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This form is a summary description of the model entitled "Dynamic Philosophers" 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.

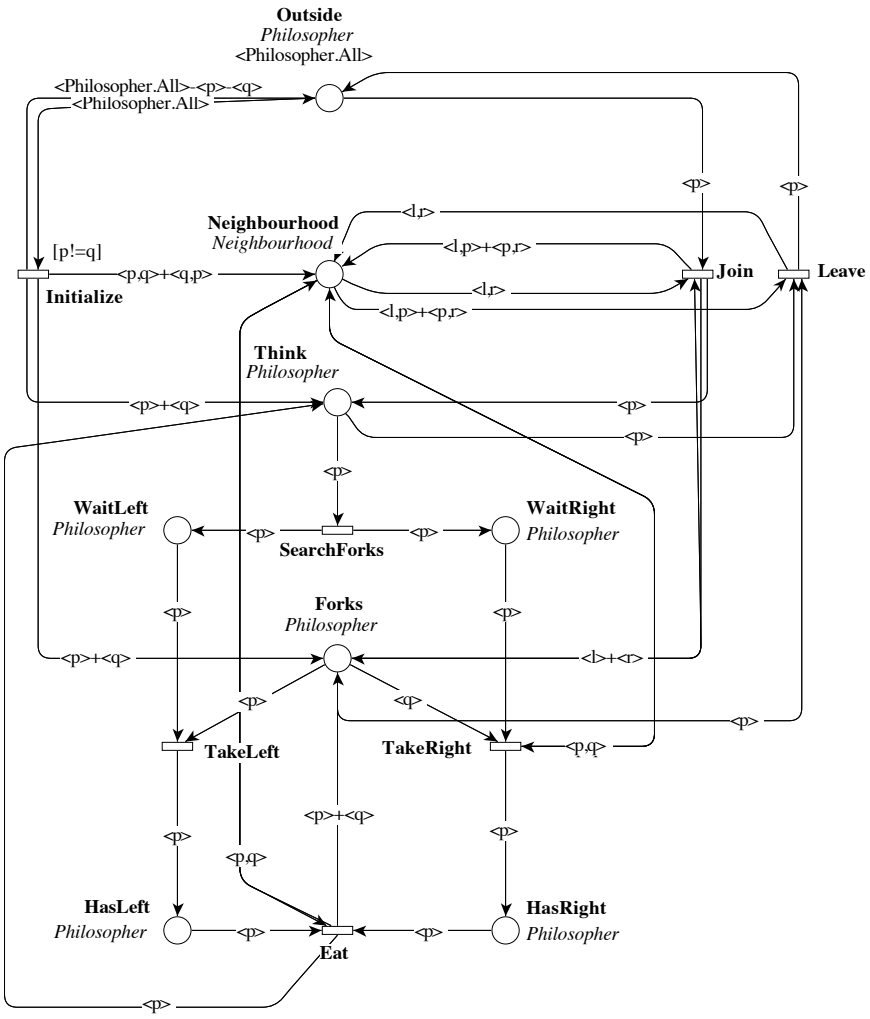
Description

This model is a variation of the Dining Philosophers where philosophers can join or leave the table. Each philosopher has its own fork, as in the usual version. The interesting point is that identifiers of left and right for each philosopher must be computed or stored somewhere.

A philosopher can enter the table only if the two forks around his position are available. He can leave if his fork is free, and he is thinking.

This model has been proposed for CO-OPN, but can be translated to colored nets, and unfolded in Place/Transition nets.

```
Class
  Philosopher is 1..N;
Domain
  Neighbourhood is <Philosopher,Philosopher>;
Var
  p in Philosopher;
  q in Philosopher;
  l in Philosopher;
  r in Philosopher;
```



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References

Chen, A, Buchs, D, Lucio, L, Pedro, L, and Risoldi, M. *Modeling Distributed Systems using Concurrent Object Oriented Petri Nets.* Proceedings of the Fourth International Workshop on Modelling of Objects, Components and Agents, MOCA'06, vol. FBI-HH-B-272, pp. 103–122

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	The maximum number of philosophers	3, 10, 20, 50, 80

Size of the colored net model

number of places:	8
number of transitions:	7
number of arcs:	33

Size of the derived P/T model instances

Parameter	Number of places	Number of transitions	Number of arcs
N	$N^2 + 7N$	$2N^3 + 3N^2 + N$	?
$N = 3$	30	84	564
$N = 10$	170	2310	18190
$N = 20$	540	17220	140780

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 3 instances (3, 10, and 20).
(b) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(c) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(d) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(e) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(f) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(g) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(h) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(i) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(j) stated by CÆSAR.BDD version 1.7 on all 3 instances (3, 10, and 20).
(k) stated by PNML2NUPN 1.3.0 on all 3 instances (3, 10, and 20).
(l) stated by PNML2NUPN 1.3.0 on all 3 instances (3, 10, and 20).

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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* ..... ✔
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* ..... ?

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
$N = 3$	7 251 [n]	?	?	≥ 3 [o]
$N = 10$	199 051 [p]	?	?	≥ 10
$N = 20$	?	?	?	≥ 20

[m] notice that the unfolded place-transition nets contain arcs whose valuation ("inscription" in PNML) is greater than one.
[n] Computed by greatSPN, ITS-Tools, marcie, neco, and pnxdd at MCC'2013.
[o] lower bound given by the number of initial tokens.
[p] Computed by greatSPN, ITS-Tools, marcie and, pnxdd at MCC'2013.