LINKÖPING UNIVERSITY

MIT CSAIL

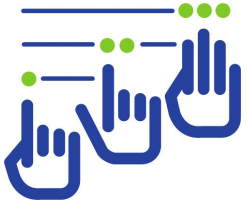
MODEL COUNTING COMPETITION 2023

4th iteration

Johannes K. Fichte (Linköping University)
Markus Hecher (Massachusetts Institute of Technology)

Jul 7, 2023 SAT, Alghero

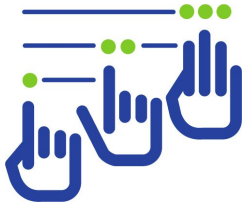
Idea of the Competition



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

Foster progress and new solving approaches and ideas

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**

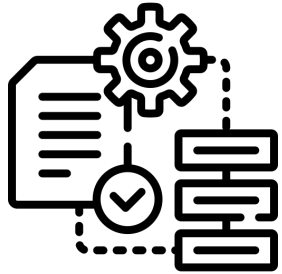
Ranking

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)

Baseline: What is a correct solution?
(no MICE or d-DNNF Proofs in 2022)

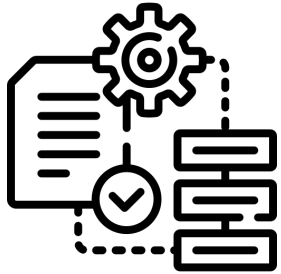
System

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



Procedure

Evaluation Procedure

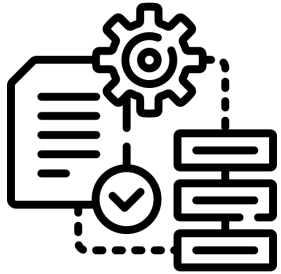


- Open call for benchmarks
- Evaluated submitted benchmark instances + known sets

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.

Evaluation



- Runs on StarExec
- After evaluation / before presentation:
- Submitters get access to
  - Logs and
  - Private Instances
- Wrong solutions
  - Corrected -> rerun if resources permit
  - No correction -> rank in a lower category

zenodo

Submission Requirements

Bottom Line

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

We received only open source submissions in 2023!

Participants

Participants

Track	Groups
MC	9 (-3)
WMC	7 (+2)
PMC	7 (+3)
PWMC	4 (+2)

Knowledge Compilation (d4)	Component Caching (SharpSAT-TD, gpmc, Arjun-ganak,ExactMC)
Dynamic Programming (DPMC,altDPMC,mtmc)	Approximate Counting (Arjun+ganak-ApproxMC)

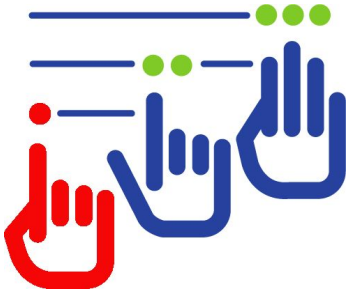
Benchmark Submissions 2023

- Mohimenul Kabir; Kuldeep S Meel
- Ivor Spence
- Arijit Shaw

Thank you!

Results

Track 1: MC



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Total:
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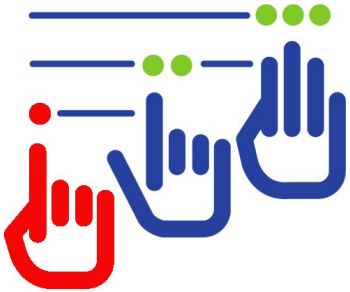

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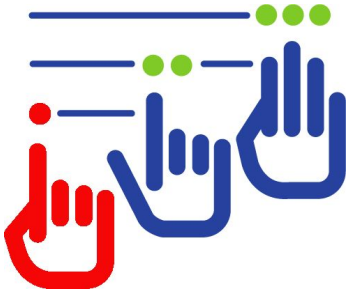

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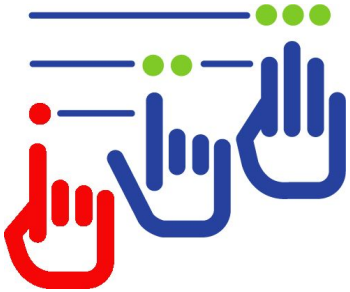

