*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 votin "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).
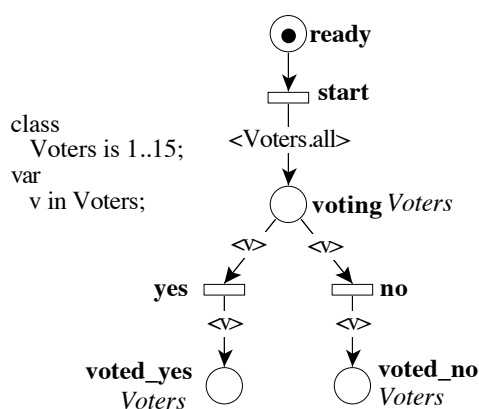
Graphical representation of the Referendum model for V=15.

References

1 S. Haddad, F. Kordon, L. Petrucci, J-F. Pradat-Peyre, and N. Trèves. Efficient State-Based Analysis by Introducing Bags in Petri Net Color Domains. 28th American Control Conference (ACC), pages 5018-5025, Omnipress IEEE Catalog, June 2009

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
V	the maximum number of voters (in the color domain)	10, 15, 20, 50, 100, 200, 500, 1000

Size of the colored net model

number of places: 4
number of transitions: 3
number of arcs: 6

Model: Referendum
Type: Colored Net (with derived P/T Nets)
Origin: Academic

since
MCC 2017

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Size of the derived P/T model instances

Parameter	Number of places	Number of transitions	Number of arcs
$V = 10$	31	21	51
$V = 15$	46	31	76
$V = 20$	61	41	101
$V = 50$	151	101	251
$V = 100$	301	201	501
$V = 200$	601	401	1001
$V = 500$	1501	1001	2051
$V = 1000$	3001	2001	5001

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]

loop-free — *no transition has an input place that is also an output place* .... ✔ [k]

conservative — *for each transition, the number of input arcs equals the number of output arcs* .... ✘ [l]

subconservative — *for each transition, the number of input arcs equals or exceeds the number of output arcs* ...... ✘ [m]

nested units — *places are structured into hierarchically nested sequential units* [n] .... ✘

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* .... ✔ [o]

deadlock — *there exists a reachable marking from which no transition can be fired* .... ✔ [p]

reversible — *from every reachable marking, there is a transition path going back to the initial marking* .... ✘ [q]

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[a] stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).

[b] stated by CÆSAR.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 CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).

[e] stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).

[f] stated by CÆSAR.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 CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).

[j] stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).

[k] stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).

[l] transition "start_0" is not conservative.

[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 CÆSAR.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 CÆSAR.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 CÆSAR.BDD version 2.7 to be false on 5 instance(s) out of 8, and unknown on the remaining 3 instance(s).

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quasi-live — *for every transition t, there exists a reachable marking in which t can fire* .... ✔ [r]
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* .... ✘ [s]

Size of the marking graphs

Parameter	Number of reachable markings	Number of transition firings	Max. number of tokens per place	Max. number of tokens per marking
$V = 10$	$59\,050$ [t]	$393\,661$ [u]	1	$\in [10,\,31]$ [v]
$V = 15$	$14\,348\,908$ [w]	$143\,489\,071$ [x]	1	$\in [15,\,46]$ [y]
$V = 20$	$3.48678e+09$ [z]	?	1	$\in [20,\,61]$ [aa]
$V = 50$	$7.17898e+23$ [ab]	?	1	$\in [50,\,151]$ [ac]
$V = 100$	$5.15378e+47$ [ad]	?	1	$\in [100,\,301]$ [ae]
$V = 200$	?	?	?	≥ 200 [af]
$V = 500$	?	?	?	≥ 500 [ag]
$V = 1000$	?	?	?	≥ 1000 [ah]

[r] 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).

[s] 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).

[t] computed by Prod in March 2017; confirmed by CÆSAR.BDD version 2.7.

[u] computed by Prod in March 2017.

[v] lower and upper bounds given by the number of initial tokens and the number of places.

[w] computed by Prod in March 2017; confirmed by CÆSAR.BDD version 2.7.

[x] computed by Prod in March 2017.

[y] lower and upper bounds given by the number of initial tokens and the number of places.

[z] stated by CÆSAR.BDD version 2.7.

[aa] lower and upper bounds given by the number of initial tokens and the number of places.

[ab] stated by CÆSAR.BDD version 2.7.

[ac] lower and upper bounds given by the number of initial tokens and the number of places.

[ad] stated by CÆSAR.BDD version 2.7.

[ae] lower and upper bounds given by the number of initial tokens and the number of places.

[af] lower bound given by the number of initial tokens.

[ag] lower bound given by the number of initial tokens.

[ah] lower bound given by the number of initial tokens.