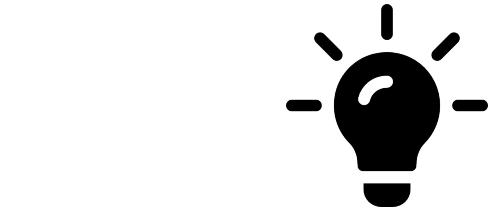
MODEL COUNTING COMPETITION 2022

Johannes K. Fichte (TU Wien)
Markus Hecher (TU Wien)

FLoC Olympic Games 2022,
Technion, Haifa

Idea of the Competition

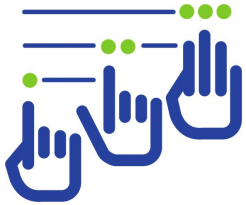


*Deepen **relationship** between latest theoretical and practical development on the various **model counting problems** and their **practical applications***

- Gain visibility of model counting
- Foster progress and new solving approaches and ideas
- **3rd iteration**

- **Report of 2020 JEA / Report 2021 (on our list)**

Tracks



Tracks

1) **Model Counting**

Input: Propositional formula F in CNF
Task: Output the number of satisfying assignments to F

2) **Weighted Model Counting**

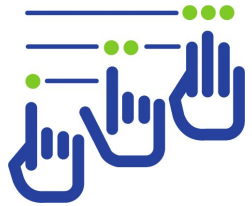
Input: F + weight for each literal in F
Task: Output sum of weights of all models, where the weight of a model is the product of the weights of its literals.

3) **Projected Model Counting**

Input: F + set P of projection variables
Task: Output the projected model count of F (number of satisfying assignment wrt. to variables in P)

4) **Projected Weighted Model Counting**

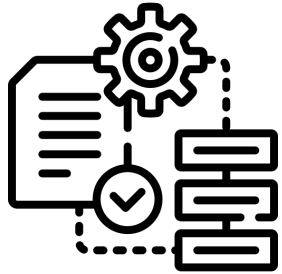
Ranking



A) Arbitrary Precision (0% relative error; DQF >0 wrong)
B) Small Precision Loss (0.1% relative error; DQF >20 wrong)
C) Approximate Solving (0.8 approx factor; DQF >20 wrong)
~~**D) Heuristic (20% relative error ok)**~~

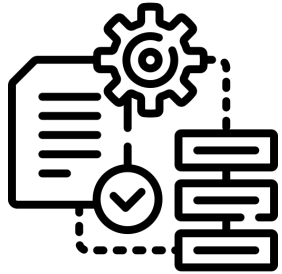
System

1. StarExec
2. 60min per instance
3. 32 GB main memory (RAM) per instance



Procedure

Evaluation Procedure



- Open call for benchmarks
- Evaluated submitted benchmark instances + known sets

We selected 200 instances and split them in public / private.

1) Public instances and public challenge
   Submission open for a few weeks.
2) **Private instances (100)**
   After a final deadline, we evaluate solvers on StarExec
   If we see errors, we give authors a few days to comment or fix.
   We included results of a fixed version if provided.

Submission Requirements

Bottom Line

Almost no limits regarding requirements on the software,
but we strongly encourage open source

Participants

10 M

Participants

Track	Groups
MC	11 (+1)
WMC	5 (-1)
PMC	4 (-1)
PWMC	2 (+2)

Knowledge Compilation (c2d, d4)	Component Caching (SharpSAT-TD, gpmc, bob, SharpSAT-td-Arjun)
Dynamic Programming (DPMC)	Approximate Counting (SharpSAT-td-Arjun+ApproxMC)

Benchmark Submissions 2022

- Guillaume Escamocher; Barry O'Sullivan
- Ivor Spence
- Daniel Pehoushek
- Samuel Teuber; Alexander Weigl
- Piotr Jerzy Gorczyca
- Yong Lai
- Elisa Böhl; Sarah Alice Gaggl; Dominik Rusovac

Instances -> Zenodo Descriptions -> Report

\+ 2020+2021 Instances

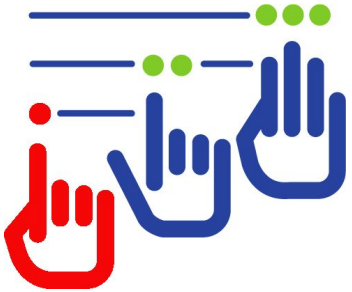
Thank you!

