MODULE *definitions*

LOCAL INSTANCE *Integers*
LOCAL INSTANCE *Sequences*
LOCAL INSTANCE *FiniteSets*
LOCAL INSTANCE *utils*

CONSTANTS *BcNodes*, *BftNodes*, *CrossLink2Nodes*
CONSTANTS *ByzBft*, *ByzCl*
CONSTANTS *Sigma*, *L*

VARIABLES *bc_chains*, *bft_chains*, *crosslink2_chains*

The genesis blocks for the chains.

$BcGenesisBlock \triangleq [context\_bft \mapsto 0, hash \mapsto 0]$
$BftGenesisBlock \triangleq [headers\_bc \mapsto \langle\rangle, hash \mapsto 0]$
$CrossLink2GenesisBlock \triangleq [fin \mapsto \langle BcGenesisBlock \rangle]$

Choose the best *BC* chain (the longest one).

$BestBcChainIdx \triangleq$
  CHOOSE $i \in 1 \,..\, BcNodes : Len(bc\_chains[i]) = Max(\{Len(bc\_chains[j]) : j \in 1 \,..\, BcNodes\})$

The subset of honest *BFT* nodes.

$HonestBftNodes \triangleq 1 \,..\, BftNodes \setminus ByzBft$

The set of all *BFT* nodes.

$BftAllNodes \triangleq 1 \,..\, BftNodes$

The number of nodes supporting the same chain as node i.

$BftSupport(i) \triangleq Cardinality(\{j \in BftAllNodes : bft\_chains[j] = bft\_chains[i]\})$

BFT Assumptions

$BftThresholdOK \triangleq BftNodes \geq 3 * Cardinality(ByzBft) + 1$

Choose the best *BFT* chain (the longest one with the most support).

$BestBftChainIdx \triangleq$
  LET
    The maximum length of all *BFT* chains
    $Lmax \triangleq Max(\{Len(bft\_chains[k]) : k \in BftAllNodes\})$
    The set of nodes having the longest chains
    $S \triangleq \{i \in BftAllNodes : Len(bft\_chains[i]) = Lmax\}$
    The maximum support among the longest chains
    $supMax \triangleq Max(\{BftSupport(k) : k \in S\})$
    The set of nodes having the longest chains with the maximum support

$T \triangleq \{i \in S : BftSupport(i) = supMax\}$

IN

CHOOSE $i \in T$: TRUE

Choose the best *Crosslink* chain (the longest one).

$ChooseBestCrosslinkChain \triangleq$

CHOOSE $i \in 1 \,..\, CrossLink2Nodes : Len(crosslink2\_chains[i]) =$
$Max(\{Len(crosslink2\_chains[j]) : j \in 1 \,..\, CrossLink2Nodes\})$

Definition: Computable efficiently function

$\star bftlastfinal : \star bftblock \to \star bftblock \cup \{\bot\}$

$BftLastFinal(n) \triangleq bft\_chains[n]$