MODULE *a_slidingwindow*

EXTENDS *Integers*, *TLC*

CONSTANTS

@type: *Int*;
l,
@type: *Int*;
n,
@type: *Int*;
NIL

ASSUME $l \geq 0$

VARIABLES

@type: *Int*;
i,
@type: *Int → Int*;
INPUT,
@type: *Int → Int*;
OUTPUT,
@type: *Set(Int)*;
got,
@type: *Set(Int)*;
ack,
@type: *Bool*;
complete,
@type: *Int → Int*;
chan

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actions

$send \triangleq$
$\land\ PrintT(\text{“send”})$
$\land\ PrintT(INPUT)$
$\land\ PrintT(chan)$
$\land\ i \leq n$
$\land\ \exists\, v \in 0\,..\,n : i \leq v \land v \leq i + l \land v \notin got$
$\land$ LET $k \triangleq$ CHOOSE $val \in 0\,..\,n : (val \in i\,..\,i + l \land val \notin got)$
IN
$\land\ chan' = [chan$ EXCEPT $![k] = INPUT[k]]$
$\land$ UNCHANGED $\langle i, INPUT, OUTPUT, got, ack, complete\rangle$

$receive \triangleq$
$\land\ PrintT(\text{“receive”})$
$\land \exists\ j \in 0\,..\,n : j \in i\,..\,i + l \cap 0\,..\,n \land chan[j] \neq NIL$
$\land$ LET $k \triangleq$ CHOOSE $val \in i\,..\,i + l : (chan[val] \neq NIL)$
IN
$\land\ ack' = ack \cup \{k\}$

$\land\ OUTPUT' = [OUTPUT \ \text{EXCEPT}\ ![k] = chan[k]]$
$\land\ \text{UNCHANGED}\ \langle i,\ INPUT,\ got,\ complete,\ chan\rangle$

$receiveack(k) \triangleq$
$\land\ PrintT(\text{“receiveack”})$
$\land\ k \in ack$
$\land\ ack' = ack \setminus \{k\}$
$\land\ got' = got \cup \{k\}$
$\land\ \text{UNCHANGED}\ \langle i,\ INPUT,\ OUTPUT,\ complete,\ chan\rangle$

$completed \triangleq$
$\land\ PrintT(\text{“completed”}) \land complete \neq \text{TRUE} \land i = n + 1 \land got = \{\} \land\ complete' = \text{TRUE}$
$\land\ \text{UNCHANGED}\ \langle i,\ INPUT,\ OUTPUT,\ got,\ ack,\ chan\rangle$

$sliding \triangleq$
$\land\ PrintT(\text{“slide”})$
$\land\ PrintT(i)$
$\land\ got \neq \{\}$
$\land\ i \in got$
$\land\ i + l < n$
$\land\ i' = i + 1$
$\land\ got' = got \setminus \{i\}$
$\land\ ack' = ack \setminus \{i\}$
$\land\ \text{UNCHANGED}\ \langle INPUT,\ OUTPUT,\ complete,\ chan\rangle$

$completesliding \triangleq$
$\land\ got \neq \{\}$
$\land\ i \in got$
$\land\ i + l \geq n$
$\land\ i \leq n$
$\land\ i' = i + 1$
$\land\ got' = got \setminus \{i\}$
$\land\ ack' = ack \setminus \{i\}$
$\land\ \text{UNCHANGED}\ \langle INPUT,\ OUTPUT,\ complete,\ chan\rangle$

$loosingchan \triangleq$
$\land\ PrintT(\text{“loosingchan”})$
$\land\ \exists j \in 0\,..\,n : j \in i\,..\,i + l \land\ chan[j] \neq NIL \land\ j \notin got$
$\land\ \text{LET}\ k \triangleq \text{CHOOSE}\ val \in 0\,..\,n : (val \in i\,..\,i + l \land val \notin got)$
IN
$\land\ chan' = [chan \ \text{EXCEPT}\ ![k] = NIL]$
$\land\ \text{UNCHANGED}\ \langle i,\ INPUT,\ OUTPUT,\ got,\ ack,\ complete\rangle$

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\begin{array}{l}
loosingack \triangleq \\
\quad \land PrintT(\text{“loosingack”}) \\
\quad \land \exists j \in 0 \,..\, n : j \in ack \\
\quad \land \text{LET } k \triangleq \text{CHOOSE } val \in 0 \,..\, n : (val \in ack) \\
\qquad \text{IN} \\
\qquad\quad \land ack' = ack \setminus \{k\} \\
\quad \land \text{UNCHANGED } \langle i, INPUT, OUTPUT, got, complete, chan \rangle \\
\\
skip \triangleq \text{UNCHANGED } \langle i, INPUT, OUTPUT, got, ack, complete, chan \rangle
\end{array}
$$

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\begin{array}{l}
NextNoLoss \triangleq \\
\qquad\quad \lor send \lor receive \\
\qquad\quad \lor (\exists k \in 0 \,..\, n : receiveack(k)) \\
\qquad\quad \lor completed \lor sliding \lor completesliding \lor skip \\
NextLoss \triangleq loosingchan \lor loosingack \\
Next \triangleq NextNoLoss \quad \lor NextLoss \lor \text{UNCHANGED } \langle i, INPUT, OUTPUT, got, ack, complete, chan \rangle
\end{array}
$$

$$
\begin{array}{l}
Init \triangleq \\
\qquad \land i = 0 \\
\qquad \land INPUT = [j \in 0 \,..\, n \mapsto 3 * j] \\
\qquad \land OUTPUT = [j \in 0 \,..\, n \mapsto NIL] \\
\qquad \land got = \{\} \land ack = \{\} \land complete = \text{FALSE} \\
\qquad \land chan = [j \in 0 \,..\, n \mapsto NIL]
\end{array}
$$

$$
\begin{array}{l}
inv0 \triangleq \\
\quad \land (ack \cup got) \subseteq (i \,..\, i + l \cap 0 \,..\, n) \\
\quad \land \forall k \in 0 \,..\, i - 1 : OUTPUT[k] = INPUT[k] \\
inv1 \triangleq (ack \cup got) \subseteq (i \,..\, i + l \cap 0 \,..\, n) \\
inv2 \triangleq \forall k \in 0 \,..\, i - 1 : OUTPUT[k] = INPUT[k]
\end{array}
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\begin{array}{l}
Q1 \triangleq OUTPUT \neq [j \in 0 \,..\, n \mapsto 3 * j] \\
Q2 \triangleq i \neq n + 1 \lor got \neq \{\} \lor ack \neq \{\} \\
Q3 \triangleq i \neq n \\
Q4 \triangleq ack \cap got = \{\} \quad \text{Propriété non valide}
\end{array}
$$

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CInit \triangleq l = 3 \land n = 5 \land NIL = -1
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