─────────────── MODULE *InnerLIFO* ───────────────

EXTENDS *Naturals*, *Sequences*

CONSTANT *Message* Set of messages that are sent but not yet received

VARIABLES *in*, *out*, *q*

$InChan \triangleq$ INSTANCE *Channel* WITH $Data \leftarrow Message, chan \leftarrow in$

$OutChan \triangleq$ INSTANCE *Channel* WITH $Data \leftarrow Message, chan \leftarrow out$

$Init \triangleq \;\land InChan!Init$
$\qquad\quad\; \land OutChan!Init$
$\qquad\quad\; \land q = \langle\rangle$

$TypeInvariant \triangleq \;\land InChan!TypeInvariant$
$\qquad\qquad\qquad\; \land OutChan!TypeInvariant$
$\qquad\qquad\qquad\; \land q \in Seq(Message)$

Send message on channel in
$Sending(msg) \triangleq \;\land InChan!Send(msg)$
$\qquad\qquad\qquad\;\; \land$ UNCHANGED $\langle out, q \rangle$

$BufRcv \triangleq \;\land InChan!Rcv$
$\qquad\qquad\; \land q' = \langle in.val \rangle \circ q$
$\qquad\qquad\; \land$ UNCHANGED out

$BufSend \triangleq \;\land q \neq \langle\rangle$
$\qquad\qquad\;\; \land OutChan!Send(Head(q))$
$\qquad\qquad\;\; \land q' = Tail(q)$
$\qquad\qquad\;\; \land$ UNCHANGED in

$Receiving \triangleq \;\land OutChan!Rcv$
$\qquad\qquad\quad\; \land$ UNCHANGED $\langle in, q \rangle$

$Next \triangleq \;\lor \exists\, msg \in Message : Sending(msg)$
$\qquad\quad\; \lor BufRcv$
$\qquad\quad\; \lor BufSend$
$\qquad\quad\; \lor Receiving$

$Spec \triangleq \; Init \land \quad \Box[Next]_{\langle in,\, out,\, q \rangle}$

THEOREM $Spec \Rightarrow \Box TypeInvariant$

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