---- MODULE $appex1\_3$ ----

$petri10$

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

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

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

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

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

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

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

$Inv1 \triangleq M[\text{``pi''}] + M[\text{``p5''}] + M[\text{``po''}] + M[\text{``p1''}] + M[\text{``p3''}] = N$

$Inv2 \triangleq M[\text{``po''}] \leq Q$

1

$Inv4 \triangleq M[\text{``pi''}] + M[\text{``p5''}] + M[\text{``po''}] + M[\text{``p2''}] + M[\text{``p4''}] = N + 2$
$Inv5 \triangleq M[\text{``p3''}] + M[\text{``p4''}] + M[\text{``p1''}] + M[\text{``p2''}] = 2$

$Inv3 \triangleq M[\text{``p3''}] = 0$
$Inv \triangleq TypeInvariant$

$Safety1 \triangleq M[\text{``p2''}] \leq 1 \land M[\text{``p2''}] \geq 0$