This form is a summary description of the model entitled “Referendum” 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 simple Petri net models a referendum system where a population is asked to accept a given proposal by voting “yes” or “no”. It was introduced in [1] as an example of combinatorial explosion that could be contained by using Symmetric Nets with Bags (SNB).

![Graphical representation of the Referendum model for V=15.](image)

References


Scaling parameter

<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Parameter description</th>
<th>Chosen parameter values</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V$</td>
<td>the maximum number of voters (in the color domain)</td>
<td>10, 15, 20, 50, 100, 200, 500, 1000</td>
</tr>
</tbody>
</table>

Size of the colored net model

- number of places: 4
- number of transitions: 3
- number of arcs: 6
Size of the derived P/T model instances

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of places</th>
<th>Number of transitions</th>
<th>Number of arcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V = 10$</td>
<td>31</td>
<td>21</td>
<td>51</td>
</tr>
<tr>
<td>$V = 15$</td>
<td>46</td>
<td>31</td>
<td>76</td>
</tr>
<tr>
<td>$V = 20$</td>
<td>61</td>
<td>41</td>
<td>101</td>
</tr>
<tr>
<td>$V = 50$</td>
<td>151</td>
<td>101</td>
<td>251</td>
</tr>
<tr>
<td>$V = 100$</td>
<td>301</td>
<td>201</td>
<td>501</td>
</tr>
<tr>
<td>$V = 200$</td>
<td>601</td>
<td>401</td>
<td>1001</td>
</tr>
<tr>
<td>$V = 500$</td>
<td>1501</td>
<td>1001</td>
<td>2051</td>
</tr>
<tr>
<td>$V = 1000$</td>
<td>3001</td>
<td>2001</td>
<td>5001</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
- reversible — from every reachable marking, there is a transition path going back to the initial marking

(a) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(b) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(c) transition “start_0” is not of a state machine.
(d) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(e) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(f) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(g) place “ready” is a source place.
(h) place “vote_yes” is a sink place.
(i) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(j) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(k) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(l) stated by CAESAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(m) transition “start_0” is not subconservative.
(n) the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php
(o) there is only one token of a given color at most in each colored place; stated by CAESAR.BDD version 2.7 to be true on 5 instance(s) out of 8, and unknown on the remaining 3 instance(s).
(p) tokens accumulate in “vote_yes” or in “voted_no”; stated by CAESAR.BDD version 2.7 to be true on 5 instance(s) out of 8, and unknown on the remaining 3 instance(s).
(q) the marking graph has deadlocks and contains more than one reachable marking; stated by CAESAR.BDD version 2.7 to be false on 5 instance(s) out of 8, and unknown on the remaining 3 instance(s).
quasi-live — for every transition $t$, there exists a reachable marking in which $t$ can fire. .......................... $\checkmark$ (r)

live — for every transition $t$, from every reachable marking, one can reach a marking in which $t$ can fire. .................. $\times$ (s)

## 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>$V = 10$</td>
<td>59,050$^{(1)}$</td>
<td>393,661$^{(2)}$</td>
<td>1</td>
<td>$\in [10, 31]^{(v)}$</td>
</tr>
<tr>
<td>$V = 15$</td>
<td>143,489,908$^{(w)}$</td>
<td>143,489,071$^{(x)}$</td>
<td>1</td>
<td>$\in [15, 46]^{(y)}$</td>
</tr>
<tr>
<td>$V = 20$</td>
<td>$3.48678e+09^{(z)}$</td>
<td>$7.17898e+23^{(aa)}$</td>
<td>1</td>
<td>$\in [20, 61]^{(ab)}$</td>
</tr>
<tr>
<td>$V = 50$</td>
<td>$5.15378e+47^{(ac)}$</td>
<td>$1.43489e+908^{(ad)}$</td>
<td>1</td>
<td>$\in [50, 151]^{(ae)}$</td>
</tr>
<tr>
<td>$V = 100$</td>
<td>$7.17898e+23^{(ab)}$</td>
<td>$5.15378e+47^{(ac)}$</td>
<td>1</td>
<td>$\in [100, 301]^{(ae)}$</td>
</tr>
<tr>
<td>$V = 200$</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>$\geq 200^{(af)}$</td>
</tr>
<tr>
<td>$V = 500$</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>$\geq 500^{(ag)}$</td>
</tr>
<tr>
<td>$V = 1000$</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>$\geq 1000^{(ah)}$</td>
</tr>
</tbody>
</table>

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$^{(1)}$ each transition is reachable from the initial state; stated by CÆSAR.BDD version 2.7 to be true on 5 instance(s) out of 8, and unknown on the remaining 3 instance(s).

$^{(2)}$ the net has at least one transition and its marking graph has deadlocks; stated by CÆSAR.BDD version 2.7 to be false on 5 instance(s) out of 8, and unknown on the remaining 3 instance(s).

$^{(w)}$ computed by Prod in March 2017.

$^{(u)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(v)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(y)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(z)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(a)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(x)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(cc)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(bb)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(aa)}$ lower and upper bounds given by the number of initial tokens and the number of places.

$^{(ab)}$ lower bound given by the number of initial tokens.

$^{(ac)}$ lower bound given by the number of initial tokens.

$^{(ad)}$ lower bound given by the number of initial tokens.

$^{(ae)}$ lower bound given by the number of initial tokens.