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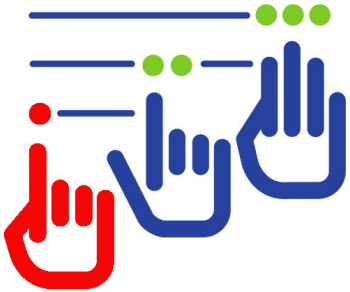

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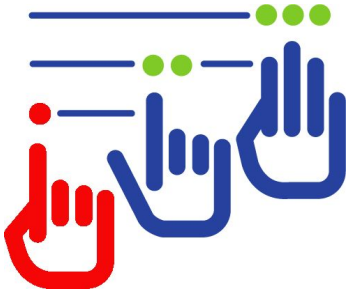

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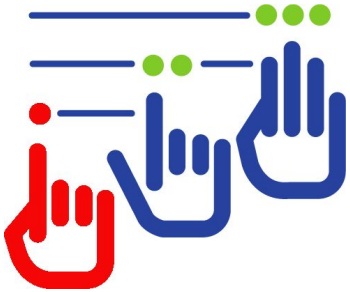

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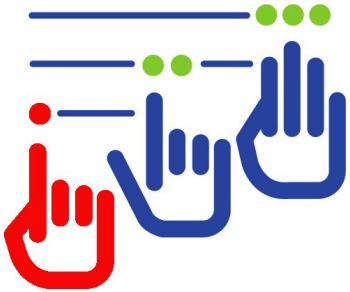

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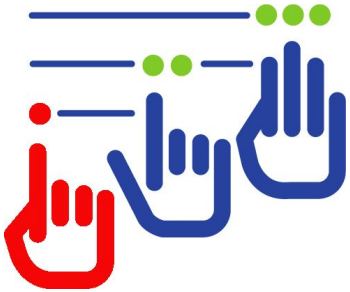

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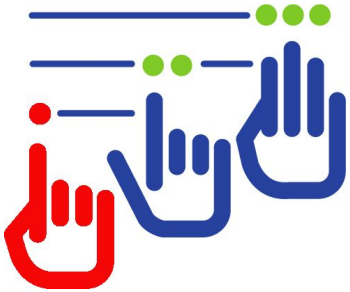

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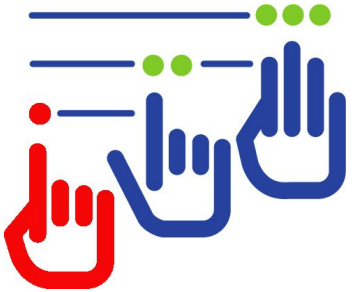

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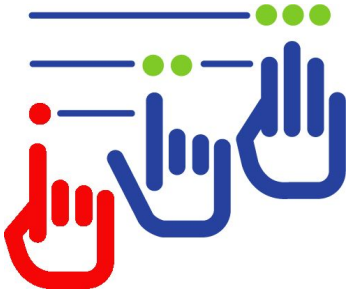

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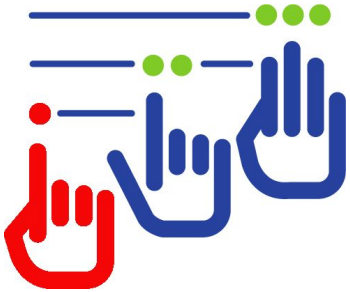

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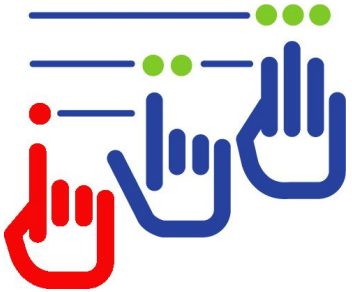

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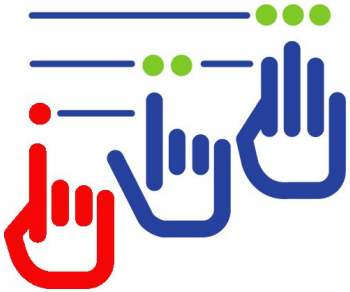

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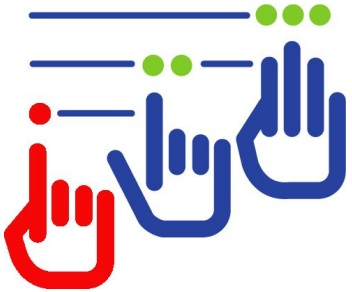

