This form is a summary description of the model entitled “HouseConstruction” 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

This model has been extracted from the petriweb.org repository available at http://www.petriweb.org. According to the provided information, the net was designed by J. L. Peterson, from a PERT chart by F. Levy. The PERT chart contains timing information, which is not accurately translated.

Graphical representation for $N = 2$
References

This model was probably described in: Peterson, James Lyle (1981). Petri Net Theory and the Modeling of Systems. Prentice Hall. ISBN 0-13-661983-5. However, this was not checked, the book being unavailable in our library.

Scaling parameter

<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Parameter description</th>
<th>Chosen parameter values</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N )</td>
<td>initial number of tokens on place p2</td>
<td>2, 5, 10, 20, 50, 100, 200, 500</td>
</tr>
</tbody>
</table>

Size of the model

Although the model is parameterized, its size does not depend on parameter values.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>number of places:</td>
<td>26</td>
</tr>
<tr>
<td>number of transitions:</td>
<td>18</td>
</tr>
<tr>
<td>number of arcs:</td>
<td>51</td>
</tr>
</tbody>
</table>

Structural properties

- **ordinary** — all arcs have multiplicity one
- **simple free choice** — all transitions sharing a common input place have no other input place
- **extended free choice** — all transitions sharing a common input place have the same input places
- **state machine** — every transition has exactly one input place and exactly one output place
- **marked graph** — every place has exactly one input transition and exactly one output transition
- **connected** — there is an undirected path between every two nodes (places or transitions)
- **strongly connected** — there is a directed path between every two nodes (places or transitions)
- **source place(s)** — one or more places have no input transitions
- **sink place(s)** — one or more places have no output transitions
- **source transition(s)** — one or more transitions have no input places
- **sink transition(s)** — one or more transitions have no output places
- **loop-free** — no transition has an input place that is also an output place
- **conservative** — for each transition, the number of input arcs equals the number of output arcs
- **subconservative** — for each transition, the number of input arcs equals or exceeds the number of output arcs
- **nested units** — places are structured into hierarchically nested sequential units

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

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(a) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(b) stated by CÆSAR.BDD version 2.6 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(c) 11 transitions are not of a state machine, e.g., transition “t3”.
(d) place “p1” is not of a marked graph.
(e) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(f) from place “p2” one cannot reach place “p1”.
(g) place “p1” is a source place.
(h) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(i) transition “t18” is a sink transition.
(j) 11 transitions are not conservative, e.g., transition “t3”.
(k) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(l) transition “t18” is a sink transition.
(m) 5 transitions are not subconservative, e.g., transition “t3”.
(n) the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php
(o) in the initial marking, some places have several tokens (the number of which depends on \( N \)).
(p) confirmed at MCC’2014 by Lola and Tapaal on all 8 instances, and by GreatSPN on 4 instances.
reversible — from every reachable marking, there is a transition path going back to the initial marking ..........X
quasi-live — for every transition \( t \), there exists a reachable marking in which \( t \) can fire .........................✓ (q)
live — for every transition \( t \), from every reachable marking, one can reach a marking in which \( t \) can fire .................?

Size of the marking graphs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of reachable markings</th>
<th>Number of transition firings</th>
<th>Max. number of tokens per place</th>
<th>Max. number of tokens per marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N = 2 )</td>
<td>1501(^{(v)})</td>
<td>4780(^{(v)})</td>
<td>2(^{(s)})</td>
<td>12(^{(s)})</td>
</tr>
<tr>
<td>( N = 5 )</td>
<td>1.1880E+6(^{(v)})</td>
<td>7.1911E+6(^{(w)})</td>
<td>5(^{(s)})</td>
<td>30(^{(s)})</td>
</tr>
<tr>
<td>( N = 10 )</td>
<td>1.6636E+9(^{(2)})</td>
<td>1.4808E+10(^{(aa)})</td>
<td>10(^{(ab)})</td>
<td>60(^{(bc)})</td>
</tr>
<tr>
<td>( N = 20 )</td>
<td>1.3666E+13(^{(ad)})</td>
<td>1.6144E+14(^{(ae)})</td>
<td>20(^{(af)})</td>
<td>120(^{(ag)})</td>
</tr>
<tr>
<td>( N = 50 )</td>
<td>1.5682E+19(^{(ah)})</td>
<td>? (^{(ai)})</td>
<td>50(^{(ai)})</td>
<td>300(^{(aj)})</td>
</tr>
</tbody>
</table>

\(^{(q)}\) stated by CÆSAR.BDD version 2.0 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
\(^{(r)}\) computed at MCC’2013 by Alpina, ITS-Tools, Marcie, Neco, and PNXDD; confirmed at MCC’2014 by GreatSPN, Marcie, PNMC, PNXDD, Strategem, and Tapaal.
\(^{(s)}\) computed at MCC’2014 by Marcie.
\(^{(t)}\) computed at MCC’2014 by GreatSPN, Marcie, PNMC, and Tapaal.
\(^{(u)}\) computed at MCC’2014 by GreatSPN, Marcie, PNMC, and Tapaal.
\(^{(v)}\) computed at MCC’2013 by Alpina, ITS-Tools, Marcie, Neco, and PNXDD; exact value: 1 187 984; confirmed at MCC’2014 by GreatSPN, Marcie, PNMC, PNXDD, Strategem, and Tapaal.
\(^{(w)}\) computed at MCC’2014 by Marcie.
\(^{(x)}\) computed at MCC’2014 by GreatSPN, Marcie, PNMC, and Tapaal.
\(^{(y)}\) computed at MCC’2014 by GreatSPN, Marcie, PNMC, and Tapaal.
\(^{(z)}\) computed at MCC’2013 by ITS-Tools, Marcie, and PNXDD; confirmed at MCC’2014 by GreatSPN, Marcie, and PNMC.
\(^{(aa)}\) computed at MCC’2014 by Marcie.
\(^{(ab)}\) computed at MCC’2014 by GreatSPN, Marcie, and PNMC.
\(^{(ac)}\) computed at MCC’2014 by GreatSPN, Marcie, and PNMC.
\(^{(ad)}\) computed at MCC’2013 by ITS-Tools, and Marcie; confirmed at MCC’2014 by GreatSPN, Marcie, and PNMC.
\(^{(ae)}\) computed at MCC’2014 by Marcie.
\(^{(af)}\) computed at MCC’2014 by GreatSPN, Marcie, and PNMC.
\(^{(ag)}\) computed at MCC’2014 by GreatSPN, Marcie, and PNMC.
\(^{(ah)}\) computed at MCC’2014 by GreatSPN.
\(^{(ai)}\) computed at MCC’2014 by GreatSPN.
\(^{(aj)}\) computed at MCC’2014 by GreatSPN.