The 6th International Verification of Neural Networks Competition (VNN-COMP 2025): Summary and Results

Konstantin Kaulen[1], Tobias Ladner[2], Stanley Bak[3], Christopher Brix[1], Hai Duong[4], Thomas Flinkow[5], Taylor T. Johnson[6], Lukas Koller[2], Edoardo Manino[7], ThanhVu H Nguyen[4], and Haoze Wu[8,9]

[1] RWTH Aachen University, Aachen, Germany
[2] Technical University of Munich, Munich, Germany
[3] Stony Brook University, Stony Brook, New York, USA
[4] George Mason University, Fairfax, Virginia, USA
[5] Maynooth University, Maynooth, Ireland
[6] Vanderbilt University, Nashville, Tennessee, USA
[7] University of Manchester, Manchester, UK
[8] Amherst College, Amherst, Massachusetts, USA
[9] VMware Research by Broadcom, USA

Abstract

This report summarizes the 6th International Verification of Neural Networks Competition (VNN-COMP 2025), held as a part of the 8th International Symposium on AI Verification (SAIV), that was collocated with the 37th International Conference on Computer-Aided Verification (CAV). VNN-COMP is held annually to facilitate the fair and objective comparison of state-of-the-art neural network verification tools, encourage the standardization of tool interfaces, and bring together the neural network verification community. To this end, standardized formats for networks (ONNX) and specification (VNN-LIB) were defined, tools were evaluated on equal-cost hardware (using an automatic evaluation pipeline based on AWS instances), and tool parameters were chosen by the participants before the final test sets were made public. In the 2025 iteration, 8 teams participated on a diverse set of 16 regular and 9 extended benchmarks. This report summarizes the rules, benchmarks, participating tools, results, and lessons learned from this iteration of this competition.

1 Introduction

Deep-learning-based systems are increasingly being deployed in a wide range of domains, including recommendation systems, computer vision, and autonomous driving. While the nominal performance of these methods has increased significantly over the last years, they largely lack formal guarantees on their behavior. However, in safety-critical applications, including autonomous systems, robotics, cybersecurity, and cyber-physical systems (CPS), such guarantees are essential for certification and reliability.

While the literature on the verification of traditionally designed systems is wide and successful, neural network verification remains an open problem, despite significant efforts over the last years. In 2020, the International Verification of Neural Networks Competition (VNN-COMP) was established to facilitate comparison between existing approaches, bring researchers working on this problem together, and help shape future directions of the field. VNN-COMP has been held annually since then [13, 74, 19, 18, 17]. In 2025, the 6th iteration of the annual VNN-COMP[1] was held as a part of the 8th International Symposium on AI Verification (SAIV) [6]

[1] https://sites.google.com/view/vnn2025/home

that was collocated with the 37th International Conference on Computer-Aided Verification (CAV) [7].

This 6th iteration of the VNN-COMP continues last year's trend of increasing standardization and automatization, aiming to enable a fair comparison between the participating tools and to simplify the evaluation of a large number of tools on a variety of (real-world) problems. As in the last iteration, VNN-COMP 2025 standardizes (1) neural network and specification formats, ONNX for neural networks and VNN-LIB [27] for specifications, (2) evaluation hardware, providing participants the choice of a range of cost-equivalent AWS instances with different trade-offs between CPU and GPU performance, and (3) evaluation pipelines, enforcing a uniform interface for the installation and evaluation of tools. The 2025 edition also introduced Competition Contribution papers in the SAIV proceedings for benchmark and tool participants, of which, several of the tools participated with papers [32, 69, 64, 26] that were reviewed by a program committee composed of members of the tool teams.

The competition was kicked off with the solicitation for participation in February 2025. Rule discussion started in March and rules were finalized in May 2025 (see an overview in Section 2). From April to June 2025, benchmarks were proposed and discussed. Meanwhile, the organizing team decided to continue using AWS as the evaluation platform and started to implement an automated submission and testing system for both benchmarks and tools. By mid-July 2025, eight teams submitted their tools (one team withdrew during the evaluation phase) and the organizers evaluated all entrants to obtain the final results, discussed in Section 5 and presented at SAIV on July 22, 2025. Discussions were structured into three issues on the official GitHub repository[2]: rules discussion, benchmarks discussion, and tool submission. All submitted benchmarks[3] and final results[4] were aggregated in separate GitHub repositories.

The remainder of this report is organized as follows: Section 2 discusses the competition rules, Section 3 lists all participating tools, Section 4 lists all benchmarks, Section 5 summarizes the results, and Section 6 concludes the report, discussing potential future improvements.

[2] https://github.com/VNN-COMP/vnncomp2025/issues
[3] https://github.com/VNN-COMP/vnncomp2025_benchmarks
[4] https://github.com/VNN-COMP/vnncomp2025_results

2 Rules

Terminology An *instance* is defined by a property specification (pre- and post-condition), a network, and a timeout. For example, one instance might consist of an MNIST classifier with one input image, a given local robustness threshold ϵ, and a specific timeout. A *benchmark* is defined as a set of related instances. For example, one benchmark might consist of a specific MNIST classifier with 100 input images, potentially different robustness thresholds ϵ, and one timeout per input.

Run-time caps Run-times are capped on a per-instance basis, i.e., any verification instance will timeout (and be terminated) after at most X seconds, determined by the benchmark proposer. These can be different for each instance. The total per-benchmark runtime (sum of all per-instance timeouts) may not exceed 6 hours per benchmark. For example, a benchmark proposal could have six instances with a one-hour timeout, or 100 instances with a 3.6-minute timeout, each. To enable a fair comparison, we measure the startup overhead for each tool by running it on a range of tiny networks and subtract the minimal overhead from the total runtime.

Hardware To allow for comparability of results, all tools were evaluated on equal-cost hardware using Amazon Web Services (AWS). Each team could decide between a range of AWS instance types (see Table 1) providing a CPU, GPU, or mixed focus.

Table 1: Available AWS instances.

	vCPUs	RAM [GB]	GPU
p3.2xlarge	8	61	V100 GPU with 16 GB memory
m5.16xlarge	64	256	✗
g5.8xlarge	32	128	A10G GPU with 24 GB memory

Scoring The final score is aggregate as the sum of all benchmark scores. Each benchmark score is the number of points (sum of instance scores discussed below) achieved by a given tool, normalized by the maximum number of points achieved by any tool on that benchmark. Thus, the tool with the highest sum of instance scores for a benchmark will get a benchmark score of 100, ensuring that all benchmarks are weighted equally, regardless of the number of constituting instances.

Instance score Each instance is scored is as follows:

- Correct hold (property proven): 10 points;
- Correct violated (counterexample found): 10 points;
- Incorrect result: -150 points (penalty increased compared to 2022);
- Timeout / Runtime Error / Unknown: 0 points.

However, the ground truth for any given instance is generally not known a priori. In the case of disagreement between tools, we, therefore, place the burden of proof on the tool claiming that a specification is violated, i.e. that a counterexample can be found, and deem it correct exactly if it produces a valid counterexample.

The provided counterexamples were supposed to define both the input and the resulting output of the networks. However, for some tools and instances, the output definition was

either missing or differed from the network output as computed by the onnxruntime package used to evaluate counterexamples (by performing inference given the inputs). The competition rules were ambiguous how this would be handled. We decided to discard all outputs in the counterexample files and base the evaluation solely on the given inputs and their respective outputs as computed by the onnxruntime.

Time bonus As opposed to previous years, no time bonus was awarded. Instead, all tools that compute the correct result within the time limit receive the same amount of points.

Overhead Correction The overhead of tools was measured, but only used to adapt the timeouts. It did not influence the scores, as no time bonus was awarded. To measure the tool-specific overhead, we created trivial network instances and included those in the measurements. We then observed the minimum verification time over all instances and considered that to be the overhead time for the tool.

Format As since 2021, we standardized neural networks to be in `onnx` format, specifications in `vnnlib` format, and counterexamples in a format similar to the `vnnlib` format. Further, tool authors were required to provide scripts fully automating the installation process of their tool, including the acquisition of any licenses that might be needed. Similar to the previous year, a preparation and execution script had to be provided for running their tool on a specific instance consisting of a network file, specification file, and timeout. The specifications are interpreted as definitions of counterexamples, meaning that a property is proven "correct" if the specification is shown to be unsatisfiable, conversely, the property is shown to be violated if a counterexample fulfilling the specification is found. Specifications consisted of disjunctions over conjunctions in both pre- and post-conditions, allowing a wide range of properties from adversarial robustness over multiple hyper-boxes to safety constraints to be encoded. For example, robustness with respect to inputs in a hyper-box had to be encoded as disjunctive property, where any of the other classes is predicted.

Tracks Similar to VNN-COMP'24, the competition was split into two tracks, both of them scored: A "regular" track, and an "extended" track. The regular track consists of benchmarks selected by the tool participants based on a voting process, where a benchmark is included in the regular track if at least 50% of tool participants voted for it to be scored. Benchmarks with at least 1 vote and not included in the regular track were scored in the extended track. All benchmarks received at least one vote, so no benchmark was unscored.

3 Participants

We list the tools and teams that participated in the VNN-COMP 2025 in Table 2 and reproduce their own descriptions of their tools below.

Table 2: Summary of the key features of participating tools. The hardware column describes the used AWS instance with `p3` and `g5` making GPUs available, see Table 1 for more details. Licenses refer to the external licenses required to use the corresponding tool, not the licensing of the tool itself.

