Model Checking Contest results for 2019

Fabrice Kordon — LIP6, Sorbonne Université, France
Hubert Garavel — Inria/LIG, France
Lom Messan Hillah — LIP6 & Université de Nanterre, France
Francis Hulin-Hubard — LSV, CNRS/ENS de Paris-Saclay, France
Emmanuel Paviot-Adet — LIP6 & Université Paris Descartes, France
Loïg Jézequel — LS2N, Université de Nantes, France

MCC 2019
Objective 1: promoting model checking tools

- Asynchronous systems
- Compare and debug
- Enhance reproducibility of results
- Encourage tools
  - To enhance reliability
  - To increase their features
- Encourage interoperability among tools
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Objective 2: creating a common collection of benchmarks

Objective 1: promoting model checking tools

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- Compare and debug
- Enhance reproducibility of results
- Encourage tools
  - To enhance reliability
  - To increase their features
- Encourage interoperability among tools

Objective 2: creating a common collection of benchmarks


Remark

9 month period = very short!
Fabrice Kordon
(SU)
The MCC Team

Hubert Garavel (Inria)

Fabrice Kordon (SU)

Lom Hillah (UPN)

Managing Models
The MCC Team

Managing Models

Hubert Garavel (Inria)

Managing Execution + analysis

Lom Hillah (UPN)

Fabric Kordon (SU)

Francis Hulin-Hubard (CNRS)
Managing Models

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Managing Formulas

Hubert Garavel (Inria)

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Loïg Jezequel (U. Nantes)

Emmanuel Paviot-Adet (UP5)
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Emmanuel Paviot-Adet
(UP5)
New Models etc.
Categories of Models

- «known» models
  - Those from past years
    - Test the tool as used by its developers

- «Surprise» models
  - New models proposed by the community this year
    - Test the tool as used by «non-expert» of the tool
    - new situations for the tool
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Model ➟ one Petri net, possibly with scaling parameter

Instance ➟ one Petri-net with scaling parameters instantiated
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**Model** ➞ one Petri net, possibly with scaling parameter

**Instance** ➞ one Petri-net with scaling parameters instantiated

---

**Coefficients in 2019**
- 969 «known» instances (x 1)
- 49 «surprise» instances (x 4)
4 New Models for 2019

L. M. Hillah & F. Kordon
- CloudOpsManagement
  - P/T

L. M. Hillah
- FamilyReunion
  - Colored + P/T

W. Serwe & Z. Zhang
- NoC3x3
  - P/T
  - + NUPN

P. Ballarini & B. Barbot
- VehicularWifi
  - Colored only
4 New Models for 2019

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Thanks!!!
We really need different models
Extending the collection of benchmarks every year

- Models
- P/T instances
- Colored instances
- Models with NUPN information
- Total instances (P/T + colored)
Extending the collection of benchmarks every year

Data on the MCC

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9 Editions of MCC — Benchmarks

Extending the collection of benchmarks every year

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This year

115 034 formulas produced
(GlobalProperties, UpperBound, Reachability, CTL, LTL)

Data on the MCC

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<th>% of colored instances</th>
<th>Number of selected instances</th>
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Participating Tools
9 Editions of MCC — Tools over the Years

26 tools

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9 Editions of MCC — Tools over the Years

26 tools

ACTIVITY-LOCAL
Alpina
Crocodile
Cunf
enPAC
GreatSPN-
Helena
Irma
ITS-Tools
LoLA
LTSMin
M4M
MARCIE
neco
PeCan
pnmc
PNXDD
PeTe
Sara
smart
Spot
Stratagem
Tapaal
TINA
Yaspa
ydd-pt

2019
9 tools and variants
+ comparison to 2018 winner
26 tools

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<th>Year</th>
<th>Tools</th>
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<td>2011</td>
<td>ACTIVITY-LOCAL, Alpina, Crocodile, Cunf, enPAC, GreatSPN-meddly, Helena, Irma, ITS-Tools, LoLA, LTSMin, M4M, MARCIE, neco, PeCan, pnmc, PNXDD, PeTe, Sara, smart, Spot, Stratagem, Tapaal, TINA, Yaspa, ydd-pt</td>
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2019
9 tools and variants + comparison to 2018 winner

