─────────────────── MODULE *skeenAlgorithm* ───────────────────

EXTENDS *TLC*, *Naturals*, *FiniteSets*

CONSTANTS *PROCESS_NUMBER*

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

$vars \triangleq \langle stamped, received, LC, deliverable, pc, sentM, sentTS, sequenceNumber \rangle$

  PC STATES:

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

ASSUME $PROCESS\_NUMBER \in Nat$

$Processes \triangleq 1 .. PROCESS\_NUMBER$
$Message \triangleq \{ \text{"MESSAGE"} \}$

$Max(S) \triangleq$ CHOOSE $t \in S : \forall s \in S : t[3] \geq s[3]$

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

$UpponBCAST(self) \triangleq$
  $\wedge pc[self] = \text{"BCAST"}$
  $\wedge sentM' = sentM \cup \{ \langle self, \text{"MESSAGE"} \rangle \}$
  $\wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"PENDING"}]$
  $\wedge$ UNCHANGED $\langle stamped, deliverable, sentTS, LC, received, sequenceNumber \rangle$

$ReceivedMessage(self) \triangleq$
  $\wedge sentM \neq \{\}$
  $\wedge \exists msg \in sentM :$
    $\wedge received' = [received \text{ EXCEPT } ![self] = received[self] \cup \{ \langle msg[1], msg[2], LC[self] \rangle \}]$
    $\wedge sentTS' = sentTS \cup \{ \langle self, \text{"MESSAGE"}, LC[self], msg[1] \rangle \}$
  $\wedge LC' = [LC \text{ EXCEPT } ![self] = LC[self] + 1]$
  $\wedge$ UNCHANGED $\langle stamped, pc, deliverable, sentM, LC, sequenceNumber \rangle$

$ReceivedStamppedMessage(self) \triangleq$
  $\wedge pc[self] = \text{"PENDING"} \wedge PROCESS\_NUMBER = Cardinality(\{x \in sentTS : x[4] = self\})$
  $\wedge Print(Max(\{x \in sentTS : x[4] = self\}), \text{TRUE})$
  $\wedge sentTS' = sentTS \setminus \{x \in sentTS : x[4] = self\}$

$\quad \wedge\ sequenceNumber' = Max(\{x \in sentTS : x[4] = self\})[3]$

$\quad \wedge\ stamped' = [stamped \text{ EXCEPT } ![self] = stamped[self] \cup \{\langle self,\ \text{"MESSAGE"},\ sequenceNumber\rangle\}]$

$\quad \wedge\ \forall\, mi \in \{x \in stamped[self] : x[4] = self\} :$

$\quad\quad \wedge\ \forall\, mii \in received[self] : mi[3] < mii[3]$

$\quad\quad \wedge\ deliverable' = [deliverable \text{ EXCEPT } ![self] = deliverable[self] \cup \{mi\}]$

$\quad \wedge\ \forall\, msg \in deliverable[self] : \wedge\ sentM' = sentM \cup \{\langle self,\ \text{"MESSAGE"}\rangle\}$

$\quad \wedge\ stamped' = [stamped \text{ EXCEPT } ![self] = stamped[self] \setminus deliverable[self]]$

$\quad \wedge\ \text{UNCHANGED } \langle stamped,\ sentM,\ pc,\ LC,\ deliverable,\ received\rangle$

$Step(self) \triangleq$

$\quad \vee\ UpponBCAST(self)$

$\quad \vee\ ReceivedMessage(self)$

$\quad \vee\ ReceivedStamppedMessage(self)$

$\quad \vee\ \text{UNCHANGED } \langle stamped,\ received,\ pc,\ sentM,\ sentTS,\ LC,\ deliverable,\ sequenceNumber\rangle$

$Next \triangleq (\exists\, p \in Processes : Step(p))$

$Spec \triangleq Init \wedge \Box[Next]_{vars}$