Tool	References	Organizations	Place	Hardware	Licenses
α,β-CROWN	[99, 100, 94, 103, 78]	UIUC, UCLA, Drexel, Duke, RWTH Aachen	**1**	g5	GUROBI
CORA	[9, 59, 58, 57, 63]	Technical University of Munich	4	g5	MATLAB
NeuralSAT	[30, 36, 34]	George Mason University	2	g5	GUROBI
nnenum	[14, 12]	Stony Brook University	6	m5	-
NNV	[92, 68]	Vanderbilt University	5	g5	MATLAB
PyRAT	[65]	Université Paris-Saclay, CEA, List	3	m5	closed source CEA license
SobolBox	[5]	IIT Gandhinagar	7	m5	-

Place in Table 2 is based on the results in Section 5.1. We considered an alternative scoring scheme in Section 5.2, in which case NNV and nneum switch places. See Section 5 for a discussion.

3.1 α,β-CROWN

Team Co-leaders: Xiangru Zhong (student lead) and Huan Zhang (faculty advisor); Team members: Keyi Shen, Duo Zhou, Hesun Chen, Haoyu Li, Hao Cheng, Ruize Gao. All members are from the University of Illinois Urbana-Champaign (UIUC).

The team **acknowledges** (ordered by last names) Jorge Chavez (UIUC), Hao Chen (UIUC), Keyu Lu (UIUC), and Zhouxing Shi (UCLA), Zhuoxuan Zhang (Brown University), who were involved in the development of the verifier in the year of 2025 but did not directly work on any benchmarks of the competition. A full list of contributors is available at `https://abcrown.org`.

Description α,β-CROWN (`alpha-beta-CROWN`) is an efficient neural network verifier based on the linear bound propagation framework and built on a series of works on bound-propagation-based neural network verifiers: CROWN [104], auto_LiRPA [99], α-CROWN [100], β-CROWN [94], GCP-CROWN [103], GenBaB [78], BICCOS [107]. The core techniques in α,β-CROWN combine the efficient and GPU-accelerated linear bound propagation method with branch-and-bound methods specialized for neural network verification.

The linear bound propagation algorithms in α,β-CROWN are based on our `auto_LiRPA` library [99], which supports general neural network architectures (including convolutional layers, pooling layers, residual connections, recurrent neural networks, Transformers, and general computation graphs) and a wide range of nonlinear functions (e.g., ReLU, tanh, trigonometric functions, sigmoid, max pooling and average pooling), and is efficiently implemented on GPUs with Pytorch and CUDA. We jointly optimize intermediate layer bounds and final layer bounds using gradient ascent (referred to as α-CROWN or optimized CROWN/LiRPA [100]). Most importantly, we use branch and bound [20] (BaB) and incorporate split constraints in BaB into the

bound propagation procedure efficiently via the β-CROWN algorithm [94], use cutting-plane method in GCP-CROWN [103] and BICCOS [107] to further tighten the bound, and support general nonlinearities in the branch-and-bound by GenBaB [78]. For smaller networks, we also use a mixed integer programming (MIP) formulation [85] combined with tight intermediate layer bounds from α-CROWN (referred to as α-CROWN + MIP [103]). The combination of efficient, optimizable and GPU-accelerated bound propagation with BaB produces a powerful and scalable neural network verifier.

New in this year: α,β-CROWN increases its capability in branch-and-bound using our new Clip-and-Verify framework, which can eliminate partial unsat domains and tighten intermediate layer bounds for both input-space and activation-space branch-and-bound. This approach is quite helpful in handling hard verification problems and can greatly reduce the number of subproblems during branch-and-bound. For example, in the verification of neural network Lyapunov functions [66], our new framework can shrink the problem size and total running time by over 50%. A research paper is currently in submission.

Link https://github.com/Verified-Intelligence/alpha-beta-CROWN (main version)

Competition submission https://github.com/Verified-Intelligence/alpha-beta-CROWN_vnncomp2025 (only for reproducing competition results; please use the main version for other purposes)

Hardware and licenses CPU and GPU with 32-bit or 64-bit floating point; Gurobi license required for certain benchmarks.

Participated benchmarks All benchmarks.

3.2 CORA

Team Lukas Koller, Tobias Ladner, Matthias Althoff (Technical University of Munich)

Description CORA [9] enables the formal verification of neural networks, both in open-loop as well as in closed-loop scenarios [57, 63]. Open-loop verification refers to the task where properties of the output set of a neural network are verified, e.g., correctly classified images given noisy input, as also considered at VNN-COMP. In closed-loop scenarios, the neural network is used as a controller of a dynamic system, e.g., controlling a car while keeping a safe distance over some time horizon. Moreover, CORA can also train robust neural networks [59, 97], which uses an efficient batch-wise propagation of zonotopes through a neural network on a GPU.

For the competition, reachability analysis with zonotopes is used to compute a convex enclosure of the output set of a neural network. In addition to simultaneous input and neuron splitting, a specification-driven input refinement procedure iteratively encloses the set of unsafe inputs [58]. All operations use batch-wise computations to take full advantage of GPU-acceleration.

Link https://github.com/kollerlukas/cora-vnncomp2025

Commit 6f1923030baafadfadca3982b72fdea217a92479

Hardware and licenses GPU, MATLAB license.

Participated Benchmarks `acasxu`, `cifar100`, `collins-rul-cnn`, `cora`, `dist-shift`, `nn4sys`, `safenlp`, `tinyimagenet`, `tllverifybench`.

3.3 NeuralSAT

Team Hai Duong and Thanhvu Nguyen (George Mason).

Description NeuralSAT [30, 36, 34, 31, 35, 33, 32] integrates conflict-driven clause learning (CDCL) in SAT/SMT-solving with an DNN abstraction-based theory solver for infeasibility checking. NeuralSAT implements the DPLL(T) framework used in modern SMT solvers such as Z3. The design of NeuralSAT is inspired by the core algorithms used in SMT solvers such as CDCL components and theory solving. The tool is written in Python and uses Gurobi for LP solving. Unlike many other modern VNN verification tools, NeuralSAT *does not* require parameter tuning and works out of the box, e.g., the tool runs on the wide-range of benchmarks in VNN-COMPs without any tuning.

Link https://github.com/dynaroars/neuralsat

Commit 8c6a493d2b9314b06c6f19cd452f1c7ab5bd2657

Hardware and licences GPU, Gurobi License

Participated benchmarks All benchmarks in the regular track.

3.4 nnenum

Team Ali Arjomandbigdeli (Student), Stanley Bak (Supervisor) (Stony Brook University)

Description The nnenum tool [12] uses multiple levels of abstraction to achieve high-performance verification of ReLU networks without sacrificing completeness [11]. The core verification method is based on reachability analysis using star sets [90], combined with the ImageStar method [87] to propagate sets through all linear layers supported by the ONNX runtime, such as convolutional layers with arbitrary parameters. The tool is written in Python 3 and uses GLPK for LP solving. Over the past few years, we have added preliminary support for single lower and single upper bounds propagation in addition to zonotopes, similar to the DeepPoly method or the CROWN approach. We have also added an option to use Gurobi instead of GLPK for LP solving.

Link https://github.com/aliabigdeli/nnenum

Commit 8346c6855e50f5c34c6b9981b18271793c8005cf

Hardware and licences CPU, Gurobi license (optional)

Participated benchmarks `acasxu`, `cgan`, `collins-rul-cnn`, `cora`, `linearizenn`, `metaroom`, `nn4sys`, `relusplitter`, `safeNLP`, `sat-relu`, `tllverifybench`, `vggnet16`.

3.5 NNV

Team Diego Manzanas Lopez, Navid Hashemi, Samuel Sasaki, Taylor T. Johnson (Vanderbilt University)

Description The Neural Network Verification (NNV) Tool [92, 68, 69] is a formal verification software tool for deep learning models and cyber-physical systems with neural network components written in MATLAB and available at https://github.com/verivital/nnv. NNV uses a star-set state-space representation and reachability algorithm that allows for a layer-by-layer computation of exact or overapproximate reachable sets for feed-forward [90], convolutional [87], semantic segmentation (SSNN) [91], and recurrent (RNN)[89] neural networks, as well as neural network control systems (NNCS) [88, 92] and neural ordinary differential equations (Neural ODEs) [72]. The star-set based algorithm is naturally parallelizable, which allows NNV to be designed to perform efficiently on multi-core platforms. Additionally, if a particular safety property is violated, NNV can be used to construct and visualize the complete set of counterexample inputs for a neural network (exact-analysis). For this competition, updated from last year's, we tailor the solver approach depending on the benchmark at hand, although all

follow a similar flow. First, we perform a simulation-guided search for counterexamples for a fixed number of samples. If no counterexamples are found (i.e., demonstrate that the property is SAT), then we utilize an iterative refinement approach using reachability analysis to verify the property (UNSAT). This consists of performing reachability analysis using a relax-approximation method [91], if not verified, then a less conservative approximation based on zonotope pre-filtering approach [86], and finally using the exact analysis when possible [87] until the specification is verified or there is a timeout. Based on the benchmark to evaluate, the initial reachability analysis may be any of the overapproximation methods or the exact method, based on the complexity of the benchmarks (size of network, input, etc). In addition to the star set-based approaches, we implement another approach based on conformal prediction that can scale better to larger networks and input sizes, although only probabilistic guarantees can be provided [43]. This is the only method that uses GPU, all others run solely on CPU.