All VMs published
For reproducibility
## Tools and Techniques Reported in 2019

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Examinations
Examinations

- **StateSpace**
- **GlobalProperties**
  - Reachability/Deadlock
- **UpperBound** → new in 2019
- **Reachability**
  - Reachability/Cardinality → atomic propositions refer to tokens
  - Reachability/Fireability → atomic propositions refer to firing
- **CTL**
  - CTL/Cardinality → atomic propositions refer to tokens
  - CTL/Fireability → atomic propositions refer to firing
- **LTL**
  - LTL/Cardinality → atomic propositions refer to tokens
  - LTL/Fireability → atomic propositions refer to firing
### Tools improve every year

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<td>4</td>
<td>4</td>
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</tr>
</tbody>
</table>

**Answered examinations**

|                  | 15.60% | 22.22% | 26.30% | 40.47% | —     |
Schedule & Tool confidence
Submissions & timing

~February 15, delivery of disk images

Qualification phase

Completed by early May

~37 000 test runs

Mach 10, starting to operate tools

91 619 runs distributed on 4 different machines over Europe

VM with 4 cores / 16GB

ITS-Tools, ITS-Tools.M, LoLa, LTSMIn, Tapaal

VM with 1 core / 16 GB

enPAC, GreatSPN-meddly, smart, TINA.tedd

Time confinement, 1h

Only physical cores allocated to VMs

March 25, feedback sent to developers about their tool
Late march, consolidation + analysis of outcomes

- 25 GB of logs and CSV files
  - Post analysis = ~18KLOC Ada + ~800 LOC bash

Analysis process

- Pass 1, computing results for the majority in a «line»
  - All tools for an examination for a model instance
- Pass 2, evaluating tool confidence
  - Only considering values with a large majority
- Pass 3, reconstructing the results using tool confidence
  - Help to decide when only 2 different answers
  - A result must be of confidence 0.98 or more (0.97 in 2018)
  - Some results are tagged «insecure»
- Pass 4 computing scores
  - «Insecure» results not considered when counting points
About Analysis of Outputs

Late march, consolidation + analysis of outcomes

- 25 GB of logs and CSV files
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Scoring (normalization)
per examination, [102..204] points

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- «insecure» results not considered when counting points

Scoring (normalization) per examination, [102..204] points

Award
- Fastest
- Small footprint
Late march, consolidation + analysis of outcomes

- 25 GB of logs and CSV files
  - Post analysis: ~18KLOC Ada + ~800 LOC bash

Analysis process

- Pass 1, computing results for the majority in a «line»
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  - «insecure» results not considered when counting points

Scoring (normalization)

per examination, [102..204] points

Award

- Fastest
- Small footprint

Penalty for mistakes

Twice the score for a good value
Consistency checks

Colored versus equivalent P/T nets

Computing the “confidence rate”

Section III.2 in http://mcc.lip6.fr/rules.php

Computing $V$, the set of values with a majority of 3 or more tools

For each tool $t$, selecting $V_t$, the values computed $\in V$

For each tool $t$, selecting $V_{tt}$, the correct values computed $\in V_t$

Confidence rate $= \frac{|V_{tt}|}{|V_t|}$
<table>
<thead>
<tr>
<th>Tools</th>
<th>Confidence</th>
<th>success</th>
<th>selected</th>
<th>Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>enPAC</td>
<td>85.63 %</td>
<td>2313</td>
<td>2701</td>
<td>3 StateSpace, LTLCardinality, LTLFireability</td>
</tr>
<tr>
<td>GreatSPN</td>
<td>100.00 %</td>
<td>32525</td>
<td>32525</td>
<td>7 StateSpace, GlobalProperties, UpperBounds</td>
</tr>
<tr>
<td>smart</td>
<td>100.00 %</td>
<td>6725</td>
<td>6725</td>
<td>2 StateSpace, UpperBounds</td>
</tr>
<tr>
<td>TINA.tedd</td>
<td>100.00 %</td>
<td>2284</td>
<td>2284</td>
<td>1 StateSpace</td>
</tr>
<tr>
<td>ITS-Tools</td>
<td>100.00 %</td>
<td>63174</td>
<td>63174</td>
<td>9 StateSpace, GlobalProperties, UpperBounds</td>
</tr>
<tr>
<td>ITS-Tools.M</td>
<td>99.95 %</td>
<td>61558</td>
<td>61585</td>
<td>9 StateSpace, GlobalProperties, UpperBounds</td>
</tr>
<tr>
<td>LoLA</td>
<td>99.99 %</td>
<td>85034</td>
<td>85039</td>
<td>8 GlobalProperties, UpperBounds</td>
</tr>
<tr>
<td>LTSMin</td>
<td>100.00 %</td>
<td>1086</td>
<td>1086</td>
<td>2 StateSpace, UpperBounds</td>
</tr>
<tr>
<td>Tapaal</td>
<td>100.00 %</td>
<td>66462</td>
<td>66462</td>
<td>7 StateSpace, GlobalProperties, UpperBounds</td>
</tr>
<tr>
<td>2018-Gold</td>
<td>99.99 %</td>
<td>88922</td>
<td>88926</td>
<td>7 StateSpace, GlobalProperties, UpperBounds</td>
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</tbody>
</table>
8 Editions of MCC — evolution of confidence