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4	6	8	DPMC	Vu Phan, Jeffrey Dudek, Moshe Vardi	43
	7	9	MTMC	Ivor Spence	34

Total:
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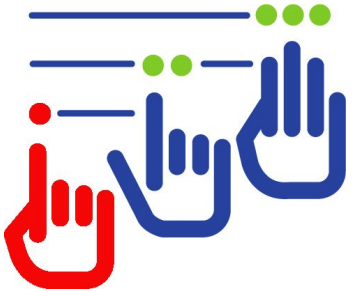
Track 1: MC



0%	0.1%	0.8	Submission	Authors	solved
1	1	1	SharpSAT-TD	Tuukka Korhonen Matti Järvisalo	82
		2	arjun-ganak-approxmc	Mate Soos Kuldeep S. Meel	79
2	2	3	d4	Pierre Marquis Jean-Marie Lagniez	75
	3	4	ExactMC-Arjun	Yong Lai, Zhenghang Xu, Minghao Yin, Kuldeep S. Meel, Roland H.C. Yap,	74
	4	5	arjun-ganak	Mate Soos Kuldeep S. Meel	71
3	5	6	gpmc	Kenji Hashimoto Shota Yap	64
	6	7	Alt-DPMC	Aditya Shrotri Moshe Vardi	50
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	8	9	MTMC	Ivor Spence	34

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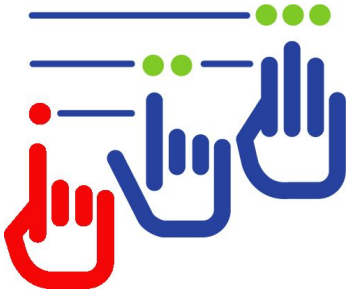

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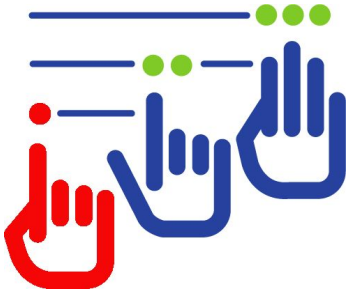

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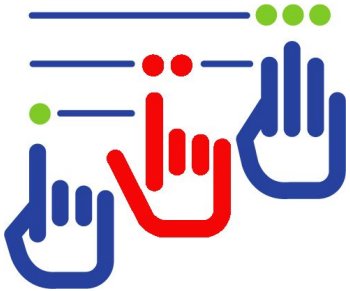
Track 2: WMC



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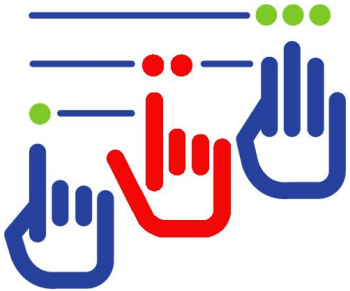

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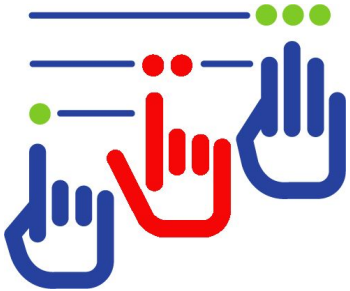

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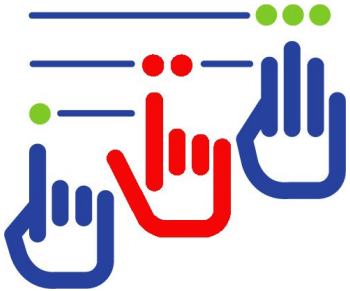

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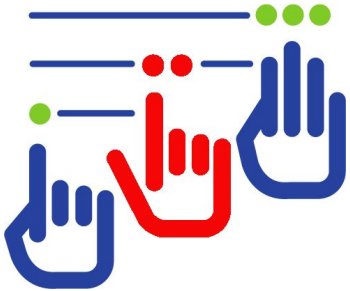

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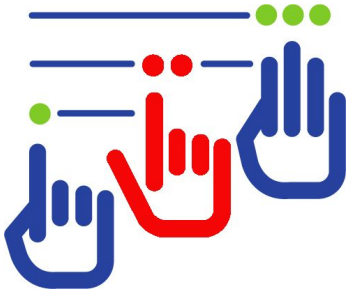