Link `https://github.com/verivital/nnv`

Commit 696e20d3dbe566ee45cd2e2a3f6c352e44bcd448

Hardware and licenses CPU and GPU, MATLAB license.

Participated Benchmarks Regular track (all) and Extended track (vggnet16, ml4acopf, reluspliter).

3.6 PyRAT

Team Augustin Lemesle, Julien Lehmann, Tristan Le Gall (CEA-List)

Description PyRAT (Python Reachability Assessment Tool) [65, 64] is an abstract interpretation based tool to verify the safety and robustness of neural networks. PyRAT relies on multiple zonotopic domains to efficiently compute the reachable states for various architectures of neural networks (fully-connected, convolutionnal, recurrent, transformers, ...). It supports multiple non-linear activation functions (ReLU, Sigmoid, Softmax, Floor, ...) with precise abstractions while maintaining floating-point soundness. PyRAT is correct in that the output bounds reached will always be a sound over-approximation of the results and complete for ReLU based networks in that it will always give a true or false result given enough time. Depending on the benchmark, different verification modes and domains can be selected. For smaller networks and problems, PyRAT can leverage branch and bound strategies on the inputs with heuristics like ReCIPH [37]. While on larger ReLU networks, PyRAT will use branch and bound strategies on the ReLU neurons in conjunction with fast GPU computation.

Link https://git.frama-c.com/pub/pyrat

Commit 4a9a4f065a623be395ac4b3385a47ea81638dc48

Hardware and licenses CPU and GPU, closed source CEA licence.

Participated benchmarks All benchmarks.

3.7 SobolBox

Team Sarthak Das (Indian Institute of Technology Gandhinagar)

Description SobolBox is a spiritual successor to the unsubmitted INNVerS [4] project, developed by Shubhajit Roy (IIT Gandhinagar) and Avishek Lahiri (IACS Kolkata) for VNNCOMP-2021, under the supervision of Dr. Rajarshi Ray (IACS Kolkata). SobolBox [5, 26] is a Python-based black-box falsification tool for detecting safety violations in neural networks. It accepts ONNX-format models and VNNLIB safety specifications, treating networks as multi-input, multi-output, non-convex systems without architectural assumptions. Input bounds are

extracted via the Z3 theorem prover, then quasi-Monte Carlo Sobol sequence sampling [83] generates low-discrepancy candidate points. Local refinement of extrema is performed with L-BFGS-B optimization [21], and the resulting bounds are checked against the safety property using Z3. Results are reported as `sat` with counterexample, `unsat` (high-confidence but unsound), or `unknown`. An optional `deep` mode applies Automatic Differentiation Variational Inference [62] to explore complex input regions when the first pass is inconclusive. SobolBox includes caching of Sobol samples and computed output bounds for faster incremental runs.

Links https://github.com/dassarthak18/SobolBox

Commit 0ec47e58f0b1ff9513667c61b5bd6350e536b77d

Hardware and licenses CPU, no license required.

Participated benchmarks `acasxu`, `cersyve`, `collins-rul-cnn`, `linearizenn`, `nn4sys`, `safe-nlp`, `sat-relu`, `tllverifybench`, `ml4acopf`.

4 Benchmarks

In this section, we provide an overview of all scored benchmarks, reproducing the benchmark proposers' descriptions. Artifacts for all benchmarks are available in the repository[5].

Table 3: Overview of all scored benchmarks.

Category	Benchmark	Application	Network Types	# Params	Effective Input Dim	Track
Complex	cGAN	Image Generation & Image Prediction	Conv. + Vision Transformer	500k - 68M	5	regular
	NN4Sys	Dataset Indexing & Cardinality Prediction	ReLU + Sigmoid	33k - 37M	1-308	regular
	LinearizeNN	NN controller approximation	FC. + Conv. + Vision Transformer + Residual + ReLU	203k	4	regular
	ml4acopf	Power System	Complex (ReLU + Trigonometric + Sigmoid)	4k-680k	22 - 402	extended
	ViT	Vision	Conv. + Residual + Softmax + BatchNorm	68k - 76k	3072	extended
	Collins Aerospace	-	FC + Conv. + Residual, LeakyReLU + MaxPool + Square	1.8M	1.2M	extended
	LSNC-ReLU	Lyapunov stability of NN controllers	FC, ReLU	275	6	extended
	CCTSDB	-	FC + Conv. + Residual, ReLU + MaxPool + Clip	100k	2	extended
CNN & ResNet	Collins RUL CNN	Condition Based Maintenance	Conv. + ReLU, Dropout	60k - 262k	400 - 800	regular
	VGGNet16	Image Classification	Conv. + ReLU + MaxPool	138M	150k	extended
	Traffic Signs Recognition	Image Classification	Conv. + Sign + MakPool + BatchNorm	905k - 1.7M	2.7k - 12k	extended
	cifar100	Image Classification	FC + Conv. + Residual, ReLU + BatchNorm	2.5M - 3.8M	3072	regular
	tinyimagenet	Image Classification	FC + Conv. + Residual, ReLU + BatchNorm	3.6M	9408	regular
	Metaroom	-	Conv. + FC, ReLU	466k - 7.4M	5376	regular
	Yolo	-	FC + Conv. + Residual, ReLU + Sigmoid	22k - 37M	1 - 308	extended
	SoundnessBench	Verifier Test	FC + Conv. + ReLU	1.7M	12k	regular
	Relusplitter	Meta-Benchmark	FC + Conv. + ReLU	13k - 625k	5 - 3k	extended
	MalBeWare	Malware Classification	FC + Conv. + ReLU	102k - 1.5M	4k	regular
	cersyve	Neural Certificates for Control Systems	FC + Residual + ReLU	1k - 4k	2 - 6	regular
FC	TLL Verify Bench	Two-Level Lattice NN	Two-Level Lattice NN (FC. + ReLU)	17k - 67M	2	regular
	Acas XU	Collision Detection	FC. + ReLU	13k	5	regular
	Dist Shift	Distribution Shift Detection	FC. + ReLU + Sigmoid	342k - 855k	792	regular
	safeNLP	Sentence classification	FC. + ReLU	4k	30	regular
	CORA	Image Classification	FC. + ReLU	575k, 1.1M	784, 3072	regular
	SAT ReLU	Verifier Test	FC. + ReLU	100-35k	2 - 100	regular

4.1 cGAN

Proposed by Feiyang Cai, Ali Arjomandbigdeli, Stanley Bak (Stony Brook University)

Motivation While existing neural network verification benchmarks focus on discriminative models, the exploration of practical and widely used generative networks remains neglected in terms of robustness assessment. This benchmark introduces a set of image generation networks specifically designed for verifying the robustness of the generative networks.

Networks The generative networks are trained using conditional generative adversarial networks (cGAN), whose objective is to generate camera images that contain a vehicle obstacle located at a specific distance in front of the ego vehicle, where the distance is controlled by the input distance condition. The network to be verified is the concatenation of a generator and a discriminator. The generator takes two inputs: 1) a distance condition (1D scalar) and 2) a noise vector controlling the environment (4D vector). The output of the generator is the generated image. The discriminator takes the generated image as input and outputs two values: 1) a real/fake score (1D scalar) and 2) a predicted distance (1D scalar). Several different models with varying architectures (CNN and vision transformer) and image sizes (32x32, 64x64) are provided for different difficulty levels.

[5] https://github.com/VNN-COMP/vnncomp2025_benchmarks

Specifications The verification task is to check whether the generated image aligns with the input distance condition, or in other words, verify whether the input distance condition matches the predicted distance of the generated image. In each specification, the inputs (condition distance and latent variables) are constrained in small ranges, and the output is the predicted distance with the same center as the condition distance but with slightly larger range.

Link https://github.com/feiyang-cai/cgan_benchmark2023

4.2 NN4Sys

Proposed by the α,β-CROWN team with collaborations with Cheng Tan, Haoyu He and Shuyi Lin at Northeastern University.

Application The benchmark contains networks for database learned index, video streaming learned adaptive bitrate, and learned cardinality estimation which map inputs from various dimensions to 1-dimension outputs.

- *Background*: learned index, learned cardinality, and learned adaptive bitrate are all instances in neural networks for computer systems (NN4Sys), which are neural network based methods performing system operations. These classes of methods show great potential but have one drawback—the outputs of an NN4Sys model (a neural network) can be arbitrary, which may lead to unexpected issues in systems.
- *What to verify*: our benchmark provides multiple pairs of (1) trained NN4Sys model and (2) corresponding specifications. We design these pairs with different parameters such that they cover a variety of user needs and have varied difficulties for verifiers. We describe benchmark details in our NN4SysBench report: http://naizhengtan.github.io/doc/papers/nn4sys23lin.pdf.
- *Translating NN4Sys applications to a VNN benchmark*: the original NN4Sys applications have some sophisticated structures that are hard to verify. We tailored the neural networks and their specifications to be suitable for VNN-COMP. For example, learned index [61] contains multiple NNs in a tree structure that together serve one purpose. However, this cascading structure is inconvenient/unsupported to verify because there is a "switch" operation—choosing one NN in the second stage based on the prediction of the first stage's NN. To convert learned indexes to a standard form, we train a monolithic (larger) NN.
- *A note on broader impact*: using NNs for systems is a broad topic, but many existing works lack strict safety guarantees. We believe that NN Verification can help system developers gain confidence to apply NNs to critical systems. We hope our benchmark can be an early step toward this vision.

