> *This form is a summary description of the model entitled "SwimmingPool" 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

In this classical example, the director of a swimming pool has established a protocol to use the pool. The protocol is described as follows:

S_1 A user gets into the building and gets a key for a cabin,

S_2 He then ask for a bag to put his clothes on and then uses the cabin to undress and get his swimming suit,

S_3 He then return the key and can enjoy the swimming pool,

S_4 He gets out the swimming pool and ask for the key of a new cabin,

S_5 He dresses again, and then give back his bag,

S_6 He gives back the key of the cabin and then leaves the building.

The system has a scaling parameter N from which the numbers of cabins, bags, and persons in the swimming pool are deduced. For a given value N, we consider $N \times 10$ cabins, $N \times 15$ bags and $N \times 20$ persons.
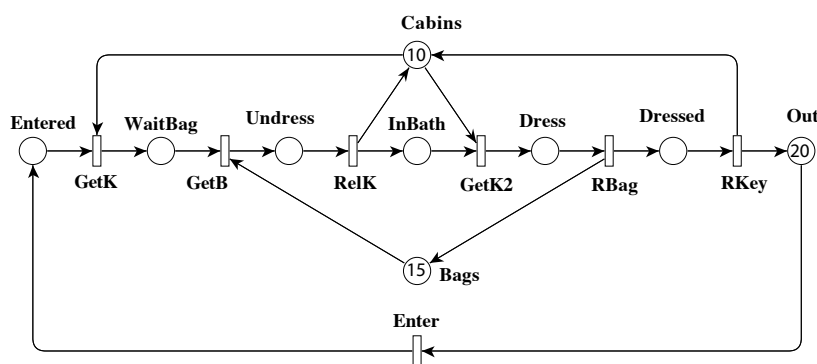
Graphical representation for $N = 1$

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	N, a parameter from which the numbers of cabins, bags, and persons in the pool are deduced. [a].	$N = 1$, $N = 2$, $N = 3$, $N = 4$, $N = 5$, $N = 6$, $N = 7$, $N = 8$, $N = 9$, $N = 10$

Size of the model

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

number of places: 9
number of transitions: 7
number of arcs: 20

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[a] These parameters affect the initial marking and thus do not impact the size of the model.

Model: SwimmingPool
Type: P/T Net
Origin: Academic

since
MCC 2015

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Structural properties

ordinary — *all arcs have multiplicity one* .... ✔

simple free choice — *all transitions sharing a common input place have no other input place* .... ✗ (b)

extended free choice — *all transitions sharing a common input place have the same input places* .... ✗ (c)

state machine — *every transition has exactly one input place and exactly one output place* .... ✗ (d)

marked graph — *every place has exactly one input transition and exactly one output transition* .... ✗ (e)

connected — *there is an undirected path between every two nodes (places or transitions)* .... ✔ (f)

strongly connected — *there is a directed path between every two nodes (places or transitions)* .... ✔ (g)

source place(s) — *one or more places have no input transitions* .... ✗ (h)

sink place(s) — *one or more places have no output transitions* .... ✗ (i)

source transition(s) — *one or more transitions have no input places* .... ✗ (j)

sink transitions(s) — *one or more transitions have no output places* .... ✗ (k)

loop-free — *no transition has an input place that is also an output place* .... ✔ (l)

conservative — *for each transition, the number of input arcs equals the number of output arcs* .... ✗ (m)

subconservative — *for each transition, the number of input arcs equals or exceeds the number of output arcs* ...... ✗ (n)

nested units — *places are structured into hierarchically nested sequential units*[(o)] .... ✗

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* .... ✗ (p)

dead place(s) — *one or more places have no token in any reachable marking* .... ✗ (q)

dead transition(s) — *one or more transitions cannot fire from any reachable marking* .... ?

deadlock — *there exists a reachable marking from which no transition can be fired* .... ✗ (r)

reversible — *from every reachable marking, there is a transition path going back to the initial marking* .... ✔ (s)

live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* .... ?

[(b)] 2 arcs are not simple free choice, e.g., the arc from place "Cabins" (which has 2 outgoing transitions) to transition "GetK" (which has 2 input places).

[(c)] transitions "GetK" and "GetK2" share a common input place "Cabins", but only the former transition has input place "Entered".

[(d)] 6 transitions are not of a state machine, e.g., transition "GetK".

[(e)] place "Cabins" is not of a marked graph.

[(f)] stated by CÆSAR.BDD version 2.2 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(g)] stated by CÆSAR.BDD version 2.2 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(h)] stated by CÆSAR.BDD version 2.2 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(i)] stated by CÆSAR.BDD version 2.2 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(j)] stated by CÆSAR.BDD version 2.2 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(k)] stated by CÆSAR.BDD version 2.2 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(l)] stated by CÆSAR.BDD version 2.2 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(m)] 6 transitions are not conservative, e.g., transition "GetK".

[(n)] 3 transitions are not subconservative, e.g., transition "RelK".

[(o)] the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php

[(p)] By construction of the model (The initial marking is not safe)..

[(q)] stated by CÆSAR.BDD version 3.3 on all 10 instances $(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)$.

[(r)] If there are more bags than cabins only..

[(s)] If there are more bags than cabins only..

generated on June 18, 2022

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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
$N = 1$	$89\,621$ [t]	$450\,003$ [u]	?	≥ 45 [v]
$N = 2$	$3\,408\,031$ [w]	$19\,929\,811$ [x]	?	≥ 90 [y]
$N = 3$	?	?	?	≥ 135 [z]
$N = 4$	?	?	?	≥ 180 [aa]
$N = 5$	?	?	?	≥ 225 [ab]
$N = 6$	?	?	?	≥ 270 [ac]
$N = 7$	?	?	?	≥ 315 [ad]
$N = 8$	?	?	?	≥ 360 [ae]
$N = 9$	?	?	?	≥ 405 [af]
$N = 10$	?	?	?	≥ 450 [ag]

Other properties

If the number of bags is greater than the number of cabins, this model does not exhibit any deadlock. Otherwise, there is a deadlock.

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[t] computed by PROD in December 2014.
[u] computed by PROD in December 2014.
[v] lower bound given by the number of initial tokens.
[w] computed by PROD in December 2014.
[x] computed by PROD in December 2014.
[y] lower bound given by the number of initial tokens.
[z] lower bound given by the number of initial tokens.
[aa] lower bound given by the number of initial tokens.
[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.
[af] lower bound given by the number of initial tokens.
[ag] lower bound given by the number of initial tokens.

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