Evolution of the confidence since it was introduced

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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</thead>
<tbody>
<tr>
<td>smallest confidence</td>
<td>62.30 %</td>
<td>37.40 %</td>
<td>79.59 %</td>
<td>99.71 %</td>
<td>85.53 %</td>
</tr>
<tr>
<td>average confidence</td>
<td>89.65 %</td>
<td>94.20 %</td>
<td>97.34 %</td>
<td>99.97 %</td>
<td>98.55 %</td>
</tr>
<tr>
<td>highest confidence</td>
<td>100 %</td>
<td>99.99 %</td>
<td>100 %</td>
<td>100 %</td>
<td>100.00 %</td>
</tr>
</tbody>
</table>
Evolution of the confidence since it was introduced

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<th></th>
<th>2015</th>
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<td>100%</td>
<td>99.99%</td>
<td>100%</td>
<td>100%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Tools are improving
Industrial quality!
### Computing Results in 2019

<table>
<thead>
<tr>
<th></th>
<th>Caserta</th>
<th>Ebro</th>
<th>Octoginta-2</th>
<th>Small (root) (cluster)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical cores</td>
<td>96 @ 2.2GHz</td>
<td>32 @ 2.7GHz</td>
<td>80 @ 2.4GHz</td>
<td>13x12 @ 2.4GHz</td>
<td>-</td>
</tr>
<tr>
<td>Memory (GB)</td>
<td>2048</td>
<td>1024</td>
<td>1536</td>
<td>13x64</td>
<td>-</td>
</tr>
<tr>
<td>Cores (1 per VM) for sequential tools</td>
<td>95 VM in // 95</td>
<td>31 VM in // 31</td>
<td>7 VM in // 7</td>
<td>13x3 VM // 13x3</td>
<td>-</td>
</tr>
<tr>
<td>Cores (4 per VM) for parallel tools</td>
<td>92 VM in // 23</td>
<td>28 VM in // 28</td>
<td>4 VM in // 4</td>
<td>13x2 VM // 13x8</td>
<td>-</td>
</tr>
<tr>
<td>Number of runs</td>
<td>28 548</td>
<td>8 819</td>
<td>27 432</td>
<td>26 820</td>
<td>91 619</td>
</tr>
<tr>
<td>Total CPU required</td>
<td>604d, 3h, 48m, 27s</td>
<td>117d, 0h, 57m, 18s</td>
<td>573d, 13h, 56m, 15s</td>
<td>518d, 3h, 32m, 34s</td>
<td>1812d, 22h, 14m, 34s</td>
</tr>
</tbody>
</table>

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**Caserta**
- **Physical cores**: 96 @ 2.2GHz, 32 @ 2.7GHz, 80 @ 2.4GHz, 13x12 @ 2.4GHz
- **Memory (GB)**: 2048, 1024, 1536, 13x64
- **Cores (1 per VM)**: 95 VM in // 95, 31 VM in // 31, 7 VM in // 7, 13x3 VM // 13x3
- **Cores (4 per VM)**: 92 VM in // 23, 28 VM in // 28, 4 VM in // 4, 13x2 VM // 13x8
- **Number of runs**: 28 548, 8 819, 27 432, 26 820
- **Total CPU required**: 604d, 3h, 48m, 27s, 117d, 0h, 57m, 18s, 573d, 13h, 56m, 15s, 518d, 3h, 32m, 34s
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<td>7</td>
<td>13x3</td>
<td>-</td>
</tr>
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<td>-</td>
</tr>
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<td>20</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>About 4 years, 11 months and 17 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time spent to complete benchmarks</strong></td>
<td></td>
<td></td>
<td></td>
<td>about 21 days</td>
<td></td>
</tr>
<tr>
<td><strong>VM boot time of VMs + management (overhead)</strong></td>
<td></td>
<td></td>
<td></td>
<td>About 8d, 21h (Included in total CPU)</td>
<td></td>
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<table>
<thead>
<tr>
<th>CPU Cores (4 per VM)</th>
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<td>for parallel tools</td>
<td>32 @ 2.7GHz</td>
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<td>31</td>
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<td>-</td>
<td>-</td>
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<table>
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<th>Small (root)</th>
<th>Total</th>
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- More CPU than in 2018
- But fewer runs this year