Networks This benchmark has twelve networks with different parameters: two for learned indexes, four for learned cardinality estimation and six for learned adaptive bitrate. The learned index uses fully-connected feed-forward neural networks. The other two—the learned cardinality and the learned adaptive bitrate—have a relatively sophisticated internal structure. Please see our NN4SysBench report (URL listed above) for details

Specifications For learned indexes, the specification aims to check if the prediction error is bounded. The specification is a collection of pairs of input and output intervals such that any input in the input interval should be mapped to the corresponding output interval. For learned cardinality estimation and learned adaptive bitrate, the specifications check the prediction error bounds (similar to the learned indexes) and monotonicity of the networks. By monotonicity

specifications, we mean that for two inputs, the network should produce a larger output for the larger input, which is required by cardinality estimation or adaptive bitrate.

Link: https://github.com/Khoury-srg/VNNComp23_NN4Sys

4.3 LinearizeNN

Proposed by Ali Arjomandbigdeli, Stanley Bak (Stony Brook University).

Motivation Assuming having a neural network controller approximation with a piecewise linear model in the form of a set of linear models with added noise to account for local linearization error. The objective of this benchmark is to investigate the neural network output falls within the range we obtain from our linear model output plus some uncertainty. The idea of this benchmark came from one of our recent paper [10] in which we approximated the NN controller with a piecewise linear model, and we wanted to check if the neural network output falls within the range we obtained from our linear model output plus some uncertainty.

Networks The neural network controller we used in this benchmark is an image-based controller for an Autonomous Aircraft Taxiing System whose goal is to control an aircraft's taxiing at a steady speed on a taxiway. This network was introduced in the paper "Verification of Image-based Neural Network Controllers Using Generative Models" [53]. The neural network integrates a concatenation of the cGAN (conditional GAN) and controller, resulting in a unified neural network controller with low-dimensional state inputs. In this problem, the inputs to the neural network consist of two state variables and two latent variables. The aircraft's state is determined by its crosstrack position (p) and heading angle error (θ) with respect to the taxiway center line. Two latent variables with a range of -0.8 to 0.8 are introduced to account for environmental changes. Because in this case the output spec depends on both the input and output and considering the VNN-LIB limitation, we added a skip-connection layer to the neural network to have the input values present in the output space. We also added one linear layer after that to create a linear equation for each local model.

Specifications As mentioned earlier, the aim of this benchmark is to examine whether the neural network output stays within the range defined by the linear model's output, including a margin for uncertainty.Given input $x \in X$ and output $Y = f_{NN}(x)$, the query is of the form: $A_{mat} \times X + b + U_{lb} \leq Y \leq A_{mat} \times X + b + U_{ub}$ for each linear model in its abstraction region.

Link https://github.com/aliabigdeli/LinearizeNN_benchmark2024

4.4 ml4acopf

Proposed by Haoruo Zhao, Michael Klamkin, Mathieu Tanneau, Wenbo Chen, and Pascal Van Hentenryck (Georgia Institute of Technology), and Hassan Hijazi, Juston Moore, and Haydn Jones (Los Alamos National Laboratory).

Motivation Machine learning models are utilized to predict solutions for an optimization model known as AC Optimal Power Flow (ACOPF) in the power system. Since the solutions are continuous, a regression model is employed. The objective is to evaluate the quality of these machine learning model predictions, specifically by determining whether they satisfy the constraints of the optimization model. Given the challenges in meeting some constraints, the goal is to verify whether the worst-case violations of these constraints are within an acceptable tolerance level.

Networks The neural network designed comprises two components. The first component predicts the solutions of the optimization model, while the second evaluates the violation of each

constraint that needs checking. The first component consists solely of general matrix multiplication (GEMM) and rectified linear unit (ReLU) operators. However, the second component has a more complex structure, as it involves evaluating the violation of AC constraints using nonlinear functions, including sigmoid, quadratic, and trigonometric functions such as sine and cosine. This complex evaluation component is incorporated into the network due to a limitation of the VNNLIB format, which does not support trigonometric functions. Therefore, these constraints violation evaluation are included in the neural network.

Specifications In this benchmark, four different properties are checked, each corresponding to a type of constraint violation:

1. Power balance constraints: the net power at each bus node is equal to the sum of the power flows in the branches connected to that node.
2. Thermal limit constraints: power flow on a transmission line is within its maximum and minimum limits.
3. Generation bounds: a generator's active and reactive power output is within its maximum and minimum limits.
4. Voltage magnitude bounds: a voltage's magnitude output is within its maximum and minimum limits.

The input to the model is the active and reactive load. The chosen input point for perturbation is a load profile for which a corresponding feasible solution to the ACOPF problem is known to exist. For the feasibility check, the input load undergoes perturbation. Although this perturbation does not exactly match physical laws, the objective is to ascertain whether a machine learning-predicted solution with the perturbation can produce a solution that does not significantly violate the constraints.

The scale of the perturbation and the violation threshold are altered by testing whether an adversarial example can be easily found using projected gradient descent with the given perturbation. The benchmark, provided with a fixed random seed, is robust against the simple projected gradient descent that is implemented.

Link https://github.com/AI4OPT/ml4acopf_benchmark

4.5 ViT

Proposed by the α,β-CROWN team.

Motivation Transformers [93] based on the self-attention mechanism have much more complicated architectures and contain more kinds of nonlinerities, compared to simple feedforward networks with relatively simple activation functions. It makes verifying Transformers challenging. We aim to encourage the development of verification techniques for Transformer-based models, and we also aim to benchmark neural network verifiers on relatively complicated neural network architectures and more general nonlinearities. Therefore, we propose a new benchmark with Vision Transformers (ViTs) [28]. This benchmark is developed based on our work on neural network verification for models with general nonlinearities [78].

Networks The benchmark contains two ViTs, as shown in Table 4. Considering the difficulty of verifying ViTs, we modify the ViTs and make the models relatively shallow and narrow, with significantly reduced number of layers and attention heads. Following [80], we also replace the layer normalization with batch normalization. The models are mainly trained with PGD training [70], and we also add a weighted IBP [41, 79] loss for one of the models as a regularization.

Table 4: Networks in the ViT benchmark.

Model	PGD_2_3_16	IBP_3_3_8
Layers	2	3
Attention heads	3	3
Patch size	16	8
Weight of IBP loss	0	0.01
Training ϵ	$\frac{2}{255}$	$\frac{1}{255}$
Clean accuracy	59.78%	62.21%

Specifications The specifications are generated from the robustness verification problem with ℓ_∞ perturbation. We use the CIFAR-10 dataset with perturbation size $\epsilon = \frac{1}{255}$ at test time. We have filtered the CIFAR-10 test set to exclude instances where either adversarial examples can be found (by PGD attack [70] with 100 steps and 1000 restarts) or the vanilla CROWN-like method [104, 80] can already easily verify. We randomly keep 100 instances for each model, with a timeout threshold of 100 seconds. Note that since instances with adversarial examples have mostly been excluded during the filtering process, this version of the benchmark may not be able to reflect soundness issues in verifiers, and we refer readers to [108] for discussions on testing soundness with models including ViT.

Link https://github.com/shizhouxing/ViT_vnncomp2023

4.6 LSNC-ReLU

Proposed by the α,β-CROWN team.

Motivation We develop a benchmark for the problem of verifying the Lyapunov stability of NN controllers in nonlinear dynamical systems within a region-of-intrest and a region-of-attraction. This is important for providing stability guarantees that are essential for safety-critical applications with NN controllers. It is also a useful application of neural network verification as recently demonstrated in [101, 77], and we refer readers to those works for more details on the problem.

Networks and Specifications The NN controller and Lyapunov function are trained using the technique presented in CT-BaB [77]. Compared to a general nonlinear dynamics as in [101], we utilized a neural-network dynamics. More specifically, the dynamics of this model is given by a shallow neural network with ReLU activations that are trained to approximate the 2D quadrotor dynamics. In this way, only ReLU nonlinearity is presented in the network (no trig functions, leakyrelu, etc.). The verification goal is to certify the Lyapunov stability of the NN controller in a nonlinear dynamical system within a certain Lyapunov sublevel set ($V < c$). Specifications for the benchmark are randomly generated and consist of random rings of the form $x : c_1 < V(x) < c_2$.

Link https://github.com/xiangruzh/LSNC-ReLU

4.7 Collins-RUL-CNN

Proposed by Collins Aerospace, Applied Research & Technology (website).

Motivation Machine Learning (ML) is a disruptive technology for the aviation industry. This particularly concerns safety-critical aircraft functions, where high-assurance design and verifi-

cation methods have to be used in order to obtain approval from certification authorities for the new ML-based products. Assessment of correctness and robustness of trained models, such as neural networks, is a crucial step for demonstrating the absence of unintended functionalities [38, 55]. The key motivation for providing this benchmark is to strengthen the interaction between the VNN community and the aerospace industry by providing a realistic use case for neural networks in future avionics systems [54].

