—————— MODULE *CausalNetwork* ——————

EXTENDS *Network*, *Naturals*

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VARIABLES
    vc

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$vector \triangleq [Replica \to Nat]$
$initvector \triangleq [r \in Replica \mapsto 0]$

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$Init \triangleq \land NInit$
$\qquad\qquad \land vc = [r \in Replica \mapsto initvector]$

$Broadcast(r, m) \triangleq \land NBroadcast(r, m)$
$\qquad\qquad\qquad\qquad \land vc' = [vc \text{ EXCEPT } ![r][r] = @ + 1]$

$Deliver(r) \triangleq$
$\quad \land incoming[r] \neq EmptyBag$
$\quad \land \exists m \in BagToSet(incoming[r]) :$
$\qquad \land \forall s \in Replica :$
$\qquad\quad \lor m.vc[s] \leq vc[r][s]$
$\qquad\quad \lor s \neq m.r$
$\qquad \land m.vc[m.r] = vc[r][m.r] + 1$
$\qquad \land vc' = [vc \text{ EXCEPT } ![r][m.r] = @ + 1]$
$\qquad \land msg' = [msg \text{ EXCEPT } ![r] = m]$
$\quad \land \text{UNCHANGED } \langle incoming \rangle$

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