MODEL COUNTING

The Results of the Model Counting Competition 2025

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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
- 6th iteration

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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)

(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

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)~~

(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

Tracks / Problems (cont.)

Additionally Planned Tracks in 2025

(5B) Algebraic Model Counting (AMC) on $\mathbb{C}$

Input: F + weights containing complex numbers
Task: Sum of weights of all models

(6B) Bitvector Counting

Input: SMT Format
Task: Model count of SMT(BV) formula.

Tracks / Problems (cont.)

Additionally Planned Tracks in 2025

(5B) Algebraic Model Counting (AMC) on $\mathbb{C}$

Input: F + weights containing complex numbers
Task: Sum of weights of all models
$\rightsquigarrow$ still evaluating

~~(6B) Bitvector Counting~~ (only one submission)

~~Input: SMT Format~~
~~Task: Model count of SMT(BV) formula.~~

$\wedge$

Restrictions, Measure, and Ranking

Measure

- Solved instances in 1h limitation per instance
- No tie-breaking
- Sosycomp Cluster at LMU, Munich
- ~~32 GB~~ 31 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)

$\wedge$

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 Sosycomp
   If we see errors, we give authors a few days to comment or fix.
   We included results of a fixed version if provided.

†

Participants

Track	Groups
MC	7 (-3)
PMC	4 (-1)
PWMC	3 (-2)
AMC	3

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MC	7 (-3)
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Exact

1. Cara
2. D4
3. Ganak
4. gpmc
5. SharpSAT-TD
6. SharpSAT-TD-CH
7. MTMC
8. bam

Approximate

1. Ganak-Approx

Benchmark Selection (2025)

Selection

- Instances selected over all submitted/collected benchmarks
- Remove unsatisfiable instances (Track 1 only: resources)
- Sample
  - c: number of submitted/collected sets (2020-2025)
  - $n = 200/c$ (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

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Submitted Benchmarks

- *Complete Symmetry Breaking for Finite Models*
  by Marek Danco; Mikolas Janota; Michael Codish; Joao Araujo
- *Hitting Sets* by Mohimenul Kabir
- *Min. Hamming of unweighted MaxSAT instances*
  by Sravanthi Chede; Anil Shukla
- *Attacker Control and Bug Prioritization*
  by Guilhem Lacombe; Sébastien Bardin
- *Quantum Circuit Simulation*
  by Jingyi Mei, Marcello Bonsangue, Alfons Laarman
- *Puzzle (Connect-4 Game)* by Ivor Spence

† **Thank You!**

Track 1: Model Counting

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Track 1: Model Counting

0%	0.1%	0.8	Counter	Author	Solved
2	2		Cara	Petr Illner	50
2	2		D4	Jean-Marie Lagniez, Pierre Marquis	50

†

Track 1: Model Counting

0%	0.1%	0.8	Counter	Author	Solved
1	1		Ganak	Mate Soos, Kuldeep S. Meel	60
2	2		Cara	Petr Illner	50
2	2		D4	Jean-Marie Lagniez, Pierre Marquis	50

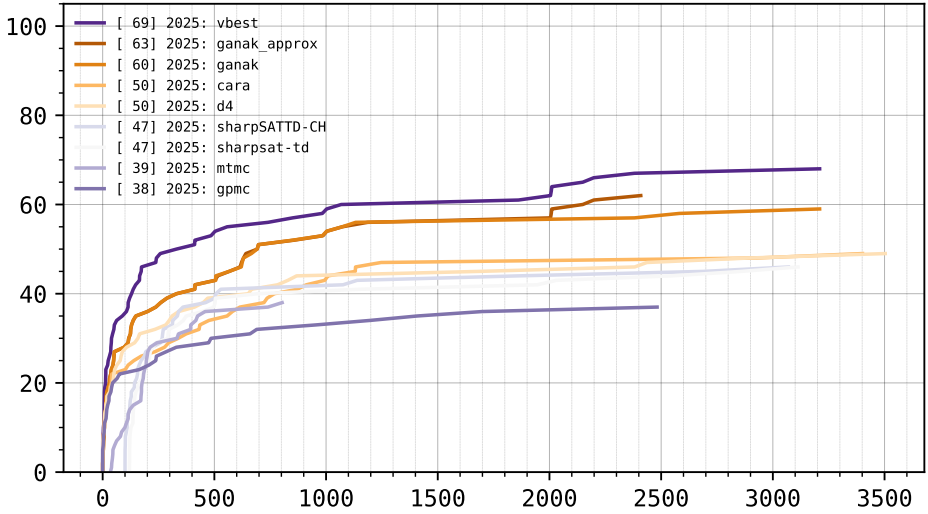
†

Track 1: Model Counting

0%	0.1%	0.8	Counter	Author	Solved
		1	Ganak-ApproxMC	Mate Soos, Kuldeep S. Meel	63
1	1		Ganak	Mate Soos, Kuldeep S. Meel	60
2	2	2	Cara	Petr Illner	50
2	2	2	D4	Jean-Marie Lagniez, Pierre Marquis	50

†

Track 1: Model Counting



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Track 3: Projected Model Counting

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0%	0.1%	0.8	Counter	Author	Solved
2	2		gpmc	Kenta Ito, Kenji Hashimoto	45

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0%	0.1%	0.8	Counter	Author	Solved
2	2		d4	Jean-Marie Lagniez, Pierre Marquis	45
2	2		gpmc	Kenta Ito, Kenji Hashimoto	45

