MODULE *telephone*

EXTENDS *Sequences*, *TLC*

```
 --algorithm telephone
variables
    to_send = ⟨1, 2, 3⟩,
    received = ⟨⟩,
    in_transit = {},
    can_send = TRUE ;
begin
    while Len(received) ≠ 3 do
          send
        if can_send ∧ to_send ≠ ⟨⟩ then
            in_transit := in_transit ∪ {Head(to_send)} ;
            can_send := FALSE ;
            to_send := Tail(to_send) ;
        end if ;

          receive
        either
            with msg ∈ in_transit do
                received := Append(received, msg) ;
                in_transit := in_transit \ {msg} ;
                either
                    can_send := TRUE ;
                or
                    skip ;
                end either ;
            end with ;
        or
            skip ;
        end either ;
    end while ;

    assert received = ⟨1, 2, 3⟩ ;
end algorithm ;
```

BEGIN TRANSLATION

VARIABLES *to_send*, *received*, *in_transit*, *can_send*, *pc*

$vars \triangleq \langle to\_send, received, in\_transit, can\_send, pc \rangle$

$Init \triangleq$ Global variables
$\land\ to\_send = \langle 1, 2, 3 \rangle$
$\land\ received = \langle \rangle$
$\land\ in\_transit = \{\}$
$\land\ can\_send = \text{TRUE}$

$\land\ pc = \text{“Lbl\_1”}$

$Lbl\_1 \triangleq$ $\land\ pc = \text{“Lbl\_1”}$
$\land$ IF $Len(received) \neq 3$
THEN $\land$ IF $can\_send \land to\_send \neq \langle\rangle$
THEN $\land\ in\_transit' = (in\_transit \cup \{Head(to\_send)\})$
$\land\ can\_send' = \text{FALSE}$
$\land\ to\_send' = Tail(to\_send)$
ELSE $\land$ TRUE
$\land$ UNCHANGED $\langle to\_send,\ in\_transit,\ can\_send\rangle$
$\land\ \lor\ \land\ pc' = \text{“Lbl\_2”}$
$\lor\ \land$ TRUE
$\land\ pc' = \text{“Lbl\_1”}$
ELSE $\land\ Assert(received = \langle 1, 2, 3\rangle,$
“Failure of assertion at line 36, column 5.”)
$\land\ pc' = \text{“Done”}$
$\land$ UNCHANGED $\langle to\_send,\ in\_transit,\ can\_send\rangle$
$\land$ UNCHANGED $received$

$Lbl\_2 \triangleq$ $\land\ pc = \text{“Lbl\_2”}$
$\land\ \exists\, msg \in in\_transit :$
$\land\ received' = Append(received,\ msg)$
$\land\ in\_transit' = in\_transit \setminus \{msg\}$
$\land\ \lor\ \land\ can\_send' = \text{TRUE}$
$\lor\ \land$ TRUE
$\land$ UNCHANGED can_send
$\land\ pc' = \text{“Lbl\_1”}$
$\land$ UNCHANGED to_send

$Next \triangleq$ $Lbl\_1 \lor Lbl\_2$
$\lor$ Disjunct to prevent deadlock on termination
$(pc = \text{“Done”} \land \text{UNCHANGED } vars)$

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

$Termination \triangleq \Diamond(pc = \text{“Done”})$

END TRANSLATION

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