MODULE *FHS*

EXTENDS *Integers*

$a \oplus b \triangleq (a + b)\%2$

```
**************************************************************************
--algorithm Handshake{

    variables p = 0, c  = 0;
    process ( Producer = 0 )
      variable tp = 0;
      { pe: while ( TRUE )
              {       tp := c;
                pe1: if ( p ≠ tp ) { goto pe } ;
                put: skip;
                px:  p := p ⊕ 1   }
       }

    process ( Consumer = 1 )
      variable tc = 0;
      { ce: while ( TRUE )
              {       tc := p;
                ce1: if ( c = tc ) { goto ce } ;
                get: skip;
                cx:  c := c ⊕ 1   }
       }
 }
**************************************************************************
```

BEGIN TRANSLATION

VARIABLES p, c, pc, tp, tc

$vars \triangleq \langle p, c, pc, tp, tc\rangle$

$ProcSet \triangleq \{0\} \cup \{1\}$

$Init \triangleq$ Global variables
$\land\ p = 0$
$\land\ c = 0$
Process *Producer*
$\land\ tp = 0$
Process *Consumer*
$\land\ tc = 0$
$\land\ pc = [self \in ProcSet \mapsto \text{CASE } self = 0 \to \text{“pe”}$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \square\ \ self = 1 \to \text{“ce”}]$

$pe \triangleq \land\ pc[0] = \text{“pe”}$
$\qquad\ \land\ tp' = c$

$\land\ pc' = [pc \text{ EXCEPT } ![0] = \text{“pe1”}]$
$\land\ \text{UNCHANGED } \langle p,\ c,\ tc\rangle$

$pe1 \triangleq$ $\land\ pc[0] = \text{“pe1”}$
$\land\ \text{IF } p \neq tp$
THEN $\land\ pc' = [pc \text{ EXCEPT } ![0] = \text{“pe”}]$
ELSE $\land\ pc' = [pc \text{ EXCEPT } ![0] = \text{“put”}]$
$\land\ \text{UNCHANGED } \langle p,\ c,\ tp,\ tc\rangle$

$put \triangleq$ $\land\ pc[0] = \text{“put”}$
$\land\ \text{TRUE}$
$\land\ pc' = [pc \text{ EXCEPT } ![0] = \text{“px”}]$
$\land\ \text{UNCHANGED } \langle p,\ c,\ tp,\ tc\rangle$

$px \triangleq$ $\land\ pc[0] = \text{“px”}$
$\land\ p' = p \oplus 1$
$\land\ pc' = [pc \text{ EXCEPT } ![0] = \text{“pe”}]$
$\land\ \text{UNCHANGED } \langle c,\ tp,\ tc\rangle$

$Producer \triangleq pe \lor pe1 \lor put \lor px$

$ce \triangleq$ $\land\ pc[1] = \text{“ce”}$
$\land\ tc' = p$
$\land\ pc' = [pc \text{ EXCEPT } ![1] = \text{“ce1”}]$
$\land\ \text{UNCHANGED } \langle p,\ c,\ tp\rangle$

$ce1 \triangleq$ $\land\ pc[1] = \text{“ce1”}$
$\land\ \text{IF } c = tc$
THEN $\land\ pc' = [pc \text{ EXCEPT } ![1] = \text{“ce”}]$
ELSE $\land\ pc' = [pc \text{ EXCEPT } ![1] = \text{“get”}]$
$\land\ \text{UNCHANGED } \langle p,\ c,\ tp,\ tc\rangle$

$get \triangleq$ $\land\ pc[1] = \text{“get”}$
$\land\ \text{TRUE}$
$\land\ pc' = [pc \text{ EXCEPT } ![1] = \text{“cx”}]$
$\land\ \text{UNCHANGED } \langle p,\ c,\ tp,\ tc\rangle$

$cx \triangleq$ $\land\ pc[1] = \text{“cx”}$
$\land\ c' = c \oplus 1$
$\land\ pc' = [pc \text{ EXCEPT } ![1] = \text{“ce”}]$
$\land\ \text{UNCHANGED } \langle p,\ tp,\ tc\rangle$

$Consumer \triangleq ce \lor ce1 \lor get \lor cx$

$Next \triangleq Producer \lor Consumer$

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

END TRANSLATION

$$
\begin{array}{l}
pcBar \triangleq [i \in \{0, 1\} \mapsto \text{CASE } i = 0 \to \text{IF } pc[0] = \text{“pe1”} \text{ THEN “pe”} \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \text{ELSE } pc[0] \\
\qquad\qquad\qquad\qquad\quad \square \quad i = i \to \text{IF } pc[1] = \text{“ce1”} \text{ THEN “ce”} \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \text{ELSE } pc[1]]
\end{array}
$$

$$
Alt \triangleq \text{INSTANCE } AltSpec \text{ WITH } b \leftarrow p \oplus c,\ pc \leftarrow pcBar
$$

* Modification History
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