Instance Selection 2022

- Solved <1s by sharpSAT => Remove
- Max 10 Instances per Benchmark Set
- Choose randomly
- Max 40 instances that cannot be solved within 14.000s by existing solvers
- Weighted Model Counting
    - Select instances randomly (weighted and unweighted)
    - Generate weights randomly
        - On counting graph, if it can be generated
        - Random weights (at most 10 rounds), otherwise
- Cleanup (minor format issues from submissions)

Results

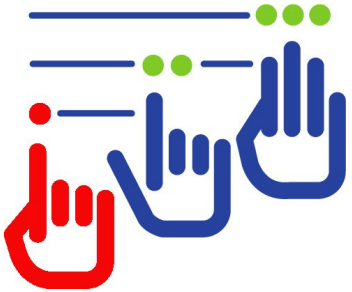
Track 1: MC / Ranking A



#	Submission	Authors	solved
1	**SharpSAT-td-Arjun**	Mate Soos Kuldeep S. Meel	**79**
2	**ExactMC**	Yong Lai, Kuldeep S. Meel. Roland H.C. Yap, Zhenghang Xu	**77**
	SharpSAT-TD	Tuukka Korhonen Matti Järvisalo	**77**
4	d4	Pierre Marquis Jean-Marie Lagniez	76
5	gpmc	Kenji Hashimoto Shota Yap	69
6	MTMC	Ivor Spence	66
7	DPMC	Vu Phan Jeffrey Dudek Moshe Vardi	61
8	c2d	Adnan Darwiche	50

Total:
100
private
instances

Track 1: MC / Ranking A



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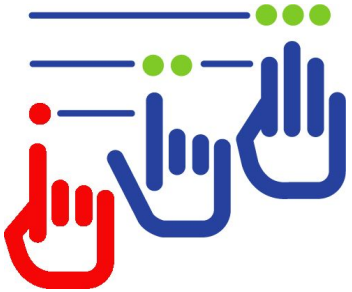

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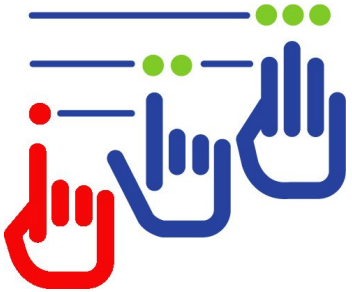

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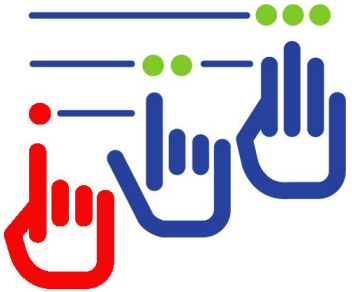

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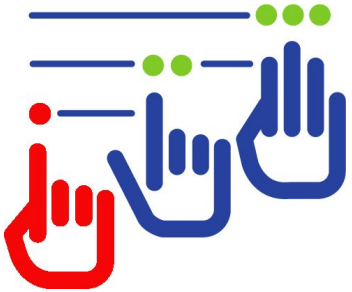

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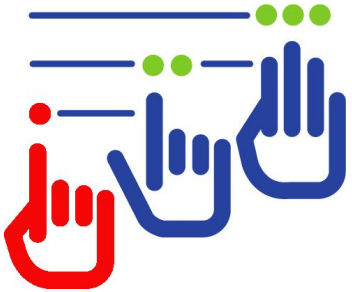

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Total:
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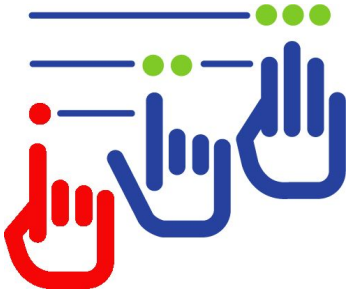
Track 1: MC / Ranking B



