

*This form is a summary description of the model entitled “Three-Module Ring” proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together with property files (possibly, one per model instance) giving a set of properties to be checked on the model.*

## Description

- Comment from the submitter: The Petri net is a nice example for a safe Petri net with a reasonably large state space. It originally models a hardware circuit.
- Original description: The net models a three-module ring architecture. The communication architecture contains as many channels as there are modules. It tests the occurrence of global deadlock arising from a local one. It uses pausable clocking scheme on arbitrated input and output channels.

## References

Sohini Dasgupta, from the University of Newcastle

## Scaling parameter

This model is not parameterized.

## Size of the model

number of places: 139  
number of transitions: 87  
number of arcs: 410

## Structural properties

<b>ordinary</b> — <i>all arcs have multiplicity one</i> .....	✓
<b>simple free choice</b> — <i>all (different) transitions with a shared input place have no other input place</i> .....	✗ (a)
<b>state machine</b> — <i>every transition has exactly one input place and exactly one output place</i> .....	✗ (b)
<b>marked graph</b> — <i>every place has exactly one input transition and exactly one output transition</i> .....	✗ (c)
<b>connected</b> — <i>there is an undirected path between every two nodes (places or transitions)</i> .....	✓ (d)
<b>strongly connected</b> — <i>there is a directed path between every two nodes (places or transitions)</i> .....	✓ (e)
<b>source place(s)</b> — <i>one or more places have no input transitions</i> .....	✗ (f)
<b>sink place(s)</b> — <i>one or more places have no output transitions</i> .....	✗ (g)
<b>source transition(s)</b> — <i>one or more transitions have no input places</i> .....	✗ (h)
<b>sink transitions(s)</b> — <i>one or more transitions have no output places</i> .....	✗ (i)
<b>loop-free</b> — <i>no transition has an input place that is also an output place</i> .....	✗ (j)

(a) 105 arcs are not free choice, e.g., the arc from place “P10” (which has 2 outgoing transitions) to transition “T30” (which has 3 input places).

(b) 82 transitions are not of a state machine, e.g., transition “T1”.

(c) 60 places are not of a marked graph, e.g., place “P10”.

(d) stated by [CÆSAR.BDD](#) version 1.7.

(e) stated by [CÆSAR.BDD](#) version 1.7.

(f) stated by [CÆSAR.BDD](#) version 1.7.

(g) stated by [CÆSAR.BDD](#) version 1.7.

(h) stated by [CÆSAR.BDD](#) version 1.7.

(i) stated by [CÆSAR.BDD](#) version 1.7.

(j) 21 transitions are not loop free, e.g., transition “T17”.

- conservative** — for each transition, the number of input arcs equals the number of output arcs ..... X<sup>(k)</sup>  
**subconservative** — for each transition, the number of input arcs equals or exceeds the number of output arcs ..... X<sup>(l)</sup>  
**nested units** — places are structured into hierarchically nested sequential units<sup>(m)</sup> ..... X

## Behavioural properties

- safe** — in every reachable marking, there is no more than one token on a place ..... ✓  
**deadlock** — there exists a reachable marking from which no transition can be fired ..... ?<sup>(n)</sup>  
**reversible** — from every reachable marking, there is a transition path going back to the initial marking ..... ?  
**quasi-live** — for every transition  $t$ , there exists a reachable marking in which  $t$  can fire ..... ?  
**live** — for every transition  $t$ , from every reachable marking, one can reach a marking in which  $t$  can fire ..... ?

## Size of the marking graph

number of reachable markings:	$9.0265 \times 10^{11}$ <sup>(o)</sup>
number of transition firings:	$9.6628E \times 10^{12}$ <sup>(p)</sup>
max. number of tokens per place:	1 <sup>(q)</sup>
max. number of tokens per marking:	61 <sup>(r)</sup>

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<sup>(k)</sup> 56 transitions are not conservative, e.g., transition “T11”.

<sup>(l)</sup> 27 transitions are not subconservative, e.g., transition “T11”.

<sup>(m)</sup> the definition of Nested-Unit Petri Nets (NUPN) is available from <http://mcc.lip6.fr/nupn.php>

<sup>(n)</sup> found to be false at MCC’2014 by GreatSPN.

<sup>(o)</sup> computed at MCC’2013 by ITS-Tools, Marcie, and PNXDD; confirmed at MCC’2014 by GreatSPN, Marcie, PNMC, and PNXDD.

<sup>(p)</sup> computed at MCC’2014 by Marcie.

<sup>(q)</sup> confirmed at MCC’2014 by GreatSPN, Marcie, and PNMC.

<sup>(r)</sup> computed at MCC’2014 at Marcie and PNMC.