───────────────────────── MODULE POD ─────────────────────────

EXTENDS $Naturals$

CONSTANT $Validator$

VARIABLES
    ********** These   are the variables in other modules ********************
            $trans\_buffer$,   messages need to transfer
            $recv\_buffer$,   received messages
            $blocks$,   all blocks for all validators
            v_status,
            $UsedIds$,
            $v\_block\_prepares$,
            $v\_block\_commits$,
            $v\_contributed\_block$

VARIABLES
    ********** These   are the variables in this module ********************
            $dynasty\_status$ dynasty count, this is an increasing number

$Message \triangleq$

    The set of all possible messages. The ins field indicates the sender. For "propose"
    message, the "val" field means she propose a block. Since we do not mind the proposed value, we do not
    record the proposed value here. The "sender" field indicates the sender of a message.
    $[type : \{\,\text{"propose"}\,\}, val : Validator, sender : Validator]$
            $\cup$
    $[type : \{\,\text{"prepare"}\,\}, val : Validator, sender : Validator]$
            $\cup$
    $[type : \{\,\text{"vote"}\,\}, val : Validator, sender : Validator]$

$Network \triangleq$ INSTANCE $Network$ WITH $Message \leftarrow Message, endpoint \leftarrow Validator,$
                                    $trans\_buffer \leftarrow trans\_buffer,$
                                    $recv\_buffer \leftarrow recv\_buffer$

$BlockValidator(n) \triangleq$ INSTANCE $PODValidator$ WITH $Validator \leftarrow Validator,$
                                    $Self \leftarrow n,$
                                    $block \leftarrow blocks[n],$
                                    $status \leftarrow v\_status[n],$
                                    $UsedIds \leftarrow UsedIds,$
                                    $block\_prepares \leftarrow v\_block\_prepares[n],$
                                    $block\_commits \leftarrow v\_block\_commits[n],$
                                    $contributed\_block \leftarrow v\_contributed\_block[n]$

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$PODTypeOK \triangleq \wedge Network!NetworkTypeOK$

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$$\land \forall\, n \in \mathit{Validator} : \mathit{BlockValidator}(n)!\mathit{PVTypeOK}$$

$$\mathit{PODInit} \;\triangleq\; \land \mathit{Network}!\mathit{NetworkInit}$$
$$\land \forall\, n \in \mathit{Validator} : \mathit{BlockValidator}(n)!\mathit{PVInit}$$

*************** Actions **

$$\mathit{GotoNextPeriod} \;\triangleq\; \lor \exists\, n \in \mathit{Validator} : \mathit{BlockValidator}(n)!\mathit{AlreadyReachFinalityStatus}$$
$$\lor \forall\, n \in \mathit{Validator} : \mathit{BlockValidator}(n)!\mathit{IsImpossibleToReachCommitStatus}$$

$$\mathit{PODNext} \;\triangleq\; \lor \exists\, n \in \mathit{Validator} : \mathit{BlockValidator}(n)!\mathit{PVNext}$$
$$\lor \mathit{Network}!\mathit{NetworkNext}$$
$$\lor \mathit{GotoNextPeriod}$$

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