### Key Metrics

- **Total CPU:** About 4 years, 11 months and 17 days
- **Time spent to complete benchmarks:** about 21 days
- **VM boot time of VMs + management (overhead):** About 8d, 21h (Included in total CPU)
Computing Results in 2019

More CPU than in 2018
But fewer runs this year

Thank you very much

Université de Genève
University of Twente
Rostock University
Université Nanterre
Sorbonne Université
StateSpace Examination

- ITS-Tools
- ITS-Tools.M
- LTSMin
- Tapaal
- enPAC
- GreatSPN
- smart
- TINA.tedd
- 2018-Gold
- BVS

Legend:
- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored
StateSpace Examination

<table>
<thead>
<tr>
<th>StateSpace</th>
<th>confidence</th>
<th>success</th>
<th>selected</th>
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<tbody>
<tr>
<td>enPAC</td>
<td>78.31 %</td>
<td>65</td>
<td>83</td>
</tr>
<tr>
<td>LTSMin</td>
<td>100.00 %</td>
<td>1086</td>
<td>1086</td>
</tr>
<tr>
<td>Tapaal</td>
<td>100.00 %</td>
<td>645</td>
<td>645</td>
</tr>
<tr>
<td>ITS-Tools</td>
<td>100.00 %</td>
<td>1482</td>
<td>1482</td>
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<tr>
<td>ITS-Tools.M</td>
<td>100.00 %</td>
<td>1373</td>
<td>1373</td>
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<tr>
<td>GreatSPN</td>
<td>100.00 %</td>
<td>2260</td>
<td>2260</td>
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<tr>
<td>smart</td>
<td>100.00 %</td>
<td>1212</td>
<td>1212</td>
</tr>
<tr>
<td>TINA.tedd</td>
<td>100.00 %</td>
<td>2284</td>
<td>2284</td>
</tr>
<tr>
<td>2018-Gold</td>
<td>100.00 %</td>
<td>2129</td>
<td>2129</td>
</tr>
</tbody>
</table>
Global Properties Examination

![Bar chart showing the comparison of different tools for Global Properties Examination.

- **ITS-Tools**
- **ITS-Tools.M**
- **LoLA**
- **Tapaal**
- **GreatSPN**
- **2018-Gold**
- **BVS**

Legend:
- Yellow: Surprise&P/T
- Red: Surprise&Colored
- Orange: Known&P/T
- Pink: Known&Colored

The chart indicates the performance or results of these tools in the examination, with the vertical axis representing the number of results or measurements.
Global Properties Examination

- ITS-Tools
- ITS-Tools.M
- LoLA
- Tapaal
- GreatSPN
- 2018-Gold
- BVS

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored
Global Properties Examination

UpperBound  | confidence | success | selected |
------------|------------|---------|----------|
Tapaal      | 100.00 %   | 719     | 719      |
LoLA        | 100.00 %   | 620     | 620      |
ITS-Tools   | 100.00 %   | 728     | 728      |
ITS-Tools.M | 100.00 %   | 739     | 739      |
GreatSPN    | 100.00 %   | 438     | 438      |
UpperBound Examination

- ITS-Tools
- ITS-Tools.M
- LoLA
- LTSMin
- Tapaal
- GreatSPN
- smart
- 2018-Gold
- BVS

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored
UpperBound Examination

- ITS-Tools
- ITS-Tools.M
- LoLA
- LTSMin
- Tapaal
- GreatSPN
- smart
- 2018-Gold
- BVS

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Gold-2018
Gold-2018
UpperBound Examination