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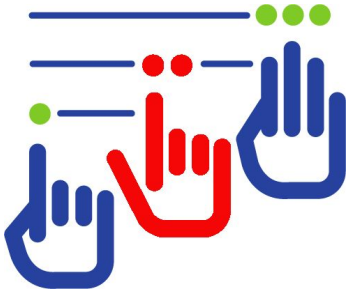

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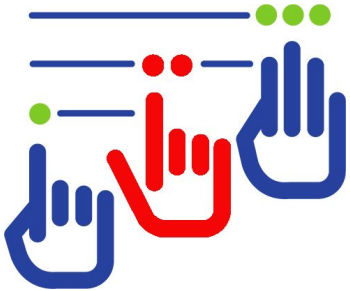

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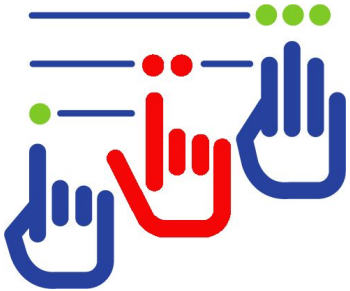

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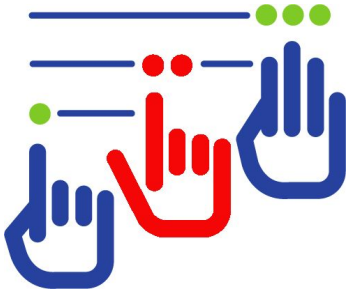

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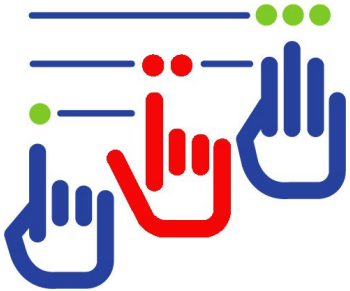

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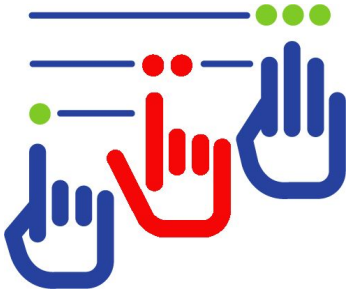

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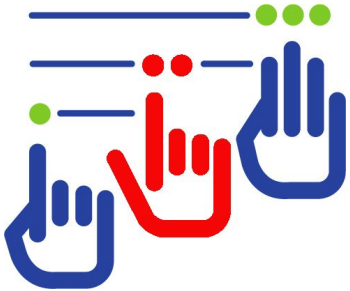

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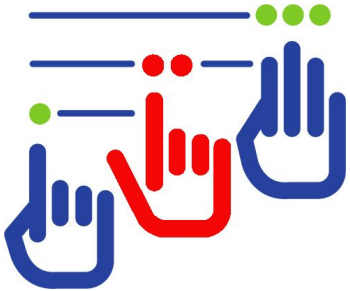

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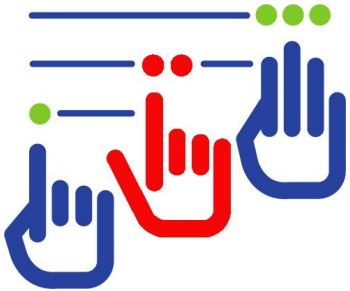

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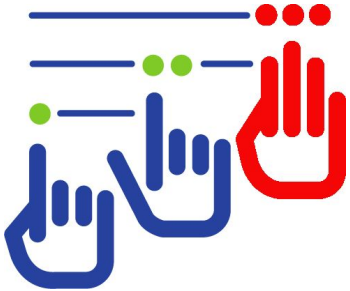
Track 3: PMC



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1	1	2	d4	Pierre Marquis Jean-Marie Lagniez	71
2	2	4	gpmc	Kenji Hashimoto Shota Yap	67
3	3	4	arjun-ganak	Mate Soos Kuldeep S. Meel	64
4	4	5	DPMC	Vu Phan, Jeffrey Dudek, Moshe Vardi	36
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Total:
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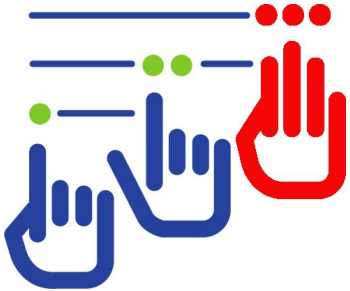
Track 3: PMC



