

This form is a summary description of the model entitled “RERS2020” 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

These 9 models were presented as parallel problems at the RERS (Rigorous Examination of Reactive Systems) challenge in 2020. We have used the models of the CTL and LTL parallel challenges (designed by M. Jasper) which exhibit complex behaviour and were solved by only one participant [2]. All these models have a non-trivial NUPN structure.

References

- 1 F. Howar, M. Schordan, B. Steffen. Parallel Problems (overview) of the RERS challenge, 2020, <http://rers-challenge.org/2020/index.php?page=parallelProblemsHead#>.
- 2 See, e.g., <https://cadp.inria.fr/news13.html#section-3>

Scaling parameter

| Parameter name | Parameter description | Chosen parameter values |
|----------------|---|-----------------------------|
| N | each model corresponds to a different problem proposed at RERS 2020 | problems 101, 102, ..., 109 |

Size of the model

| Parameter | Number of places | Number of transitions | Number of arcs | Number of units | HWB code |
|-------------|------------------|-----------------------|----------------|-----------------|----------|
| problem 101 | 906 | 149 363 | 595 952 | 6 | 1-5-36 |
| problem 102 | 1 276 | 125 387 | 499 222 | 8 | 1-7-47 |
| problem 103 | 520 | 31 658 | 125 892 | 9 | 1-8-46 |
| problem 104 | 1 353 | 143 642 | 572 292 | 10 | 1-9-61 |
| problem 105 | 1 982 | 153 412 | 610 156 | 12 | 1-11-73 |
| problem 106 | 2 041 | 125 740 | 498 326 | 13 | 1-12-76 |
| problem 107 | 1 382 | 104 643 | 417 030 | 14 | 1-13-82 |
| problem 108 | 2 339 | 132 214 | 523 950 | 16 | 1-15-94 |
| problem 109 | 1 907 | 151 872 | 605 350 | 17 | 1-16-101 |

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)

(a) stated by [CÆSAR.BDD](#) version 3.7 on all 9 instances (problems 101 to 109).
 (b) stated by [CÆSAR.BDD](#) version 3.7 on all 9 instances (problems 101 to 109).
 (c) stated by [CÆSAR.BDD](#) version 3.7 on all 9 instances (problems 101 to 109).
 (d) stated by [CÆSAR.BDD](#) version 3.7 on all 9 instances (problems 101 to 109).
 (e) stated by [CÆSAR.BDD](#) version 3.7 on all 9 instances (problems 101 to 109).

- 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)
- dead place(s)** — *one or more places have no token in any reachable marking* ?^(p)
- dead transition(s)** — *one or more transitions cannot fire from any reachable marking* ?^(q)
- 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* ?^(t)

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 |
|-------------|------------------------------------|------------------------------|---------------------------------|-----------------------------------|
| problem 101 | 345421 ^(u) | ? | 1 | 5 ^(v) |
| problem 102 | $\geq 1.14736e+07$ ^(w) | ? | 1 ^(x) | 7 ^(y) |
| problem 103 | $6.46576e+07$ ^(z) | ? | 1 | 8 ^(aa) |
| problem 104 | $\geq 3.92045e+06$ ^(ab) | ? | 1 ^(ac) | 9 ^(ad) |
| problem 105 | $\geq 2.96522e+06$ ^(ae) | ? | 1 ^(af) | 11 ^(ag) |
| problem 106 | $\geq 3.75815e+08$ ^(ah) | ? | 1 ^(ai) | 12 ^(aj) |
| problem 107 | $\geq 6.59343e+07$ ^(ak) | ? | 1 ^(al) | 13 ^(am) |
| problem 108 | $\geq 2.61085e+08$ ^(an) | ? | 1 ^(ao) | 15 ^(ap) |
| problem 109 | $\geq 4.82768e+06$ ^(aq) | ? | 1 ^(ar) | 16 ^(as) |

(f) stated by CÆSAR.BDD version 3.7 on all 9 instances (problems 101 to 109).
 (g) stated by CÆSAR.BDD version 3.7 on all 9 instances (problems 101 to 109).
 (h) stated by CÆSAR.BDD version 3.7 to be true on 3 instance(s) out of 9, and false on the remaining 6 instance(s).
 (i) stated by CÆSAR.BDD version 3.7 on all 9 instances (problems 101 to 109).
 (j) stated by CÆSAR.BDD version 3.7 on all 9 instances (problems 101 to 109).
 (k) stated by CÆSAR.BDD version 3.7 on all 9 instances (problems 101 to 109).
 (l) stated by CÆSAR.BDD version 3.7 on all 9 instances (problems 101 to 109).
 (m) stated by CÆSAR.BDD version 3.7 on all 9 instances (problems 101 to 109).
 (n) the definition of Nested-Unit Petri Nets (NUPN) is available from <http://mcc.lip6.fr/nupn.php>
 (o) safe by construction – stated by PNML2NUPN 3.2.0.
 (p) stated by CÆSAR.BDD version 3.7 to be true on 2 instance(s) out of 9, and unknown on the remaining 7 instance(s).
 (q) stated by CÆSAR.BDD version 3.7 to be true on 2 instance(s) out of 9, and unknown on the remaining 7 instance(s).
 (r) stated by CÆSAR.BDD version 3.7 to be true on 1 instance(s) out of 9, false on the remaining 1 instance(s), and unknown on the remaining 7 instance(s).
 (s) stated by CÆSAR.BDD version 3.7 to be false on 1 instance(s) out of 9, and unknown on the remaining 8 instance(s).
 (t) stated by CÆSAR.BDD version 3.7 to be false on 2 instance(s) out of 9, and unknown on the remaining 7 instance(s).
 (u) stated by CÆSAR.BDD version 3.7.
 (v) number of initial tokens, because the net is conservative.
 (w) stated by CÆSAR.BDD version 3.7.
 (x) stated by PNML2NUPN 3.2.0.
 (y) number of initial tokens, because the net is conservative.
 (z) stated by CÆSAR.BDD version 3.7.
 (aa) number of initial tokens, because the net is conservative.
 (ab) stated by CÆSAR.BDD version 3.7.

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- (ac) stated by [PNML2NUPN](#) 3.2.0.
(ad) number of initial tokens, because the net is conservative.
(ae) stated by [CÆSAR.BDD](#) version 3.7.
(af) stated by [PNML2NUPN](#) 3.2.0.
(ag) number of initial tokens, because the net is conservative.
(ah) stated by [CÆSAR.BDD](#) version 3.7.
(ai) stated by [PNML2NUPN](#) 3.2.0.
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(am) number of initial tokens, because the net is conservative.
(an) stated by [CÆSAR.BDD](#) version 3.7.
(ao) stated by [PNML2NUPN](#) 3.2.0.
(ap) number of initial tokens, because the net is conservative.
(aq) stated by [CÆSAR.BDD](#) version 3.7.
(ar) stated by [PNML2NUPN](#) 3.2.0.
(as) number of initial tokens, because the net is conservative.