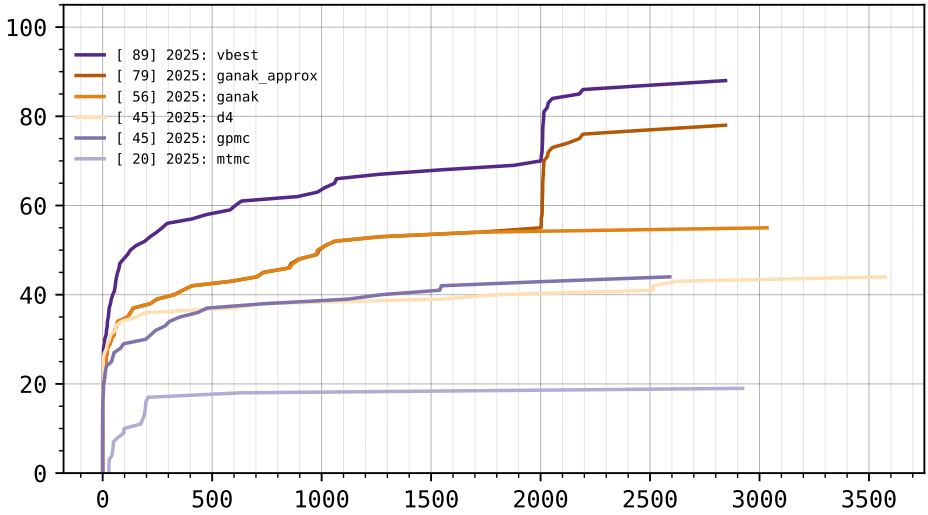
Track 3: Projected Model Counting

0%	0.1%	0.8	Counter	Author	Solved
1	1		Ganak	Mate Soos, Kuldeep S. Meel	56
2	2		d4	Jean-Marie Lagniez, Pierre Marquis	45
2	2		gpmc	Kenta Ito, Kenji Hashimoto	45

Track 3: Projected Model Counting

0%	0.1%	0.8	Counter	Author	Solved
		1	Ganak-ApproxMC	Mate Soos, Kuldeep S. Meel	79
1	1		Ganak	Mate Soos, Kuldeep S. Meel	56
2	2	2	d4	Jean-Marie Lagniez, Pierre Marquis	45
2	2	3	gpmc	Kenta Ito, Kenji Hashimoto	45

Track 3: Projected Model Counting



Track 4: Projected Weighted Model Counting

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0%	0.1%	0.8	Counter	Author	Solved
	3		MTMC	Ivor Spence	36

Track 4: Projected Weighted Model Counting

0%	0.1%	0.8	Counter	Author	Solved
2	2		d4	Jean-Marie Lagniez, Pierre Marquis	46
	3		MTMC	Ivor Spence	36

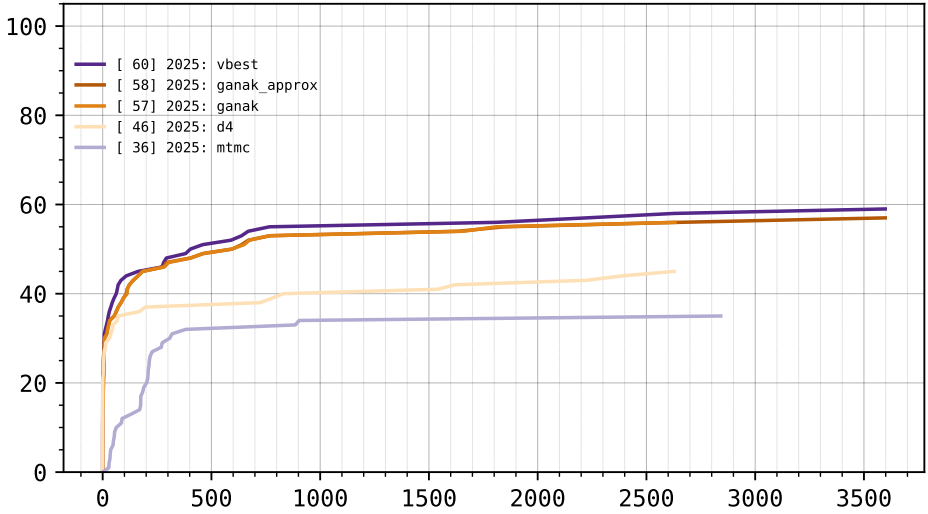
Track 4: Projected Weighted Model Counting

0%	0.1%	0.8	Counter	Author	Solved
1	1		Ganak	Mate Soos, Kuldeep S. Meel	57
2	2		d4	Jean-Marie Lagniez, Pierre Marquis	46
	3		MTMC	Ivor Spence	36

Track 4: Projected Weighted Model Counting

0%	0.1%	0.8	Counter	Author	Solved
		1	Ganak-Approx	Mate Soos, Kuldeep S. Meel	58
1	1		Ganak	Mate Soos, Kuldeep S. Meel	57
2	2	2	d4	Jean-Marie Lagniez, Pierre Marquis	46
	3	3	MTMC	Ivor Spence	36

Track 4: Projected Weighted Model Counting



Overview

Many New Additions

- Cara (great newcomer)
- Representing weights compactly by Randal Bryant (Workshop)
- A new track (but still evaluating)!
- New applications

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Thanks to

- **All the participants of the 2025 competition!**
  - For their submissions and active participation
  - Their patience
- **All contributors of instances!**
- Judge (Mario Alviano) /
  Technical Advisor (Daniel Le Berre)
- **Philipp Wendler** (SoSy Cluster)
- **Olivier Roussel** (CRIL Cluster)
- **Markus Iser** (Cluster Setup)

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- **Markus Iser** (Cluster Setup)

Call for benchmarks in October.
Hope we see you in 2026.
`mccompetition.org`

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Certificates