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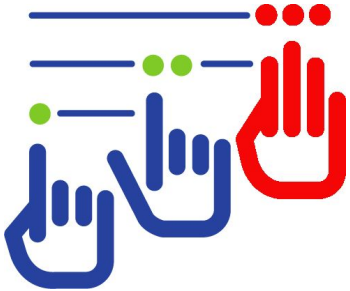

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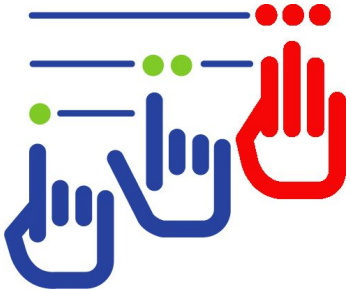

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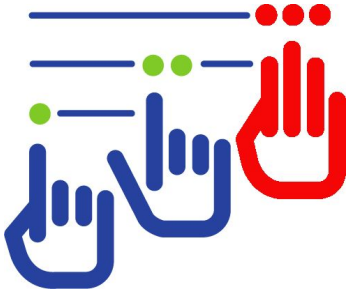

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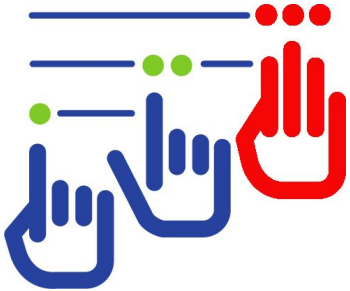

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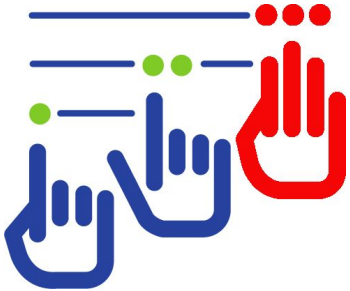

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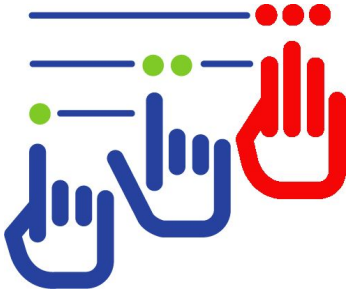

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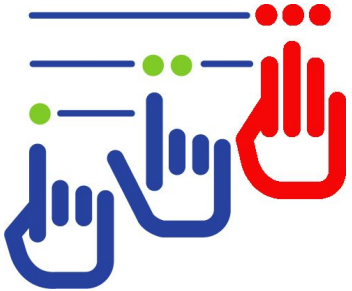

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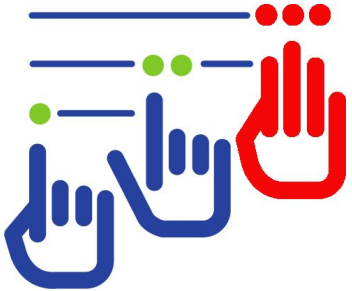

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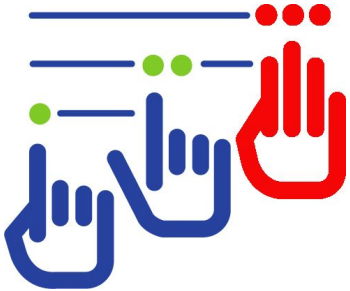

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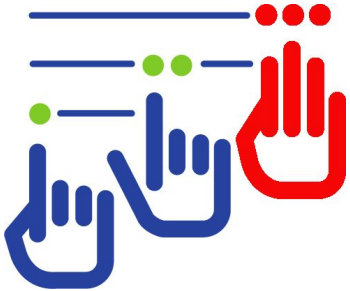

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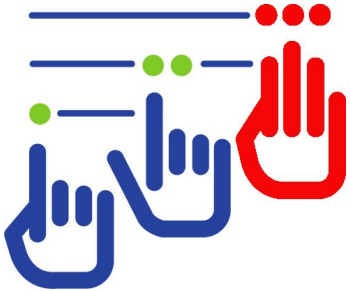

