
MODULE *apex1_3*

petri10
EXTENDS *Naturals*, *TLC*
CONSTANTS *Places*, *N*, *Q*, *B*
VARIABLES *M*

$t1 \triangleq$
 $\wedge M["p2"] \geq 1 \wedge M["pi"] \geq 1$
 $\wedge M' = [[[M \text{ EXCEPT } !["p1"] = 1]$
 $\text{EXCEPT } !["pi"] = @ - 1]$
 $\text{EXCEPT } !["p2"] = @ - 1]$

$t2 \triangleq$
 $\wedge M["p1"] \geq 1 \wedge M["p5"] < B$
 $\wedge M' = [[[M \text{ EXCEPT } !["p1"] = @ - 1]$
 $\text{EXCEPT } !["p5"] = M["p5"] + 1]$
 $\text{EXCEPT } !["p2"] = 1]$

$t3 \triangleq$
 $\wedge M["p5"] \geq 1 \wedge M["p4"] \geq 1$
 $\wedge M' = [[[M \text{ EXCEPT } !["p3"] = @ + 1]$
 $\text{EXCEPT } !["p5"] = @ - 1]$
 $\text{EXCEPT } !["p4"] = @ - 1]$

$t4 \triangleq$
 $\wedge M["p3"] \geq 1 \wedge M["po"] < Q$
 $\wedge M' = [[[M \text{ EXCEPT } !["p3"] = M["p3"] - 1]$
 $\text{EXCEPT } !["po"] = M["po"] + 1]$
 $\text{EXCEPT } !["p4"] = M["p4"] + 1]$

$Init1 \triangleq M = [p \in Places \mapsto \text{IF } p \in \{"p4", "p2"\} \text{ THEN } 1 \text{ ELSE}$
 $\text{IF } p = "pi" \text{ THEN } N \text{ ELSE } 0]$
 $Init \triangleq Init1$
 $Next \triangleq t1 \vee t2 \vee t3 \vee t4 \vee M' = M$

$TypeInvariant \triangleq \forall p \in Places : M[p] \geq 0$
 $Inv1 \triangleq M["pi"] + M["p5"] + M["po"] + M["p1"] + M["p3"] = N$
 $Inv2 \triangleq M["po"] \leq Q$

$$QInv4 \triangleq M["pi"] + M["p5"] + M["po"] + M["p2"] + M["p4"] = N + 2$$

$$Inv5 \triangleq M["p3"] + M["p4"] + M["p1"] + M["p2"] = 2$$

$$Inv3 \triangleq M["p3"] = 0$$

$$Inv6 \triangleq M["p1"] + M["p2"] = 1$$

$$Question \triangleq M["po"] \neq N$$

$$Safety1 \triangleq M["p2"] \leq 1 \wedge M["p2"] \geq 0$$

$$Check \triangleq Inv6$$

$$safe \triangleq Inv3$$