The Results of the
Model Counting Competition 2024

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Motivation

Why having a solving competition?

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

Goals

- Gain visibility of model counting
- Foster progress and new solving approaches and ideas
- 5th iteration

Tracks / Problems

Input: Propositional formula F in CNF

(1) Model Counting

Task: Number of satisfying assignments to F.

(2) Weighted Model Counting

Input: F + weight for each literal in F
Task: Sum of weights of all models (weight product of the weights of its literals)
New Bonus Track: Negative Weights (Motivation: Quantum Circuit Simulation)

(3) Projected Model Counting

Input: F + set P of projection variables
Task: Projected model count of F (restrict model to "show" variables)

(4) Projected Weighted Model Counting

Restrictions, Measure, and Ranking

Measure

- Solved instances in 1h limitation per instance
- No tie-breaking
- StarExec
- 32 GB main memory (RAM) per instance

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)

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 (100) 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.

Participants

Search-based

1. D4
2. ExactMC
3. Ganak
4. gpmc
5. SharpSAT-TD
6. SharpSAT-TD-CH

Dynamic Programming-based

1. DPMC
2. MTMC

Hashing-based

1. Ganak-Approx

Portfolio-based

1. as4moco

Track	Groups
MC	10 (+1)
WMC	7 (+0)
PMC	5 (-2)
PWMC	5 (+1)

Benchmark Selection (2024)

Selection

- Instances selected over all submitted/collected benchmarks
- Remove instances that can be solved in 60s by SharpSAT (2011)
- Remove unsatisfiable instances (Track 1 only: resources)
- Sample
  - c: number of submitted/collected sets (2020-2024)
  - $n = 200/c$ (number of instances by set)
  - pick a random order on sets
  - compute distribution, i.e, between n-3 and n+3 instances per set
    (3, number increases slightly to fill 200 instances)
  - randomly sample instances according to distribution

Submitted Benchmarks

- Joseph Daniel Pehoushek
- Fabio Visona
- Boris Wiegand
- Mohimenul Kabir
- Jiong Yang, Yash Pote
- Ivor Spence
- Suwei Yang

- Jingyi Mei, Marcello Bonsangue, Alfons Laarman

- Arijit Shaw, Brendan Juba, Kuldeep S. Meel

- Nazareno Garagiola, Holger Hermanns, Pedro R. D'Argenio

Thank You!

Track 1: Model Counting

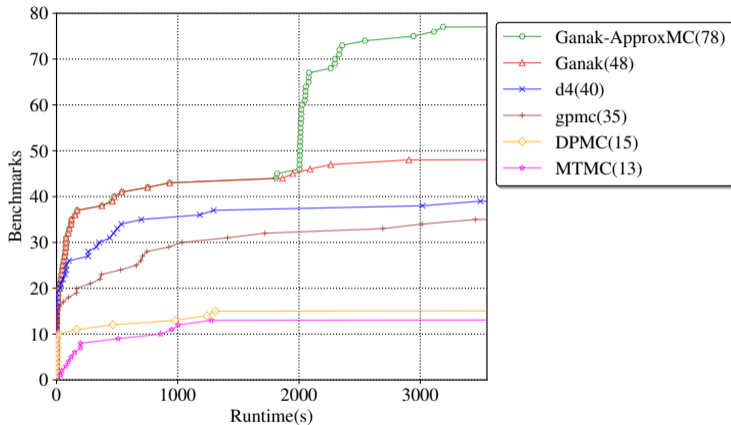| 0%	0.1%	0.8	Counter	Author	Solved
		1	Ganak-ApproxMC	Mate Soos, Jiong Yang, Kuldeep S. Meel, Shubham Sharma	63
1	1		Ganak	Mate Soos, Jiong Yang, Kuldeep S. Meel, Shubham Sharma	54
2	2	2	SharpSAT-TD	Tuukka Korhonen, Matti Järvisalo	48
2	2	2	SharpSAT-TD-CH	Yipei Deng, Junping Zhou, Jiaxin Liang, Le Xin	48