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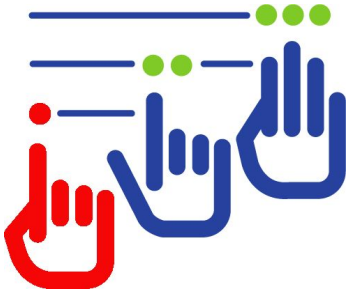
5	gpmc	Kenji Hashimoto Shota Yap	69
6	MTMC	Ivor Spence	66
7	DPMC	Vu Phan Jeffrey Dudek Moshe Vardi	61
8	TwG	Sylvester Swats	53
9	c2d	Adnan Darwiche	50

Total:
100
private
instances

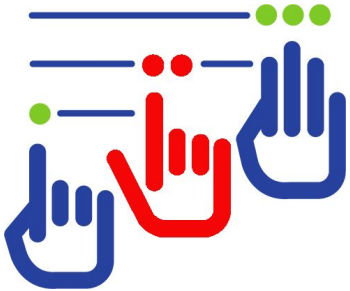
Track 1: MC / Ranking C



#	Submission	Authors	solved
1	**SharpSAT-td-Arjun+ApproxMC**	Mate Soos Kuldeep S. Meel	**74**

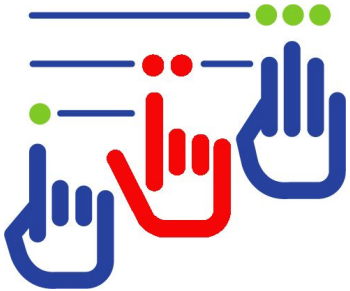
Total:
100
private
instances

Track 2: WMC / Ranking A



#	Submission	Authors	solved
1	SharpSAT-TD	Tuukka Korhonen Matti Järvisalo	75
2	c2d	Adnan Darwiche	60
3	**DPMC**	Vu Phan Jeffrey Dudek Moshe Vardi	**35**

Track 2: WMC / Ranking A



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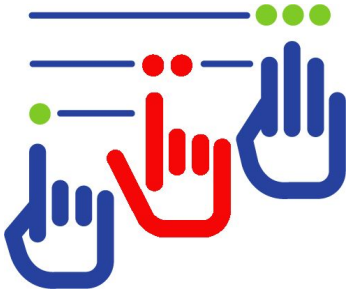

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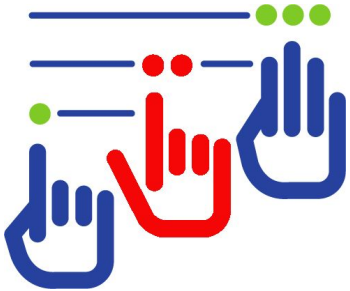
Track 2: WMC / Ranking B



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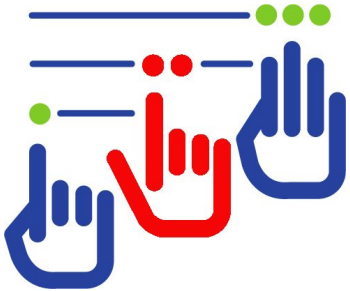
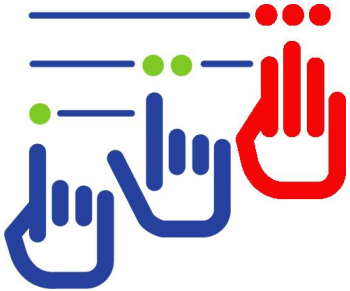
Track 2: WMC / Ranking C



No submission

Track 3: PMC / Ranking A



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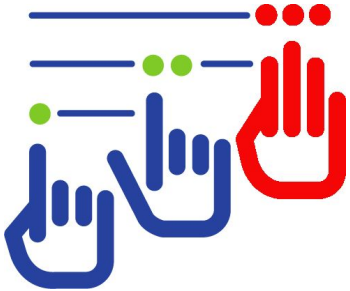
Track 3: PMC / Ranking A



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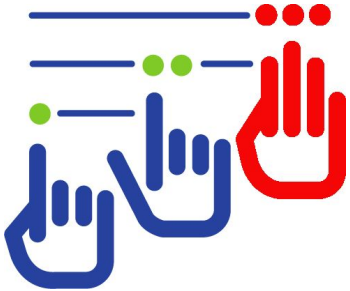