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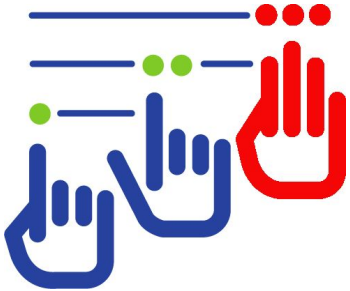

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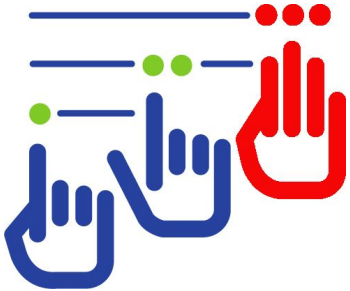

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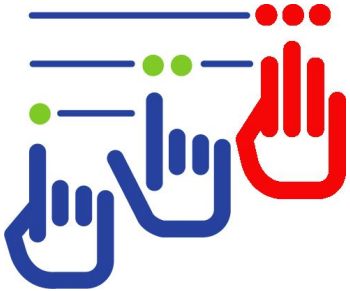

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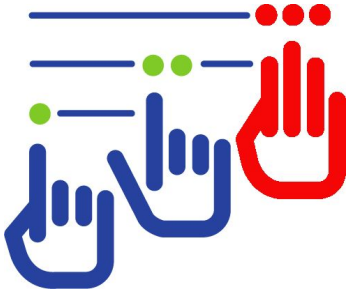
Track 4: PWMC



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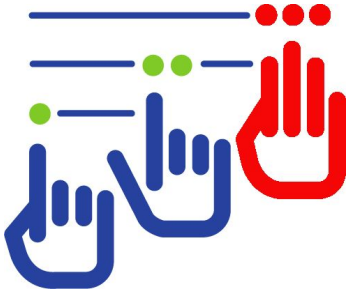

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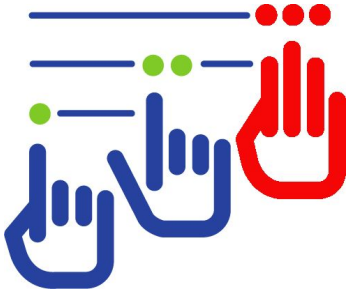

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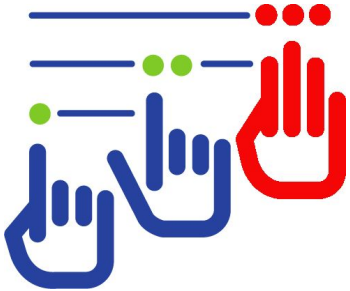

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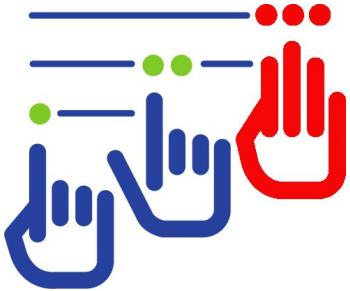

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Parallel Solver:
Alt-DPMC solved 40 instances

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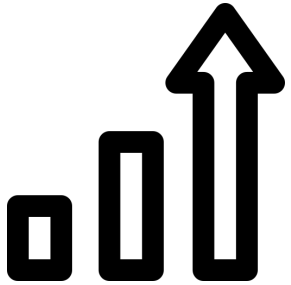
Conclusion

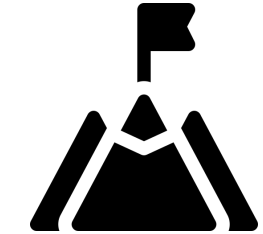
Summary



- Only open source submissions

- Great solvers and no clear winner
  - **gpmc (good behavior on all instances)**
  - sharpsat-td (best solver on counting and weighted counting)
  - d4 (best exact solver for projected counting)
  - arjun-ganak-approxmc (best approximate projected solver)
  - alt-dpmc parallel solving (not much benefit yet)

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 2023 competition**!
  - For their submissions and active participation and
  - Their patience
- All **contributors of instances**!

- Judge (Martin Gebser) /
  Technical Advisor (Daniel Le Berre)

- **Aaron Stump** (StarExec)
- **ZIH** (**TU Dresden)** for providing cluster resources

Der Wissenschaftsfonds.

Outlook

Outlook

Call for benchmarks in September.

Hope we see you in 2024.

mccompetition.org