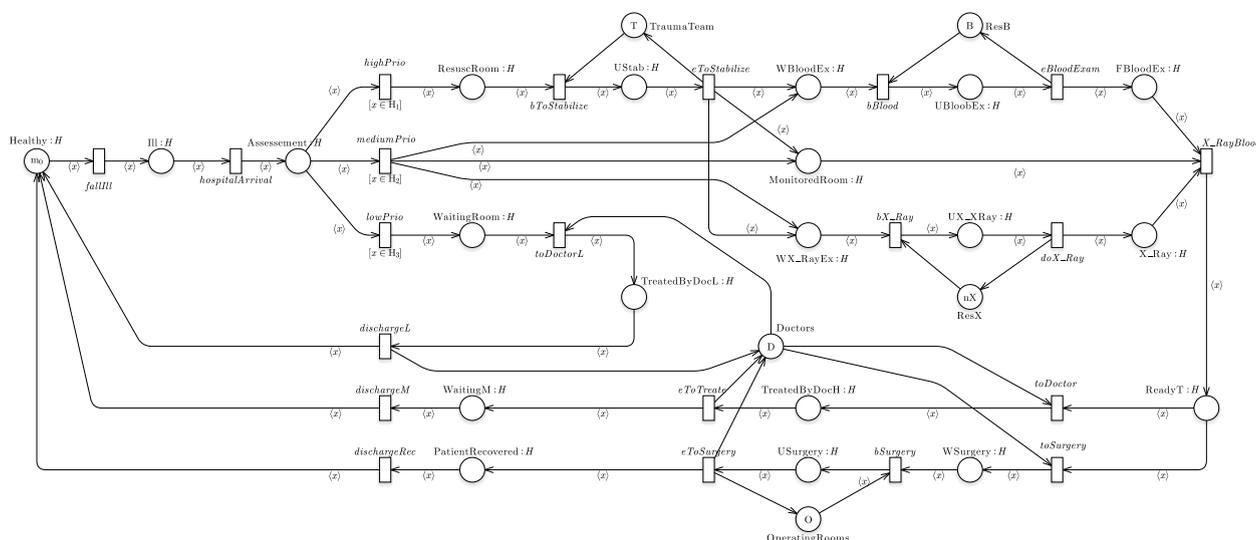


This form is a summary description of the model entitled “HospitalTriage” proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given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

Description

The model represents the workflow of a hospital Emergency Department (ED) [1], described in [2] and [3]. Patients are divided in three categories: patients requiring resuscitation (high priority), patients with major illnesses or injuries (medium priority) and patients with minor illnesses or injuries (low priority). High priority patients go through a stabilization process first. Medium priority patients are immediately admitted to a Monitored room, where the examinations (blood test, X-ray) can be performed by a doctor. Low priority patients stay in a waiting room, and wait the availability of a doctor when no other high priority patients are being treated. Priorities, which were part of the original model, have been dropped in order to obtain a P/T PNML2009 model.



Graphical representation of the Hospital model

References

- [1] G. Balbo, M. Beccuti, M. D. Pierro, and G. Franceschinis. *Computing first passage time distributions in stochastic well-formed nets*. In ICPE'11 - Second Joint WOSP/SIPEW International Conference on Performance Engineering, pages 7-18, Karlsruhe, Germany, March 2011.
- [2] S. Wau Men Au-Yeung. *Response Times in Healthcare Systems*. PhD thesis, Imperial College, London, 2008. pubs.doc.ic.ac.uk/response-times-in-healthcare
- [3] Elvio Gilberto Amparore, Benoit Barbot, Marco Beccuti, Susanna Donatelli, and Giuliana Franceschinis. 2013. *Simulation-based verification of hybrid automata stochastic logic formulas for stochastic symmetric nets*. In Proceedings of the 1st ACM SIGSIM Conference on Principles of Advanced Discrete Simulation (SIGSIM PADS 2013). ACM, pp. 253-264.

Scaling parameter

This model is not parameterized.

Size of the model

number of places: 245
number of transitions: 228
number of arcs: 680

Structural properties

ordinary — *all arcs have multiplicity one* yes
simple free choice — *all transitions sharing a common input place have no other input place* no ^(a)
extended free choice — *all transitions sharing a common input place have the same input places* no ^(b)
state machine — *every transition has exactly one input place and exactly one output place* no ^(c)
marked graph — *every place has exactly one input transition and exactly one output transition* no ^(d)
connected — *there is an undirected path between every two nodes (places or transitions)* yes ^(e)
strongly connected — *there is a directed path between every two nodes (places or transitions)* no ^(f)
source place(s) — *one or more places have no input transitions* yes ^(g)
sink place(s) — *one or more places have no output transitions* no ^(h)
source transition(s) — *one or more transitions have no input places* no ⁽ⁱ⁾
sink transitions(s) — *one or more transitions have no output places* no ^(j)
loop-free — *no transition has an input place that is also an output place* yes ^(k)
conservative — *for each transition, the number of input arcs equals the number of output arcs* no ^(l)
subconservative — *for each transition, the number of input arcs equals or exceeds the number of output arcs* no ^(m)
nested units — *places are structured into hierarchically nested sequential units* ⁽ⁿ⁾ no

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* no ^(o)
dead place(s) — *one or more places have no token in any reachable marking* yes ^(p)
dead transition(s) — *one or more transitions cannot fire from any reachable marking* yes ^(q)
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* ?
live — *for every transition t , from every reachable marking, one can reach a marking in which t can fire* ?

^(a) 108 arcs are not simple free choice, e.g., the arc from place “P31” (which has 2 outgoing transitions) to transition “T58” (which has 2 input places).

^(b) transitions “T216” and “T7” share a common input place “P38”, but only the former transition has input place “P20”.

^(c) 172 transitions are not of a state machine, e.g., transition “T1”.

^(d) 57 places are not of a marked graph, e.g., place “P2”.

^(e) stated by [CÆSAR.BDD](#) version 2.7.

^(f) from place “P2” one cannot reach place “P18”.

^(g) there exist 16 source places, e.g., place “P18”.

^(h) stated by [CÆSAR.BDD](#) version 2.7.

⁽ⁱ⁾ stated by [CÆSAR.BDD](#) version 2.7.

^(j) stated by [CÆSAR.BDD](#) version 2.7.

^(k) stated by [CÆSAR.BDD](#) version 2.7.

^(l) 172 transitions are not conservative, e.g., transition “T1”.

^(m) 76 transitions are not subconservative, e.g., transition “T1”.

⁽ⁿ⁾ the definition of Nested-Unit Petri Nets (NUPN) is available from <http://mcc.lip6.fr/nupn.php>

^(o) in the initial marking, there exist 11 places containing between 2 and 4 tokens.

^(p) 84 places, at least, are never marked, e.g., place “P18”.

^(q) 80 transitions, at least, can never fire, e.g., transition “T2”.

Size of the marking graph

number of reachable markings: ?
number of transition firings: ?
max. number of tokens per place: ?
max. number of tokens per marking: ≥ 37 ^(r)

^(r) lower bound given by the number of initial tokens.