

EXTENDS *Naturals*, *TLC*

```

--algorithm FastMutex
{ variables  $x = 0, y = 0, b = [i \in 1 \dots N \mapsto false]$ ;
process (  $Proc \in 1 \dots N$  )
variable  $j$ ;
{  $ncs$ : skip; The Noncritical Section
start:  $b[self] := true$ ;
lab1:  $x := self$ ;
lab2: if (  $y \neq 0$  ) { lab3:  $b[self] := false$ ;
lab4: await  $y = 0$ ;
goto start } ;
lab5:  $y := self$ ;
lab6: if (  $x \neq self$  ) { lab7:  $b[self] := false$ ;
 $j := 1$ ;
lab8: while (  $j \leq N$  ) { await  $\neg b[j]$ ;
 $j := j + 1$  } ;
lab9: if (  $y \neq self$  ) { lab10: await  $y = 0$ ;
goto start } } ;
cs: skip; The Critical Section
lab11:  $y := 0$ ;
lab12:  $b[self] := false$ ;
goto ncs } }
```

BEGIN TRANSLATION

CONSTANT *defaultInitValue*

VARIABLES x, y, b, pc, j

$vars \triangleq \langle x, y, b, pc, j \rangle$

$ProcSet \triangleq (1 \dots N)$

$Init \triangleq$ Global variables

$\wedge x = 0$

$\wedge y = 0$

$\wedge b = [i \in 1 \dots N \mid \rightarrow false]$

Process *Proc*

$\wedge j = [self \in 1 \dots N \mapsto defaultInitValue]$

$\wedge pc = [self \in ProcSet \mapsto "ncs"]$

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

$\wedge TRUE$

$\wedge pc' = [pc \text{ EXCEPT } ![self] = "start"]$

$\wedge UNCHANGED \langle x, y, b, j \rangle$

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

$$\begin{aligned}
& \wedge b' = [b \text{ EXCEPT } ![self] = true] \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab1"}] \\
& \wedge \text{UNCHANGED } \langle x, y, j \rangle \\
lab1(self) & \triangleq \wedge pc[self] = \text{"lab1"} \\
& \wedge x' = self \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab2"}] \\
& \wedge \text{UNCHANGED } \langle y, b, j \rangle \\
lab2(self) & \triangleq \wedge pc[self] = \text{"lab2"} \\
& \wedge \text{IF } y \neq 0 \\
& \quad \text{THEN } \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab3"}] \\
& \quad \text{ELSE } \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab5"}] \\
& \wedge \text{UNCHANGED } \langle x, y, b, j \rangle \\
lab3(self) & \triangleq \wedge pc[self] = \text{"lab3"} \\
& \wedge b' = [b \text{ EXCEPT } ![self] = false] \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab4"}] \\
& \wedge \text{UNCHANGED } \langle x, y, j \rangle \\
lab4(self) & \triangleq \wedge pc[self] = \text{"lab4"} \\
& \wedge y = 0 \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"start"}] \\
& \wedge \text{UNCHANGED } \langle x, y, b, j \rangle \\
lab5(self) & \triangleq \wedge pc[self] = \text{"lab5"} \\
& \wedge y' = self \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab6"}] \\
& \wedge \text{UNCHANGED } \langle x, b, j \rangle \\
lab6(self) & \triangleq \wedge pc[self] = \text{"lab6"} \\
& \wedge \text{IF } x \neq self \\
& \quad \text{THEN } \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab7"}] \\
& \quad \text{ELSE } \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"cs"}] \\
& \wedge \text{UNCHANGED } \langle x, y, b, j \rangle \\
lab7(self) & \triangleq \wedge pc[self] = \text{"lab7"} \\
& \wedge b' = [b \text{ EXCEPT } ![self] = false] \\
& \wedge j' = [j \text{ EXCEPT } ![self] = 1] \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab8"}] \\
& \wedge \text{UNCHANGED } \langle x, y \rangle \\
lab8(self) & \triangleq \wedge pc[self] = \text{"lab8"} \\
& \wedge \text{IF } j[self] \leq N \\
& \quad \text{THEN } \wedge \neg b[j[self]] \\
& \quad \wedge j' = [j \text{ EXCEPT } ![self] = j[self] + 1] \\
& \quad \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab8"}]
\end{aligned}$$

$$\begin{aligned}
& \text{ELSE } \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab9"}] \\
& \quad \wedge j' = j \\
& \wedge \text{UNCHANGED } \langle x, y, b \rangle \\
lab9(self) & \triangleq \wedge pc[self] = \text{"lab9"} \\
& \wedge \text{IF } y \neq self \\
& \quad \text{THEN } \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab10"}] \\
& \quad \text{ELSE } \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"cs"}] \\
& \wedge \text{UNCHANGED } \langle x, y, b, j \rangle \\
lab10(self) & \triangleq \wedge pc[self] = \text{"lab10"} \\
& \wedge y = 0 \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"start"}] \\
& \wedge \text{UNCHANGED } \langle x, y, b, j \rangle \\
cs(self) & \triangleq \wedge pc[self] = \text{"cs"} \\
& \wedge \text{TRUE} \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab11"}] \\
& \wedge \text{UNCHANGED } \langle x, y, b, j \rangle \\
lab11(self) & \triangleq \wedge pc[self] = \text{"lab11"} \\
& \wedge y' = 0 \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"lab12"}] \\
& \wedge \text{UNCHANGED } \langle x, b, j \rangle \\
lab12(self) & \triangleq \wedge pc[self] = \text{"lab12"} \\
& \wedge b' = [b \text{ EXCEPT } ![self] = false] \\
& \wedge pc' = [pc \text{ EXCEPT } ![self] = \text{"ncs"}] \\
& \wedge \text{UNCHANGED } \langle x, y, j \rangle \\
Proc(self) & \triangleq ncs(self) \vee start(self) \vee lab1(self) \vee lab2(self) \\
& \quad \vee lab3(self) \vee lab4(self) \vee lab5(self) \vee lab6(self) \\
& \quad \vee lab7(self) \vee lab8(self) \vee lab9(self) \vee lab10(self) \\
& \quad \vee cs(self) \vee lab11(self) \vee lab12(self) \\
Next & \triangleq (\exists self \in 1 \dots N : Proc(self)) \\
& \quad \vee \text{Disjunct to prevent deadlock on termination} \\
& \quad ((\forall self \in ProcSet : pc[self] = \text{"Done"}) \wedge \text{UNCHANGED } vars) \\
Spec & \triangleq Init \wedge \Box[Next]_{vars} \\
Termination & \triangleq \Diamond(\forall self \in ProcSet : pc[self] = \text{"Done"}) \\
& \text{END TRANSLATION}
\end{aligned}$$

\ * Modification History
\ * Last modified Thu Mar 29 13:58:04 EDT 2018 by SabraouM

* Created *Mon Mar 26 15:54:05 EDT 2018* by *SabraouM*