Application Remaining Useful Life (RUL) is a widely used metric in Prognostics and Health Management (PHM) that manifests the remaining lifetime of a component (e.g., mechanical bearing, hydraulic pump, aircraft engine). RUL is used for Condition-Based Maintenance (CBM) to support aircraft maintenance and flight preparation. It contributes to such tasks as augmented manual inspection of components and scheduling of maintenance cycles for components, such as repair or replacement, thus moving from preventive maintenance to *predictive* maintenance (do maintenance only when needed, based on component's current condition and estimated future condition). This could allow to eliminate or extend service operations and inspection periods, optimize component servicing (e.g., lubricant replacement), generate inspection and maintenance schedules, and obtain significant cost savings. Finally, RUL function can also be used in airborne (in-flight) applications to dynamically inform pilots on the health state of aircraft components during flight. Multivariate time series data is often used as RUL function input, for example, measurements from a set of sensors monitoring the component state, taken at several subsequent time steps (within a time window). Additional inputs may include information about the current flight phase, mission, and environment. Such highly multi-dimensional input space motivates the use of Deep Learning (DL) solutions with their capabilities of performing automatic feature extraction from raw data.

Networks The benchmark includes 3 convolutional neural networks (CNNs) of different complexity: different numbers of filters and different sizes of the input space. All networks contain only convolutional and fully connected layers with ReLU activations. All CNNs perform the regression function. They have been trained on the same dataset (time series data for mechanical component degradation during flight).

Specifications We propose 3 properties for the NN-based RUL estimation function. First, two properties (robustness and monotonicity) are local, i.e., defined around a given point. We provide a script with an adjustable random seed that can generate these properties around input points randomly picked from a test dataset. For robustness properties, the input perturbation (delta) is varied between 5% and 40%, while the number of perturbed inputs varies between 2 and 16. For monotonicity properties, monotonic shifts between 5% and 20% from a given point are considered. Properties of the last type ("if-then") require the output (RUL) to be in an expected value range given certain input ranges. Several if-then properties of different complexity are provided (depending on range widths).

Link https://github.com/loonwerks/vnncomp2022

Paper Available in [54] or on request.

4.8 VGGNET16

Proposed by Stanley Bak, Stony Brook University

Motivation This benchmark tries to scale up the size of networks being analyzed by using the well-studied VGGNET-16 architecture [82] that runs on ImageNet. Input-output properties are proposed on pixel-level perturbations that can lead to image misclassification.

Networks All properties are run on the same network, which includes 138 million parameters. The network features convolution layers, ReLU activation functions, as well as max pooling layers.

Specifications Properties analyzed ranged from single-pixel perturbations to perturbations on all 150528 pixles (L-infinity perturbations). A subset of the images was used to create the specifications, one from each category, which was randomly chosen to attack. Pixels to perturb were also randomly selected according to a random seed.

Link https://github.com/stanleybak/vggnet16_benchmark2022/

4.9 Traffic Signs Recognition

Proposed by Mădălina Eraşcu and Andreea Postovan (West University of Timisoara, Romania)

Motivation Traffic signs play a crucial role in ensuring road safety and managing traffic flow in both city and highway driving. The recognition of these signs, a vital component of autonomous driving vision systems, faces challenges such as susceptibility to adversarial examples [84] and occlusions [105], stemming from diverse traffic scene conditions.

Networks Binary neural networks (BNNs) show promise in computationally limited and energy-constrained environments within the realm of autonomous driving [48]. BNNs, where weights and/or activations are binarized to ± 1, offer reduced model size and simplified convolution operations for image recognition compared to traditional neural networks (NNs).

We trained and tested various BNN architectures using the German Traffic Sign Recognition Benchmark (GTSRB) dataset [3]. This multi-class dataset, containing images of German road signs across 43 classes, poses challenges for both humans and models due to factors like perspective change, shade, color degradation, and lighting conditions. The dataset was also tested using the Belgian Traffic Signs [1] and Chinese Traffic Signs [2] datasets. The Belgium Traffic Signs dataset, with 62 classes, had 23 overlapping classes with GTSRB. The Chinese Traffic Signs dataset, with 58 classes, shared 15 classes with GTSRB. Pre-processing steps involved relabeling classes in the Belgium and Chinese datasets to match those in GTSRB and eliminating non-overlapping classes (see [75] for details).

We provide three models with the structure in Figures 1, 2, and 3. They contain QConv, Batch Normalization (BN), Max Pooling (ML), Fully Connected/Dense (D) layers. Note that the QConv layer binarizes the corresponding convolutional layer. All models were trained for 30 epochs. The model from Figure 1 was trained with images having the dimension 64px x 64 px, the one from Figure 2 with 48px x 48 px and the one from Figure 3 with 30px x 30 px. The two models involving Batch Normalization layers introduce real valued parameters besides the binary ones, while the third one contains only binary parameters (see Table 5) for statistics.

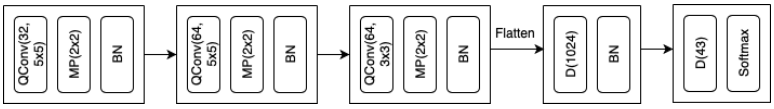

Figure 1: Accuracy Efficient Architecture for GTSRB and Belgium dataset

Specifications To evaluate the *adversarial robustness* of the networks above, we assessed perturbations within the infinity norm around zero, with the radius denoted as $\epsilon = \{1, 3, 5, 10, 15\}$. This involved randomly selecting three distinct images from the GTSRB dataset's test set for each model and generating VNNLIB files for each epsilon in the set. In total, we created

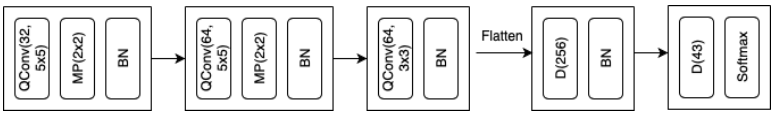

Figure 2: Accuracy Efficient Architecture for Chinese dataset

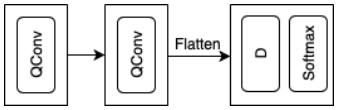

Figure 3: XNOR(QConv) architecture

45 VNNLIB files. Due to a 6-hour total timeout constraint for solving all instances, each instance had a maximum timeout of 480 seconds. To review the generated VNNLIB specification files submitted to VNNCOMP 2023, as well as to generate new ones, please refer to https://github.com/apostovan21/vnncomp2023.

Link https://github.com/apostovan21/vnncomp2023

4.10 CIFAR100

Proposed by the α,β-CROWN team.

Motivation This benchmark is reused from VNN-COMP 2022 with a reduced complexity (only two out of the four models with medium sizes are retained). See details in Section 4.5 of the report of VNN-COMP 2022 [74].

Networks We provide two ResNet models on CIFAR-100 with different model widths and depths (input dimension $32 \times 32 \times 3$, 100 classes):

- `CIFAR100-ResNet-medium`: 8 residual blocks, 17 convolutional layers + 2 linear layers
- `CIFAR100-ResNet-large`: 8 residual blocks, 19 convolutional layers + 2 linear layers (almost identical to standard ResNet-18 architecture)

Specifications We randomly select 100 images from the CIFAR-100 test set with a verification timeout of 100 seconds for each of the two models. We filtered out the samples which can be verified by vanilla CROWN (which is used during training) to make the benchmark more challenging. The filtering process is done offline on a machine with a GPU due to the large sizes of these models. A small proportion of instances (around 18%) with adversarial examples have been retained for potentially identifying unsound results.

Link https://github.com/huanzhang12/vnncomp2024_cifar100_benchmark

4.11 TinyImagenet

Proposed by the α,β-CROWN team.

Motivation This benchmark is reused from VNN-COMP 2022. See details in Section 4.5 of the report of VNN-COMP 2022 [74].

Networks We provide a ResNet for TinyImageNet (input dimension $64 \times 64 \times 3$, 200 classes):

- `TinyImageNet-ResNet-medium`: 8 residual blocks, 17 convolutional layers + 2 linear layers

Table 5: Training and Testing Statistics

Input size	Model name	Accuracy			#Params		
		German	China	Belgium	Binary	Real	Total
64px × 64px	Figure 1	96.45	81.50	88.17	1772896	2368	1775264
48px × 48px	Figure 2	95.28	83.90	87.78	904288	832	905120
30px × 30px	Figure 3	81.54	N/A	N/A	1005584	0	1005584

Specifications We randomly select 200 images from the TinyImageNet test set with a verification timeout of 100 seconds for each of the two models. A filtering procedure has been adopted similar to the CIFAR100 benchmark.

Link https://github.com/huanzhang12/vnncomp2024_tinyimagenet_benchmark

4.12 Yolo

Proposed by the α,β-CROWN team.

Motivation Object detection is central to many safety-critical applications, yet verification research has had limited benchmarks that capture its unique challenges. Even in a simplified form, YOLO highlights key aspects of detection tasks: multiple outputs, spatial reasoning over bounding boxes, and the need to ensure reliable perception under perturbations. A YOLO benchmark therefore provides a concrete step toward advancing verification methods for complex perception tasks such as object detection.

Networks The model is a modified version of YOLOv2. For simplicity of verification, the backbone of the original YOLOv2 model is replaced with a much smaller network. The network takes in an image ($3 \times 52 \times 52$) and outputs a tensor of a shape $125 \times 13 \times 13$, which contains the confidence scores, the classification result, and the positions of 5 bounding boxes for each of the 13×13 grid cells. The network was trained using adversarial training, incorporating an ℓ_1 regularization term in the loss.