<table>
<thead>
<tr>
<th>UpperBound</th>
<th>confidence</th>
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<th>selected</th>
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</thead>
<tbody>
<tr>
<td>LTSMin</td>
<td>100,00 %</td>
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<td>6267</td>
</tr>
<tr>
<td>Tapaal</td>
<td>100,00 %</td>
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<td>13156</td>
</tr>
<tr>
<td>LoLA</td>
<td>100,00 %</td>
<td>12575</td>
<td>12575</td>
</tr>
<tr>
<td>ITS-Tools</td>
<td>100,00 %</td>
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<td>8048</td>
</tr>
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<td>99,90 %</td>
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<td>8769</td>
</tr>
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<td>8936</td>
</tr>
<tr>
<td>smart</td>
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<td>5513</td>
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<tr>
<td>Gold-2018</td>
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</tbody>
</table>
Reachability Examinations

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Tools:
- ITS-Tools
- ITS-Tools.M
- LoLA
- Tapaal
- GreatSPN
- 2018-Gold
- BVS
Reachability Examinations

- ITS-Tools
- ITS-Tools.M
- LoLA
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- GreatSPN
- 2018-Gold
- BVS

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Bar chart showing the performance of various tools in reachability examinations.
Reachability Examinations

Surprise&P/T
Surprise&Colored
Known&P/T
Known&Colored

ITS-Tools
ITS-Tools.M
LoLA
Tapaal
GreatSPN
2018-Gold
BVS
Reachability Examinations

<table>
<thead>
<tr>
<th>Tool</th>
<th>Confidence</th>
<th>Success</th>
<th>Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapaal</td>
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<td>28370</td>
<td>28370</td>
</tr>
<tr>
<td>LoLA</td>
<td>99,98 %</td>
<td>26915</td>
<td>26918</td>
</tr>
<tr>
<td>ITS-Tools</td>
<td>100,00 %</td>
<td>20072</td>
<td>20072</td>
</tr>
<tr>
<td>ITS-Tools.M</td>
<td>99,97 %</td>
<td>18784</td>
<td>18789</td>
</tr>
<tr>
<td>GreatSPN</td>
<td>100,00 %</td>
<td>10546</td>
<td>10546</td>
</tr>
<tr>
<td>2018-Gold</td>
<td>100,00 %</td>
<td>28377</td>
<td>28377</td>
</tr>
</tbody>
</table>
CTL Examinations

- ITS-Tools
- ITS-Tools.M
- LoLA
- Tapaal
- GreatSPN
- 2018-Gold
- BVS

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored
CTL Examinations

- ITS-Tools
- ITS-Tools.M
- LoLa
- Tapaal
- GreatSPN
- 2018-Gold
- BVS

- Surprise&P/T
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- Known&P/T
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CTL Examinations

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- LoLA
- Tapaal
- GreatSPN
- 2018-Gold
- BVS

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored
CTL Examinations

<table>
<thead>
<tr>
<th>CTL</th>
<th>confidence</th>
<th>success</th>
<th>selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapaal</td>
<td>99,99 %</td>
<td>23572</td>
<td>23573</td>
</tr>
<tr>
<td>LoLA</td>
<td>99,99 %</td>
<td>12751</td>
<td>12756</td>
</tr>
<tr>
<td>ITS-Tools</td>
<td>100,00 %</td>
<td>11044</td>
<td>11044</td>
</tr>
<tr>
<td>ITS-Tools.M</td>
<td>99,99 %</td>
<td>11829</td>
<td>11832</td>
</tr>
<tr>
<td>GreatSPN</td>
<td>100,00 %</td>
<td>10345</td>
<td>10345</td>
</tr>
<tr>
<td>Gold-2018</td>
<td>99,97 %</td>
<td>23566</td>
<td>23573</td>
</tr>
</tbody>
</table>
LTL Examinations

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Bar chart showing comparisons among ITS-Tools, ITS-Tools,M, LoLA, enPAC, 2018-Gold, and BVS.
LTL Examinations

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Bar chart showing the performance of different tools in various categories.
LTL Examinations

