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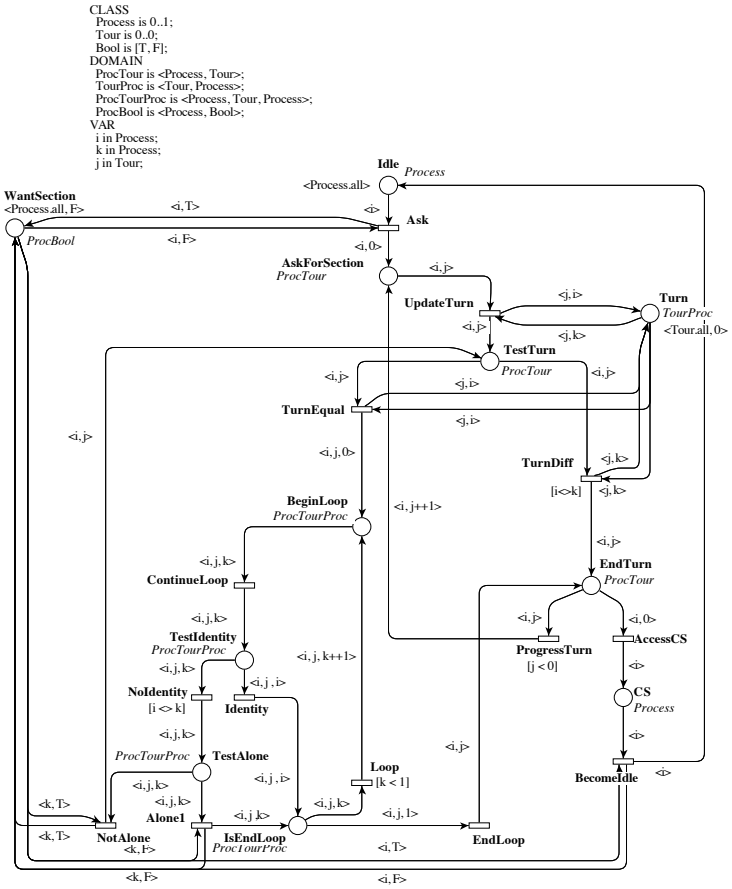
This form is a summary description of the model entitled "Peterson" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together with property files (possibly, one per model instance) giving a set of properties to be checked on the model.

Description

This is a model of the Peterson's algorithm for the mutual exclusion problem, in its generalized version for N processes. This algorithm is based on shared memory communication and uses a loop with N-1 iterations, each iteration is in charge of stopping one of the competing processes.



Graphical representation for $N = 2$

References

http://dblp.uni-trier.de/rec/bibtex/journals/ipl/Peterson81

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Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	N is the number of processes. It has an impact on the initial marking of places Idle, Turn and WantSection. It has, also, an impact on the guards of transitions ProgressTurn and Loop. The color functions between EndTurn and AccessCS, as well as the one between IsEndLoop and EndLoop are impacted.	2, 3, 4, 5, 6, 7

Size of the colored net model

number of places:	11
number of transitions:	14
number of arcs:	42

Size of the derived P/T model instances

Parameter	Number of places	Number of transitions	Number of arcs
$N = 2$	102	126	384
$N = 3$	244	332	1016
$N = 4$	480	690	2120
$N = 5$	834	1242	3828
$N = 6$	1330	2030	6272
$N = 7$	1992	3096	9584

Structural properties

free choice — *all (different) transitions with a shared input place have no other input place* ..... ✗ [a]
state machine — *every transition has exactly one input place and exactly one output place* ..... ✗ [b]
marked graph — *every place has exactly one input transition and exactly one output transition* ..... ✗ [c]
connected — *there is a undirected path between every two nodes (places or transitions)* ..... ✓ [d]
strongly connected — *there is a directed path between every two nodes (places or transitions)* ..... ✓ [e]
source place(s) — *one or more places have no input transitions* ..... ✗ [f]
sink place(s) — *one or more places have no output transitions* ..... ✗ [g]
source transition(s) — *one or more transitions have no input places* ..... ✗ [h]
sink transitions(s) — *one or more transitions have no output places* ..... ✗ [i]
loop-free — *no transition has an input place that is also an output place* ..... ✗ [j]
conservative — *for each transition, the number of input arcs equals the number of output arcs* ..... ✓ [k]
subconservative — *for each transition, the number of input arcs equals or exceeds the number of output arcs* ..... ✓ [l]

[a] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[b] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[c] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[d] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[e] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[f] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[g] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[h] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[i] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[j] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[k] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).
[l] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 6, and 7).

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Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... ✔ [m]
deadlock — *there exists a reachable marking from which no transition can be fired* ..... ✗ [n]
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* ..... ? [o]
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* ..... ?

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
$N = 2$	20 754 [p]	?	1	$\in [8, 102]$ [q]
$N = 3$	3.408×10^6 [r]	?	?	≥ 11 [s]
$N = 4$	6.299×10^8 [t]	?	?	≥ 14
$N = 5$	1.366×10^{11} [u]	?	?	≥ 17
$N = 6$	?	?	?	≥ 20
$N = 7$	?	?	?	≥ 23

[m] stated by CÆSAR.BDD version 2.0 to be true on 1 instance(s) out of 6, and unknown on the remaining 5 instance(s).
[n] stated by CÆSAR.BDD version 2.0 to be false on 1 instance(s) out of 6, and unknown on the remaining 5 instance(s).
[o] found to be true by CÆSAR.BDD version 1.9 on instances 2 and 3.
[p] computed by alpina, ITS-Tools, marcie, neco, and pnxdd at MCC'2013; confirmed by CÆSAR.BDD version 1.8.
[q] lower and upper bounds given by the number of initial tokens and the number of places.
[r] computed by alpina, ITS-Tools, marcie, and pnxdd at MCC'2013; confirmed by CÆSAR.BDD version 1.8.
[s] lower bound given by the number of initial tokens.
[t] computed by ITS-Tools, and pnxdd at MCC'2013.
[u] computed by ITS-Tools at MCC'2013.