Specifications Robustness properties are defined on the inputs and raw output tensors of the backbone network. For each instance, the property is verified if there is at least one bounding box successfully predicting the same object (with a confidence score greater than a preset threshold) given any bounded random perturbations on the input image.

Link https://github.com/xiangruzh/Yolo-Benchmark

4.13 SoundnessBench

Proposed by the α,β-CROWN team.

Motivation We introduce SoundnessBench, a novel benchmark designed to evaluate the soundness of neural network (NN) verifiers, inspired by the work [108]. While recent years have seen significant progress in developing both NN verifiers and benchmarks, existing benchmarks typically lack ground truth for challenging instances. As a result, it remains difficult to determine whether a verification claim is sound when no verifier can falsify the property under consideration.

Networks SoundnessBench includes a simple feedforward neural network with minimal architectures and standard operators widely supported by mainstream verifiers. These operators include fully connected (linear) layers, 2D convolutional layers, ReLU activations, as well as reshaping and flattening operations between 2D and 1D formats.

Specifications The verification tasks are synthetic, with some specifications intentionally designed to embed counterexamples that are difficult for standard falsification methods—such as projected gradient descent (PGD)—to discover. Specifications are expressed as conjunctions of clauses. **All instances are SAT**, and any UNSAT reports likely indicate a verifier bug.

Link https://github.com/keyis2/SoundnessBench_vnncomp2025

4.14 Relusplitter

Proposed by Linhan Li and ThanhVu Nguyen (George Mason University)

Motivation Many existing DNN verification benchmarks are becoming ineffective at evaluating modern verifiers because their instances are often too easy or too hard and lack architectural diversity. To address these issues and allow for the reuse of established benchmarks, we propose Relusplitter [67]. It takes a DNN verification instance (network and property) and generates a semantically equivalent network on which the property is harder to verify. Relusplitter achieves this by systematically destabilizing stable neurons in the network.

Description This benchmark uses selected instances from benchmarks used in previous VNNCOMP iterations as seed inputs to generate more challenging instances. The networks include both fully connected (FC) and convolutional (Conv) architectures. All networks use a standard feed-forward structure. The timeout for the instances was reduced based on results from prior iterations, and the generated instances have 3x timeout. Benchmarks used as seed inputs include (1) ACAS Xu, (2) MNIST_FC, (3) Oval21, and (4) Cifar Biasfield.

Networks The seed instances use the original network, and the generated instances use a destabilized network generated from the original network.

Specifications The original specification from the seed instance was used for each generated instance.

Link https://github.com/dynaroars/relusplitter/tree/VNNCOMP-25

4.15 TLL Verify Bench

Proposed by James Ferlez (University of California, Irvine)

Motivation This benchmark consists of Two-Level Lattice (TLL) NNs, which have been shown to be amenable to fast verification algorithms (e.g. [40]). Thus, this benchmark was proposed as a means of comparing TLL-specific verification algorithms with general-purpose NN verification algorithms (i.e. algorithms that can verify arbitrary deep, fully-connected ReLU NNs).

Networks The networks in this benchmark are a subset of the ones used in [40, Experiment 3]. Each of these TLL NNs has $n = 2$ inputs and $m = 1$ output. The architecture of a TLL NN is further specified by two parameters: N, the number of local linear functions, and M, the number of selector sets. This benchmark contains TLLs of sizes $N = M = 8, 16, 24, 32, 40, 48, 56, 64$, with 30 randomly generated examples of each (the generation procedure is described in [40, Section 6.1.1]). At runtime, the specified verification timeout determines how many of these networks are included in the benchmark so as to achieve an overall 6-hour run time; this selection process is deterministic. Finally, a TLL NN has a natural representation using multiple computation paths [40, Figure 1], but many tools are only compatible with fully-connected networks. Hence, the ONNX models in this benchmark implement TLL NNs by "stacking" these computation paths to make a fully connected NN (leading to sparse weight matrices: i.e. with many zero weights and biases). The `TLLnet` class (https://github.com/jferlez/TLLnet) contains the code necessary to generate these implementations via the `exportONNX` method.

Specifications All specifications have as input constraints the hypercube $[-2, 2]^2$. Since all networks have only a single output, the output properties consist of a randomly generated real number and a randomly generated inequality direction. Random output samples from the network are used to roughly ensure that the real number property has an equal likelihood of being within the output range of the NN and being outside of it (either above or below all NN outputs on the input constraint set). The inequality direction is generated independently and with each direction having an equal probability. This scheme biases the benchmark towards verification problems for which counterexamples exist.

Link https://github.com/jferlez/TLLVerifyBench

Commit 199d2c26d0ec456e62906366b694a875a21ff7ef

4.16 ACAS Xu

Networks The ACASXu benchmark consists of ten properties defined over 45 neural networks used to issue turn advisories to aircraft to avoid collisions. The neural networks have 300 neurons arranged in 6 layers, with ReLU activation functions. There are five inputs corresponding to the aircraft states, and five network outputs, where the minimum output is used as the turn advisory the system ultimately produces.

Specifications We use the original 10 properties [51], where properties 1-4 are checked on all 45 networks as was done in later work by the original authors [52]. Properties 5-10 are checked on a single network. The total number of benchmarks is therefore 186. The original verification times ranged from seconds to days—including some benchmark instances that did not finish. This year we used a timeout of around two minutes (116 seconds) for each property, in order to fit within a total maximum runtime of six hours.

4.17 Real-world distribution shifts

Proposed by the Marabou team.

Motivation While robustness against handcrafted perturbations (e.g., norm-bounded) for perception networks are more commonly investigated, robustness against real-world distribution shifts [98] are less studied but of practical interests. This benchmark set contains queries for verifying the latter type of robustness.

Networks The network is a concatenation of a generative model and a MNIST classifier. The generative model is trained to take in an unperturbed image and an embedding of a particular type of distribution shifts in latent space, and produce a perturbed image. The distribution shift captured in this case is the "shear" perturbation.

Specifications The verification task is to certify that a classifier correctly classifies all images in a perturbation set, which is a set of images generated by the generative model given a fixed image and a ball centering the mean perturbations on this image (in the latent space). This mean perturbation is computed by a prior network.

Link https://github.com/wu-haoze/dist-shift-vnn-comp

4.18 safeNLP

Proposed by Marco Casadio, Ekaterina Komendantskaya, Luca Arnaboldi, Tanvi Dinkar.

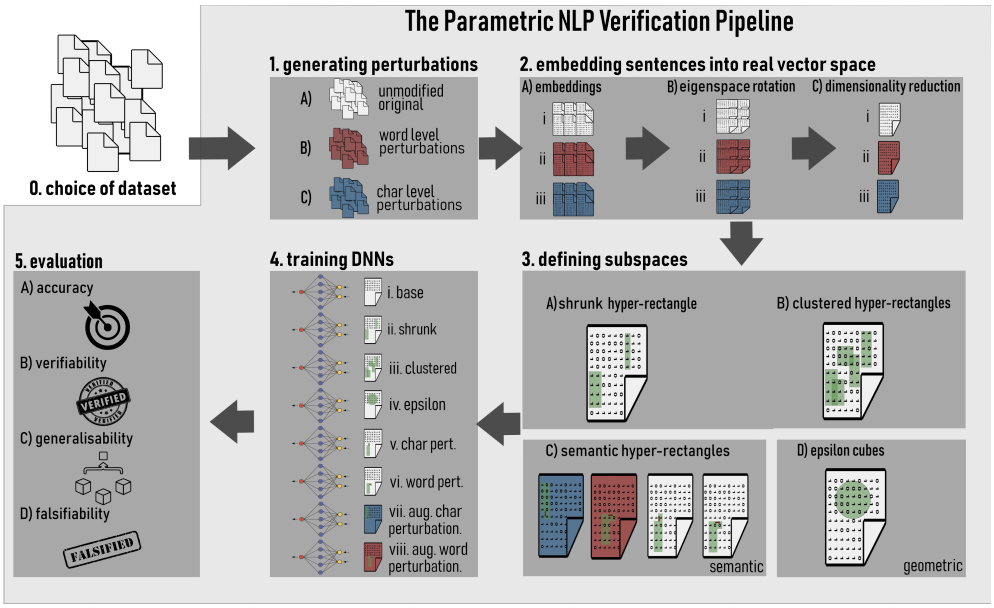

Figure 4: *Generic approach to generating the NLP verification pipelines [22, 23] deployed to obtain the safeNLP benchmark.*

Motivation While considerable research has been dedicated to the verification of DNN-based systems in domains such as computer vision, there has been a notable lack of focus on the verification of natural language processing (NLP) systems. This is particularly critical given the rise of conversational agents across various domains, where inaccurate or misleading responses can cause real-world harm. For example, recent EU legislation [60] requires chatbots to disclose their non-human nature when queried, and developers of the chatbots should provide firm, and if possible, formal, guarantees that such disclosure will be given in an accurate manner. Medical assistants give another example where formal guarantees about the conversational agent responses are needed in order to safeguard against chatbots generating harmful medical advice [15]. While some initial work has been done in this area of NLP verification [50, 47, 96, 106, 95, 56, 29, 81, 16], no agreement on commonly accepted benchmarks has been reached in this domain. To address this gap, we introduce safeNLP, the first such benchmark.

