SAT Competition 2017
Overview and Results

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SAT Solver Competitions

Goals

- identify new challenging benchmarks
- promote SAT solvers & their development
- “snapshot” evaluation of current solvers

Long tradition, starting from 1992

- 3 competitions in the 90s (1992, 1993, 1996)
- 11 SAT Competitions (2002–)
- 1 SAT Challenge (2012)
Key rules

- Certified UNSAT using DRAT proof logging
- Disqualification of buggy solvers
  - Provided model incorrect
  - Report UNSAT on know-to-be-satisfiable instance
  - Proof check fails on UNSAT instance → “timeout”
    transition-period rule, will likely be changed
- Mandatory solver descriptions + open source
New for 2017

- Ranking scheme: PAR-2
  - Favors solvers that are faster (not only count solved instances)
- BYOB — Bring your own beer benchmarks
  - Each submitter must submit 20 benchmarks
- Proofs of unsatisfiability certified by a theorem prover
  - Proofs were converted into LRAT and checked with ACL2
- Updated IPASIR interface (for incremental track)
  - Learned clauses can be extracted from the solvers (implemented via callback function)
- Many new benchmarks in the Incremental Track
Tracks
## Tracks

<table>
<thead>
<tr>
<th>Track</th>
<th>Benchmarks</th>
<th>Solvers</th>
<th>Limits</th>
<th>Cluster</th>
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<tbody>
<tr>
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<td>350 main</td>
<td>28</td>
<td>5000 s, 1 core, 24 GB</td>
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</tr>
<tr>
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<tr>
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Total number of solvers (solver versions) submitted: 82
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**Towards a leaner competition?**

Interest in the Agile, Random SAT, and No-limits tracks appears limited.
Benchmarks

**Main**: Several new benchmark domains/sets submitted, including Rubik’s Cube, Equivalence Checking, Bounded Model Checking, Pseudo Industrial, Cryptography (SHA-1), Latin Square, Balanced Random, Block Puzzle, Subshape in Grid, and Polynomial Multiplication.

**Incremental**

- Instances of SAT-based applications under various inputs (assumptions)
- average rank for each application determines winner

**Agile**: Bit-blasted Z3 instances. Selected 5000 from a suite submitted last year, a significant overlap with last year’s selection.

**Random**: Satisfiable \( k \)-SAT. Three types: medium size close to the phase transition, huge and somewhat below the phase transition, and hard planted SAT.
Results

Note: Medals will be posted from Germany.
All medalists should provide us a current mailing address via email.
Random Track: Top-3

1. YalSAT (1794277.02) by Armin Biere
2. tch glucose3 (1894840.68) by Seongsoo Moon, Inaba Mary
3. Score2SAT (2075884.23) by Shaowei Cai, Chuan Luo
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Dimetheus, the strongest solver in recent years, did not participate.
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1. AbcdSAT (average rank: 1.875) by Jingchao Chen
2. Glucose (average rank: 2.000) by Gilles Audemard, Laurent Simon
2. Riss (average rank: 2.000) by Norbert Manthey
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### Incremental Track: Ranking for each application

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<th>Glucose</th>
<th>Riss</th>
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<tr>
<td>Essential Variables</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Longest Path Search</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Partial MaxSAT</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pigeon Hole Principle</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Automated Planning</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ijtihad (QBF solver)</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CBMC (C verification)</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>SATPin (axiom pinpointing)</td>
<td>2</td>
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<td>1</td>
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<td>1.875</td>
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Parallel Track: Top-3

1. Syrup24 (1229297.31)
   by Gilles Audemard, Laurent Simon

2. Plingeling (1266163.50)
   by Armin Biere

3. Painless MapleCOMSPS (1368420.48)
   by Ludovic Le Frioux, Souheib Baarir, Julien Sopena, Fabrice Kordon
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Less is more
Solvers that did not use hyper-threading were faster
Agile Track: Top-3

1. CaDiCal Agile
   CaDiCal NoProof
   by Armin Biere

2. Glucose 4.1
   by Gilles Audemard, Laurent Simon

3. GluVC
3. **Glucose 4.1** (263772.21)
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2. **Glu_VC** (257997.93)  
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Few new benchmarks!
No-Limits Track: Top-3

1. COMiniSatPS Pulsar (1758011.46) by Chanseok Oh
2. MapleCOMSPS LRB VSIDS 2 (1758801.49)
3. CaDiCaL NoProof (1841142.37) by Armin Biere
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No “real” no-limits solvers?
Main Track: Top-3

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   Maple LCM (1640696.51)
   MapleLRB LCMoccRestart (1654244.83)
   MapleLRB LCM (1676517.65)
   by Fan Xiao, Mao Luo, Chu-Min Li, Felip Many`a, Zhipeng L¨u

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   MapleCOMSPS LRB VSIDS (1805445.41)
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No solver announced as Glucose hack
Impact of PAR-2

Penalized average runtime (PAR)
- PAR-\(x\): penalized timeouts by \(x \cdot \text{TIMEOUT}\)
- SCR, solution-count ranking: PAR-\(x\) as \(x \rightarrow \infty\).
- \(x\) balances average successful runtimes and number of solved instances

In 2017: little differences between PAR-2 and SCR.
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In 2017: little differences between PAR-2 and SCR.
Determined winner in the parallel track:

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Disclaimer: Results Depend Heavily on the Benchmarks

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This part of the competition must become more scientific, but how?
Final Remarks

Full details (to be available) at
https://baldur.iti.kit.edu/sat-competition-2017/

- Detailed per-instance per-solver results
- Proceedings: solver and benchmark descriptions
- These slides

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