}]
                     IN  IF n ≥ rmax THEN n ELSE rmax
IN  Max[S]
```

CONSTANT RM, $Acceptor$, $Majority$, $Ballot$

ASSUME

$\land\ Ballot \subseteq Nat$

$\land\ 0 \in Ballot$

$\land\ Majority \subseteq \text{SUBSET } Acceptor$

$\land\ \forall\, MS1,\ MS2 \in Majority : MS1 \cap MS2 \neq \{\}$

$Messages \triangleq$

$[type : \{\text{“phase1a”}\},\ ins : RM,\ bal : Ballot \setminus \{0\}]$

$\cup$

$[type : \{\text{“phase1b”}\},\ ins : RM,\ mbal : Ballot,\ bal : Ballot \cup \{-1\},$
$\ val : \{\text{“prepared”},\ \text{“aborted”},\ \text{“none”}\},\ acc : Acceptor]$

$\cup$

$[type : \{\text{“phase2a”}\},\ ins : RM,\ bal : Ballot,$
$\ val : \{\text{“prepared”},\ \text{“aborted”},\ \text{“none”}\}]$

$\cup$

$[type : \{\text{“phase2b”}\},\ acc : Acceptor,\ ins : RM,\ bal : Ballot,$
$\ val : \{\text{“prepared”},\ \text{“aborted”}\}]$

$\cup$

$[type : \{\text{“Commit”},\ \text{“Abort”}\}]$

VARIABLES $rmState$, $aState$, $msgs$

$PCTypeOk \triangleq$

$\land\ rmState \in [RM \to \{\text{“working”},\ \text{“prepared”},\ \text{“committed”},\ \text{“aborted”}\}]$

$\land\ aState \in [RM \to [Acceptor \to [mbal : Ballot,$
$\qquad\qquad\qquad\qquad\qquad\qquad bal\ \ : Ballot \cup \{-1\},$
$\qquad\qquad\qquad\qquad\qquad\qquad val\ \ : \{\text{“prepared”},\ \text{“aborted”},\ \text{“none”}\}]]]$

$\land\ msgs \subseteq Messages$

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