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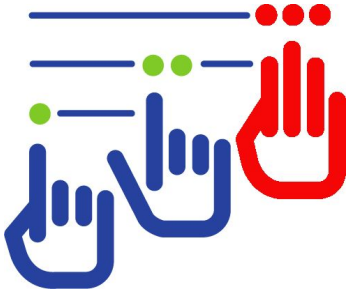

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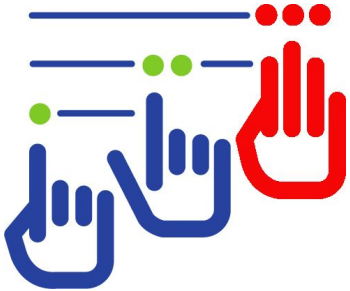
Track 3: PMC / Ranking B



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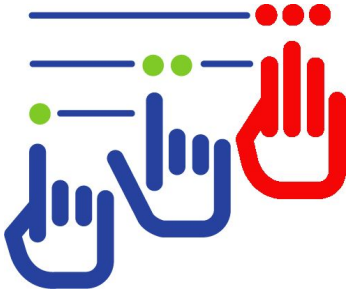

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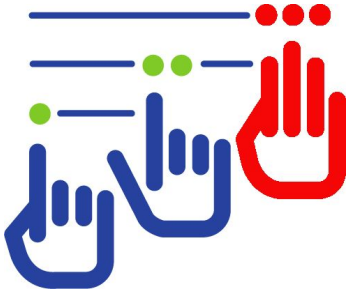
1	**Ganak**	Mate Soos Kuldeep Meel	**83**

Track 4: PWMC / Ranking A



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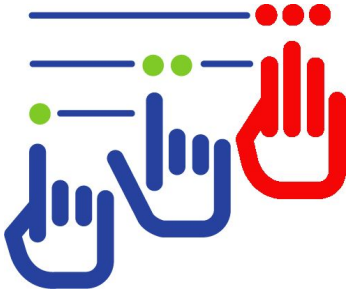
Track 4: PWMC / Ranking B



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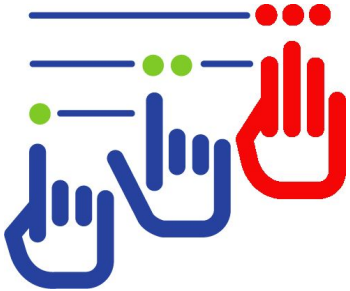
Track 4: PWMC / Ranking B



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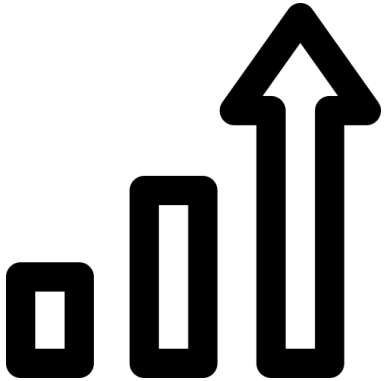
Conclusion



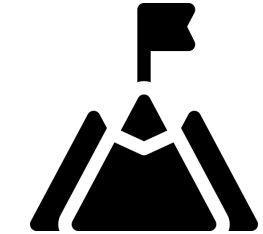
Small Improvements

1) New Participants

2) More open source solvers / Solver quality improved

3) New Track / Better Ranking

Challenges



- Hard meaningful instances for Weighted Model Counting
  Pls submit probabilistic reasoning instances?

- Multiple Rankings

- Cluster resources

Thanks go to

- All the **participants of the 2022 competition**!
  - For their submissions and active participation and
  - Their incredible patience
- All **contributors of instances**!
- Judge: **Mario Alviano** (University of Calabria) and Technical Advisor: **Daniel Le Berre** (CRIL Lens)
- **Aaron Stump** (StarExec)
- **ZIH** (**TU Dresden)** for providing cluster resources

Organizers

Johannes K. Fichte
TU Dresden
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TECHNISCHE UNIVERSITÄT DRESDEN

ZIH
Zentrum für Informationsdienste und Hochleistungsrechnen

data experts
Systemberatung
Softwareentwicklung
Informationsverarbeitung

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Outlook

Edition 2023

- Same Tracks as 2022?
- Same Ranking as 2022?
- Virtual meeting to prepare the next iteration in Oct 2022?

Call for benchmarks in September.

Hope we see you in 2023.

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