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MODULE *petri10*

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

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

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

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

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

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$Init1 \triangleq M = [p \in Places \mapsto \text{IF } p \in \{"p4", "p2"\} \text{ THEN } 1 \text{ ELSE}$   
 $\text{ IF } p = "pi" \text{ THEN } N \text{ ELSE } 0]$

$Init \triangleq Init1$   
 $Next \triangleq t1 \vee t2 \vee t3 \vee t4 \vee M' = M$

$Petri \triangleq Init \wedge \Box[Next]_{\langle M \rangle}$

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$TypeInvariant \triangleq \forall p \in Places : M[p] \geq 0$

$Inv1 \triangleq M["pi"] + M["p5"] + M["po"] + M["p1"] + M["p3"] = N$

$Inv2 \triangleq M["po"] \leq Q$

$Inv4 \triangleq M["pi"] + M["p5"] + M["po"] + M["p2"] + M["p4"] = N + 2$   
 $Inv5 \triangleq M["p3"] + M["p4"] + M["p1"] + M["p2"] = 2$

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

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