Application In [23], we have undertaken a large-scale study of the existing literature on NLP verification, and distilled common patterns among the existing approaches. Usually, given a dataset consisting of sentences divided into classes, Large Language Models (LLMs) are used to embed these sentences into real-vector spaces, after which smaller neural networks are trained to classify the embedded vectors (relative to the originally given classes). For verification, one can generate meaning-preserving sentence perturbations, again embed them into vector spaces, and verify that subspaces that contain the (embeddings of) the perturbed sentences are classified correctly. Also, in line with classical verification pipelines [24], one can use these input subspaces to train the neural network to be robust on them. The problem was that each of the existing approaches [50, 47, 96, 106, 95, 56, 29, 81, 16] used parts of this pipeline in different ways, which made it difficult to compare or audit the results. In [22, 23], we made a generic implementation of this pipeline, where each of the components of the pipeline is implemented in a modular and transparent way. For example, we can choose and vary embedding functions, training modes,

algorithms for sentence perturbations and algorithms for robust training, independently and modularly; as shown in Figure 4. This implementation was used to generate the presented VNNCOMP benchmark.

- *Datasets:* Although there was no clear consensus in [50, 47, 96, 106, 95, 56, 29, 81, 16], the most frequently used dataset in prior works was the IMDB dataset containing film reviews. Its disadvantage is unclear relation to safety critical domains that usually motivate verification efforts. On the other hand, none of the previously used datasets concerned safety-critical applications of NLP. We decided to address this problem, and therefore applied our generic NLP verification pipeline on two safety-critical datasets: R-U-A-Robot [42], which focuses on the chatbot disclosure problem, and Medical [8], which addresses the issue of harmful advice provided by medical chatbots. Both datasets are pre-processed into two classes, positive and negative, to simplify the verification task. For further details on the pre-processing steps and datasets, see [23] and the benchmark GitHub repository.
- *Input Space:* In both datasets, sentences are transformed into fixed-size vector representations, i.e. embeddings, which serve as the inputs to the neural networks. For this VNNCOMP benchmark, we used Sentence-BERT [76].
- *What to Verify:* For each dataset, we generated meaning-preseving sentence perturbations at character and word level as in Moradi et al. [73] and at sentence level with Vicuna [25]. For each positive sentence in the dataset, the smallest hypercube containing the embeddings of all of its obtained perturbations formed one input subspace for verification. Such subspaces were obtained for all positive sentences from the given data set, and were subject to VNCCOMP verification challenge.
- *A note on broader impact:* Verified models can serve as filters for larger NLP systems: e.g. to screen inputs to ensure they meet safety criteria before being passed on to more complex models.

Networks The safeNLP benchmark includes two neural networks, each corresponding to a different dataset (R-U-A-Robot and Medical). Both networks share the same architecture, consisting of two fully-connected layers. The hidden layer has 128 units with a ReLU activation function, while the output layer has 2 units representing the two classification classes (positive/negative). To enhance the robustness of the networks to the specified safety requirements, they are trained using a custom PGD (Projected Gradient Descent) [71] adversarial training technique. In particular, the PGD attack explores the above-mentioned subspaces of the input space (cf. also Figure 4).

Specifications The benchmark uses hyper-rectangles in the 30-dimensional embedding space as the subspaces of choice, offering a computationally efficient way to define more precise and adaptable regions compared to the traditional ϵ-cubes. The specifications require verifying that, for a given network and hyper-rectangle, every point within the hyper-rectangle is classified as the positive class by the network. To meet time constraints, we randomly select 1,080 such specifications, each linked to one of the two networks and a corresponding hyper-rectangle, with a timeout of 20 seconds per specification.

Link `https://github.com/ANTONIONLP/safeNLP`

4.19 CORA Benchmark

Proposed by the CORA team.

Motivation The verification of neural networks can be quite slow, i.e., the verification of a single instance can take multiple days – which is often hard to justify, particularly in safety-critical scenarios. To encourage the fast verification of neural networks, our benchmark focuses on the verification time by setting a small timeout and testing three different (adversarial) training techniques that aim to ease the verifiability.

Networks The benchmark consists of one ReLU-neural network architecture (7x250 + ReLU), which was trained on three datasets, (MNIST, SVHN, and CIFAR10), using three different (adversarial) training methods, i.e., standard (point), interval-bound propagation, and set-based. Both interval-bound propagation and set-based training are training methods that improve the robustness of the trained neural network and aim to ease later verification. The neural networks are taken from the first evaluation run of [59]; please refer to [59] for the training details.

Specifications All networks are trained on classification tasks. The goal is to verify that no image within a given input set is incorrectly classified.

Link https://github.com/kollerlukas/cora-vnncomp2024-benchmark

4.20 SAT ReLU

Proposed by Edoardo Manino (The University of Manchester)

Motivation Neural network verifiers are fundamentally not different from any other piece of software in that they may contain bugs. As such, it is necessary to test their behavior for correctness. To this end, the SAT ReLU benchmark is constructed with the additional requirement of having its verification verdicts (safe or unsafe) known a priori. With it, we can test all neural network verifiers for correctness.

Description The SAT ReLU benchmark is entirely synthetic. Each instance is built by generating a random 3-SAT boolean formula with known satisfiability verdict. In total, we generate 50 satisfiable formulae and 50 unsatisfiable ones in CNF format. We vary the number of variables in $v = [2, 100]$ and the number of clauses in $c = [v, 5v]$. Then, we encode the formulae as neural network verification problems.

Networks We encode each CNF formula as a fully-connected ReLU network with one hidden layer. To do so, we take inspiration from the ReLU gadgets introduced by [51]. First, we assume that each element of the input $x \in \mathbb{R}^v$ represents a boolean variable $x_i \in \{0, 1\}$. Half of the network encodes the boolean arithmetic necessary to compute the CNF formula under this assumption. Second, we let each variable vary in $x_i \in [0, 1]$ and use the other half of the network to encode the necessary binarization constraints. Finally, we merge the two halves into a single network. The final network has v inputs, $c + 2v$ hidden activations, and 2 outputs.

Specifications Given the nature of the networks we construct, the original CNF formula is satisfiable if and only if there exists some input $x \in \{0, 1\}^n$ that produces an output of $y_1 \geq 1$. Non-binary inputs cause the second output to be positive, and thus are rejected by setting a binarization constraint of $y_2 \leq 0$.

Link https://github.com/emanino/neurocodebench

4.21 MetaRoom

Proposed by Hanjiang Hu (CMU), Zuxin Liu (CMU), Linyi Li (UIUC), Jiacheng Zhu (CMU), Ding Zhao (CMU).

Motivation MetaRoom Benchmark is based on the MetaRoom dataset, which aims at the robustness certification and verification of deep learning based vision models against camera motion perturbation in the indoor robotics application. Specifically, this benchmark focuses on the classification of 20 labels against camera moves within tiny perturbation radii of translation along the z-axis and rotation along the y-axis (e.g. 1e-5 m, 2.5e-4 degree). The MetaRoom dataset is a realistic indoor object recognition dataset with dense point cloud maps, which enables image projections from different camera poses and simulates object-centric semantic robustness in real-world robotic applications. More details about the dataset can be found in [45].

Networks The models of `cnn_4layer` and `cnn_6layer` are 4-layer and 6-layer convolutional neural networks with a last layer of a fully connected layer for multi-class classification. The input shape is `1*3*32*56`, which is projected from one-dimensional relative camera rotation or translation around 0 (e.g. [-1e-5, 1e-5]) from a very dense point cloud based on direct Z-buffering. And the output is for the classification of 20 labels. The pretrained models give correct predictions at camera motion movement origins.

Specifications Simplified from the 1-dim semantic perturbation studied in [44, 46], the benchmark for VNN-COMP adopts the pre-projected image specifications from a very dense point cloud, where the lower and upper bounds are all pixels of the image during the projection within the camera perturbation radius of translation along the z-axis or rotation along the y-axis. The output specifications will be the classification labels at camera movement origins.

Link https://github.com/HanjiangHu/metaroom_vnn_comp2023

4.22 cersyve

Proposed by Yujie Yang (THU, CMU), Hanjiang Hu (CMU), Tianhao Wei (CMU), Shengbo Eben Li (THU), Changliu Liu (CMU).

Motivation Neural safety certificate verification is a special type of verification problems that require neural networks to satisfy certain properties everywhere in the state space, i.e., the input set of the verification problem is the entire state space. This is different from most existing benchmarks, which only consider verification in either a small disturbance set around data samples or part of the state space, such as MNIST, CIFAR, and ACAS Xu. Another distinct feature of safety certificate verification is that it not only involves a single safety certificate network but also needs system dynamics and control policies for verification, and certain conversions are required before these components can be formulated as a standard verification problem.

Description While this version of cersyve only contains necessary networks and specifications for verification, our full version also includes a set of neural safety certificate synthesis tools, including pre-training, adversarial training, and verification-guided training modules, as well as evaluation tools for synthesized certificates. For a detailed description of cersyve, please refer to our paper [102].

Networks The cersyve benchmark contains nine commonly used control tasks with state dimensions ranging from two to six. These tasks include both linear and nonlinear dynamics and safety constraints. We provide two ONNX models for each task. One is a pre-trained safety certificate, and the other is fine-tuned. The models are already integrated with all necessary elements for verification, such as system dynamics, constraints, and control policies. Users can view each of them as a single neural network for standard verification.

