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.

- number of places: 26
- number of transitions: 18
- number of arcs: 51

Structural properties

- **free choice** — all (different) transitions with a shared input place have no other input place
- **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 a 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

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
- **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

(a) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(b) 11 transitions are not of a state machine, e.g., transition “t3”.
(c) place “p1” is not of a marked graph.
(d) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(e) from place “p2” one cannot reach place “p1”.
(f) place “p1” is a source place.
(g) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(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) stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
(k) 11 transitions are not conservative, e.g., transition “t3”.
(l) 5 transitions are not subconservative, e.g., transition “t3”.
(m) in the initial marking, some places have several tokens (the number of which depends on $N$).
(n) stated by CÆSAR.BDD version 2.0 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
## 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>$N = 1$</td>
<td>66</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>$N = 2$</td>
<td>1501 $^{(o)}$</td>
<td>?</td>
<td>?</td>
<td>$\geq 2$ $^{(p)}$</td>
</tr>
<tr>
<td>$N = 3$</td>
<td>1 187 984 $^{(q)}$</td>
<td>?</td>
<td>?</td>
<td>$\geq 3$</td>
</tr>
<tr>
<td>$N = 10$</td>
<td>$1.664 \times 10^9$ $^{(r)}$</td>
<td>?</td>
<td>?</td>
<td>$\geq 10$</td>
</tr>
<tr>
<td>$N = 20$</td>
<td>$1.367 \times 10^{13}$ $^{(s)}$</td>
<td>?</td>
<td>?</td>
<td>$\geq 20$</td>
</tr>
</tbody>
</table>

(o) Computed by alpina, ITS-Tools, marcie, neco, and pnxdd at MCC’2013.
(p) Lower bound given by the number of initial tokens.
(q) Computed by alpina, ITS-Tools, marcie, neco, and pnxdd at MCC’2013.
(r) Computed by ITS-Tools, marcie, and pnxdd at MCC’2013.
(s) Computed by ITS-Tools, and marcie at MCC’2013.