- ITS-Tools
- ITS-Tools.M
- LoLA
- enPAC
- 2018-Gold
- BVS

- Surprise&P/T
- Surprise&Colored
- Known&P/T
- Known&Colored

Gold-2018
Gold-2018
LTL Examinations

- **enPAC**: 85.87% confidence, 2248 success, 2618 selected
- **LoLA**: 99.99% confidence, 22163 success, 22164 selected
- **ITS-Tools**: 100.00% confidence, 21800 success, 21800 selected
- **ITS-Tools.M**: 100.00% confidence, 20073 success, 20073 selected
- **Gold-2018**: 99.98% confidence, 22303 success, 22306 selected
Conclusive remarks
Many generated web pages (more than 85K in 2018)
F. Kordon — Sorbonne Université — CC2019

Many generated web pages (more than 85K in 2018)

Detailed HTML Report

Model Checking Contest 2018
8th edition, Bratislava, Slovakia, June 26, 2018

Execution of r284-csrt-152749174900307

Model Checking Contest 2018
8th edition, Bratislava, Slovakia, June 26, 2018

Execution of r284-csrt-152749174900307

About the Execution of ITS-Tools for NQueens-PT-05

Execution Summary

<table>
<thead>
<tr>
<th>Method</th>
<th>Used Memory (MB)</th>
<th>Time Wait (ms)</th>
<th>CPU Usage (ms)</th>
<th>I/O Wait (ms)</th>
<th>Result</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTSMin</td>
<td>157.70</td>
<td>2367.00</td>
<td>5170.00</td>
<td>68.20</td>
<td>GOOD</td>
<td>normal</td>
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<tr>
<td>Tapaal</td>
<td>166</td>
<td>166</td>
<td>166</td>
<td>166</td>
<td>166</td>
<td>normal</td>
</tr>
<tr>
<td>LoLA</td>
<td>166</td>
<td>166</td>
<td>166</td>
<td>166</td>
<td>166</td>
<td>normal</td>
</tr>
</tbody>
</table>

Execution Chart

We display below the execution chart for this examination (boot time has been removed).

Resources Consumption for ITS-Tools
StateSpace on NQueens-PT-05

![Graph showing resource consumption over time]
Many generated web pages (more than 85K in 2018)

Some statistics are displayed below, based on 1894 runs (947 for GreatSPN and 947 for M4M.struct, so there are 947 plots on each of the two charts). Each performance chart comparing GreatSPN to M4M.struct are shown (you may click on one graph to enlarge it).

Statistics on the execution

<table>
<thead>
<tr>
<th>All computed OK</th>
<th>GreatSPN = M4M.struct</th>
<th>GreatSPN &gt; M4M.struct</th>
<th>GreatSPN &lt; M4M.struct</th>
<th>Do not compute</th>
<th>Error detected</th>
<th>Cannot Compute + Time-out</th>
</tr>
</thead>
<tbody>
<tr>
<td>GreatSPN</td>
<td>346</td>
<td>8</td>
<td>169</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M4M.struct</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Times tool wins

- GreatSPN: Smallest Memory Footprint: 568
- M4M.struct: Shortest Execution Time: 24

On the chart below, ◊ denote cases where the two tools did computed all results without error, ◊ denote cases where the two tool did computed the same number of values (but not of values in the examination), ▲ denote cases where GreatSPN computed more values than M4M.struct, ▼ denote cases where GreatSPN computed less values than M4M.struct, ◊ denote the cases where at least one tool did not computed, ◊ denote the cases where at least one tool computed a bad value and □ denote the cases where at least one tool stated it could not compute a result or timed-out.

GreatSPN wins when points are below the diagonal, M4M.struct wins when points are above the diagonal.
Numerous generated charts (88 867 in 2018)
Numerous generated charts (88,867 in 2018)
Numerous generated charts (88 867 in 2018)
Numerous generated charts (88,867 in 2018)
Generated Charts

Numerous generated charts (88,867 in 2018)

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EPS available on demand

Kindly cite the MCC (see bibtex at mcc.lip6.fr)
Next year?

- Handling some rare bugs in models
  - Unexpected infinite instances in RefineWG

- Improving verdicts
  - Instance-based verdict

- Best Virtual Tool
  - Better measure than Best Virtual Score tool
Next year?

- Handling some rare bugs in models
  - Unexpected infinite instances in RefineWG
- Improving verdicts
  - Instance-based verdict
- Best Virtual Tool
  - Better measure than Best Virtual Score tool
- Lessons learnt, 6 weeks was too short for running MCC
  - 15 months until the next edition
And now...
let’s have time for discussion