

*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

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## 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

**ordinary** — all arcs have multiplicity one ..... ✓  
**simple free choice** — all transitions sharing a common input place have no other input place ..... ✗ (a)  
**extended free choice** — all transitions sharing a common input place have the same input places ..... ✗ (b)  
**state machine** — every transition has exactly one input place and exactly one output place ..... ✗ (c)  
**marked graph** — every place has exactly one input transition and exactly one output transition ..... ✗ (d)  
**connected** — there is an undirected path between every two nodes (places or transitions) ..... ✓ (e)  
**strongly connected** — there is a directed path between every two nodes (places or transitions) ..... ✓ (f)  
**source place(s)** — one or more places have no input transitions ..... ✗ (g)  
**sink place(s)** — one or more places have no output transitions ..... ✗ (h)  
**source transition(s)** — one or more transitions have no input places ..... ✗ (i)  
**sink transitions(s)** — one or more transitions have no output places ..... ✗ (j)

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

(b) transitions “T30” and “T32” share a common input place “P10”, but only the former transition has input place “P3”.

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

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

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

<b>loop-free</b> — no transition has an input place that is also an output place .....	✗ <sup>(k)</sup>
<b>conservative</b> — for each transition, the number of input arcs equals the number of output arcs .....	✗ <sup>(l)</sup>
<b>subconservative</b> — for each transition, the number of input arcs equals or exceeds the number of output arcs .....	✗ <sup>(m)</sup>
<b>nested units</b> — places are structured into hierarchically nested sequential units <sup>(n)</sup> .....	✗

## Behavioural properties

<b>safe</b> — in every reachable marking, there is no more than one token on a place .....	✓
<b>deadlock</b> — there exists a reachable marking from which no transition can be fired .....	? <sup>(o)</sup>
<b>reversible</b> — from every reachable marking, there is a transition path going back to the initial marking .....	?
<b>quasi-live</b> — for every transition $t$ , there exists a reachable marking in which $t$ can fire .....	?
<b>live</b> — 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>(p)</sup>
number of transition firings:	$9.6628E \times 10^{12}$ <sup>(q)</sup>
max. number of tokens per place:	1 <sup>(r)</sup>
max. number of tokens per marking:	61 <sup>(s)</sup>

<sup>(k)</sup> 21 transitions are not loop free, e.g., transition “T17”.

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

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

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

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

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

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

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

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