

EXTENDS *Integers*

```
--algorithm OneBitProtocol{
  variable  $x \in \{0, 1\} \rightarrow \text{BOOLEAN}$  ;
  process (  $P \in \{0, 1\}$  )
  {  $r$ : while ( TRUE )
    { either { with (  $v \in \text{BOOLEAN}$  ) {  $x[self] := v$  } ;
      goto  $r$ 
    }
    or skip ;
    e1:  $x[self] := \text{TRUE}$  ;
    e2: if (  $\neg x[1 - self]$  ) {  $cs$ : skip } ;
  }
}
```

BEGIN TRANSLATION

VARIABLES x, pc

$vars \triangleq \langle x, pc \rangle$

$ProcSet \triangleq (\{0, 1\})$

$Init \triangleq$ Global variables

$\wedge x \in \{0, 1\} \rightarrow \text{BOOLEAN}$]
 $\wedge pc = [self \in ProcSet \mapsto "r"]$

$r(self) \triangleq \wedge pc[self] = "r"$
 $\wedge \vee \wedge \exists v \in \text{BOOLEAN} :$
 $\quad x' = [x \text{ EXCEPT } ![self] = v]$
 $\quad \wedge pc' = [pc \text{ EXCEPT } ![self] = "r"]$
 $\vee \wedge \text{TRUE}$
 $\quad \wedge pc' = [pc \text{ EXCEPT } ![self] = "e1"]$
 $\quad \wedge x' = x$

$e1(self) \triangleq \wedge pc[self] = "e1"$
 $\wedge x' = [x \text{ EXCEPT } ![self] = \text{TRUE}]$
 $\wedge pc' = [pc \text{ EXCEPT } ![self] = "e2"]$

$e2(self) \triangleq \wedge pc[self] = "e2"$
 $\wedge \text{IF } \neg x[1 - self]$
 $\quad \text{THEN } \wedge pc' = [pc \text{ EXCEPT } ![self] = "cs"]$
 $\quad \text{ELSE } \wedge pc' = [pc \text{ EXCEPT } ![self] = "r"]$
 $\wedge x' = x$

$cs(self) \triangleq \wedge pc[self] = "cs"$

$$\begin{aligned}
& \wedge \text{TRUE} \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"r"}] \\
& \wedge x' = x \\
P(self) & \triangleq r(self) \vee e1(self) \vee e2(self) \vee cs(self) \\
Next & \triangleq (\exists self \in \{0, 1\} : P(self)) \\
Spec & \triangleq Init \wedge \Box[Next]_{vars} \\
& \text{END TRANSLATION} \\
TypeOK & \triangleq \wedge pc \in [\{0, 1\} \rightarrow \{\text{"r"}, \text{"e1"}, \text{"e2"}, \text{"cs"}\}] \\
& \wedge x \in [\{0, 1\} \rightarrow \text{BOOLEAN}] \\
InCS(i) & \triangleq pc[i] = \text{"cs"} \\
MutualExclusion & \triangleq \neg(InCS(0) \wedge InCS(1)) \\
Inv & \triangleq \wedge TypeOK \\
& \wedge MutualExclusion \\
& \wedge \forall i \in \{0, 1\} : InCS(i) \vee (pc[i] = \text{"e2"}) \Rightarrow x[i]
\end{aligned}$$

\ * Modification History
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