Track 1: Model Counting
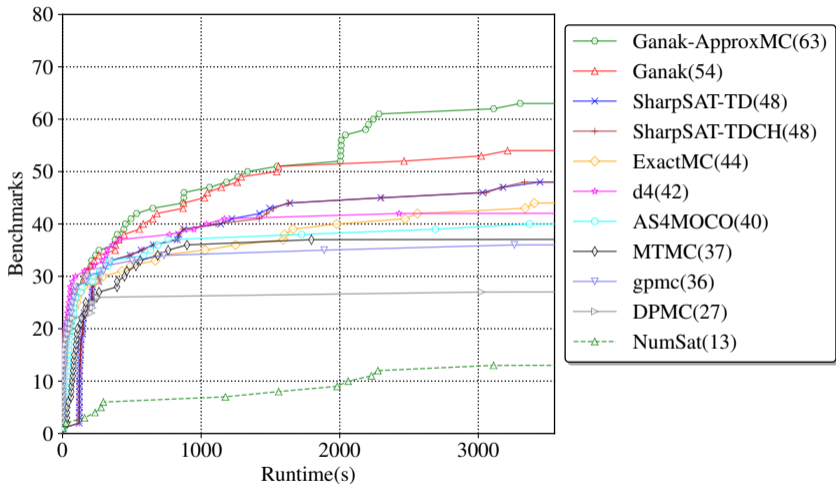
Track 2: Weighted Model Counting

0%	0.1%	0.8	Counter	Author	Solved
	1	1	Ganak	Mate Soos, Jiong Yang, Kuldeep S. Meel, Shubham Sharma	63
	2	2	SharpSAT-TD	Tuukka Korhonen, Matti Järvisalo	52
	3	3	d4	Jean-Marie Lagniez, Pierre Marquis	45

Track 3: Projected Model Counting

0%	0.1%	0.8	Counter	Author	Solved
		1	Ganak-ApproxMC	Mate Soos, Jiong Yang, Kuldeep S. Meel, Shubham Sharma	78
1	1		Ganak	Mate Soos, Jiong Yang, Kuldeep S. Meel, Shubham Sharma	48
2	2	2	d4	Jean-Marie Lagniez, Pierre Marquis	40
3	3	3	gpmc	Kenji Hashimoto	35

Track 3: Projected Model Counting

Track 4: Projected Weighted Model Counting

0%	0.1%	0.8	Counter	Author	Solved
1	1	1	Ganak	Mate Soos, Jiong Yang, Kuldeep S. Meel, Shubham Sharma	75
2	2	2	d4	Jean-Marie Lagniez, Pierre Marquis	72
3	3	3	gpmc	Kenji Hashimoto	64

Track 2 Bonus: Weighted Model Counting

with negative weights

0%	0.1%	0.8	Counter	Author	Solved
1	1	1	Ganak	Mate Soos, Jiong Yang, Kuldeep S. Meel, Shubham Sharma	77
2	2	2	SharpSAT-TD	Tuukka Korhonen, Matti Järvisalo	73
2	2	2	SharpSAT-TD-CH	Yipei Deng, Junping Zhou, Jiaxin Liang, Le Xin	73

Summary

Many New Additions

- ganak (19k LOC change, performance improvement)
- sharpsat-td (no change, yet competitive to ganak)
- gpmc, D4 (behaved perfectly on all tracks)
- as4moco (first portfolio counter)
- ganak+approxmc (combination helps in PMC)
- A new track!
- New applications

Thanks Goes to

- **All the participants of the 2024 competition!**
  - For their submissions and active participation
  - Their patience
- **All contributors of instances!**
- Judge (Martin Gebser) /
  Technical Advisor (Daniel Le Berre)
- **Aaron Stump** (StarExec)

Call for benchmarks in September.
Hope we see you in 2025.
`mccompetition.org`