Specifications The cersyve benchmark requires to verify that within a bounded state space, whether the constraint satisfaction and forward invariance properties of a neural safety certifi-

cate is satisfied for all states. For a detailed description of the verification problem formulation, please refer to our paper [102]. The input specifications are lower and upper bounds on each dimension of the state. The output specifications are always two inequalities corresponding to the two properties.

Link https://github.com/intelligent-control-lab/cersyve.jl/tree/VNN-COMP-2025

4.23 Additional Benchmarks

We have not yet obtained benchmark descriptions for other benchmark sets reported in Table 3. We will update the report when these descriptions are available. Artifacts of the benchmarks are available in the repository[6].

[6] https://github.com/VNN-COMP/vnncomp2025_benchmarks

5 Results

Each tool was run on each of the benchmarks and produced a `csv` result file, that was provided as feedback to the tool authors using the online execution platform. The final `csv` files for each tool as well as scoring scripts are available online: https://github.com/VNN-COMP/vnncomp2025_results. The results were automatically analyzed to compute scores and create the statistics presented in this section.

We consider two sets of results based on two different criteria of accepting counter-examples as valid ones. They are reported in Section 5.1 and Section 5.2, respectively. The former deems a counter-example valid if executing the original counter-example in the evaluation environment results in the violation of the specification. The latter allows a small tolerance (1e-6) when checking the violation of the specification. The latter criterion may accept more counter-examples. The reason to allow such tolerance is that we have discovered cases where replaying the same counter-examples on different hardware can result in different outputs due to floating-point rounding errors, and thus the counter-example may not violate the specification in the evaluation environment even though it does so during the verification process. This is an issue that we have not discovered in previous competitions and it calls for a discussion on how to handle it in future competitions.

5.1 Zero Tolerance

5.1.1 Regular Track

The regular track contained all the benchmarks that were voted for by at least half of all participants.

Table 6: Overall Score

#	Tool	Score
1	α-β-CROWN	1566.9
2	NeuralSAT	1430.2
3	PyRAT	1228.4
4	CORA	987.2
5	NNV	796.4
6	nnenum	740.3
7	SobolBox	593.3

5.1.2 Extended Track

All benchmarks that were voted for by at least one team and did not make it into the regular track were part of the extended track. Every benchmark was voted for at least once, so no benchmark was unscored.

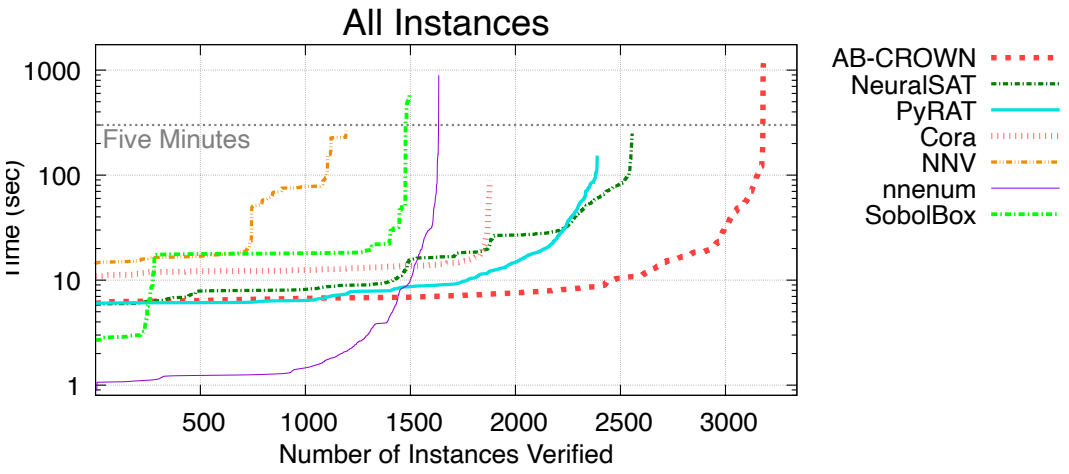

Figure 5: Cactus Plot for All Instances.

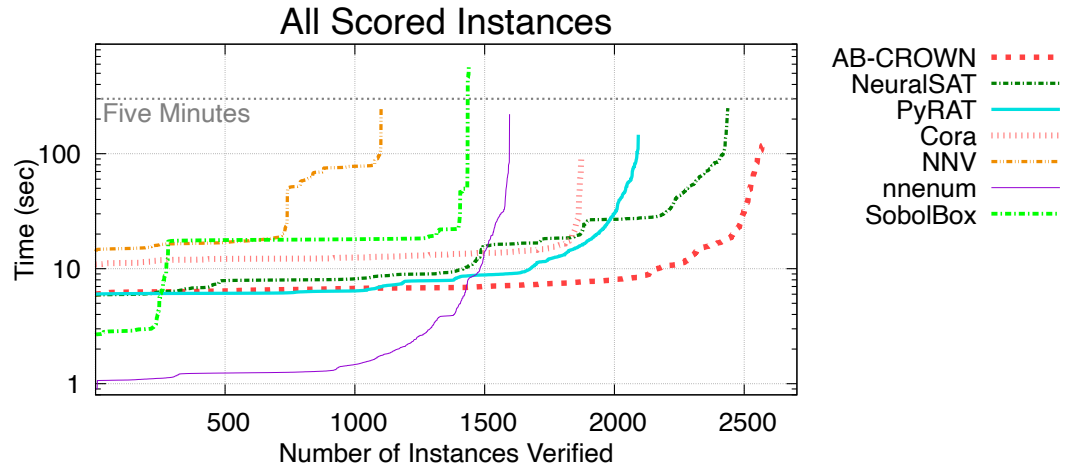

Figure 6: Cactus Plot for All Scored Instances.

5.1.3 Other Stats

This section presents other statistics related to the measurements that are interesting but did not play a direct role in scoring this year. The results reflect the tool performance on the regular track.

Table 7: Overhead

#	Tool	Seconds
1	nnenum	0.9
2	SobolBox	2.7
3	NeuralSAT	5.9
4	α-β-CROWN	6.0
5	PyRAT	6.0
6	CORA	10.9
7	NNV	14.2

Table 8: Num Benchmarks Participated

#	Tool	Count
1	NeuralSAT	16
2	α-β-CROWN	16
3	PyRAT	15
4	NNV	15
5	CORA	14
6	nnenum	11
7	SobolBox	9

Table 9: Num Instances Verified

#	Tool	Count
1	α-β-CROWN	2575
2	NeuralSAT	2437
3	PyRAT	2092
4	CORA	1872
5	nnenum	1596
6	SobolBox	1439
7	NNV	1101

Table 10: Num SAT

#	Tool	Count
1	α-β-CROWN	1082
2	NeuralSAT	1055
3	PyRAT	1018
4	CORA	946
5	nnenum	786
6	NNV	354
7	SobolBox	317

Table 11: Num UNSAT

#	Tool	Count
1	α-β-CROWN	1493
2	NeuralSAT	1382
3	SobolBox	1122
4	PyRAT	1074
5	CORA	926
6	nnenum	810
7	NNV	747

Table 12: Incorrect Results (or Missing CE)

#	Tool	Count
1	SobolBox	55
2	NeuralSAT	5
3	CORA	2

5.2 Small Tolerance

5.2.1 Regular Track

The regular track contained all the benchmarks that were voted for by at least half of all participants.

Table 13: Overall Score

#	Tool	Score
1	α-β-CROWN	1600.0
2	NeuralSAT	1360.1
3	PyRAT	1218.5
4	CORA	954.6
5	nnenum	740.8
6	NNV	697.3
7	SobolBox	529.0

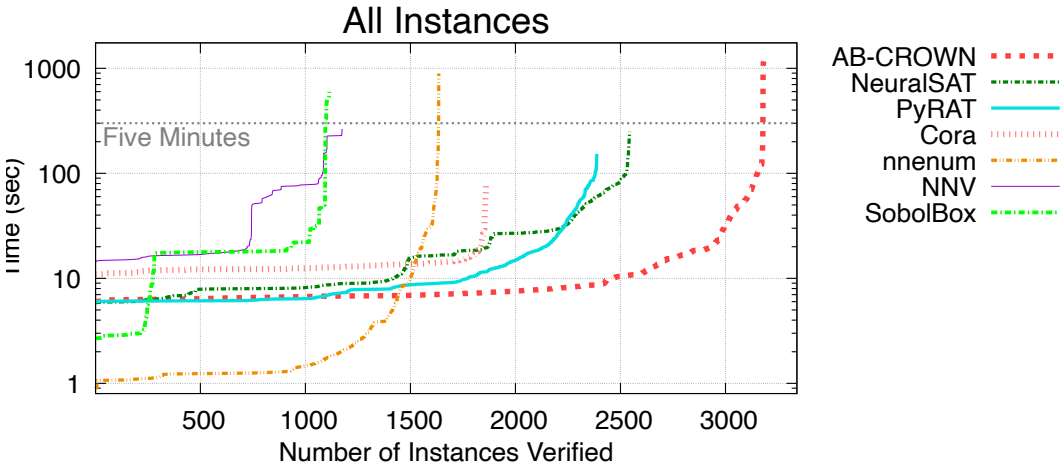

Figure 7: Cactus Plot for All Instances.

5.2.2 Extended Track

All benchmarks that were voted for by at least one team and did not make it into the regular track were part of the extended track. Every benchmark was voted for at least once, so no benchmark was unscored.

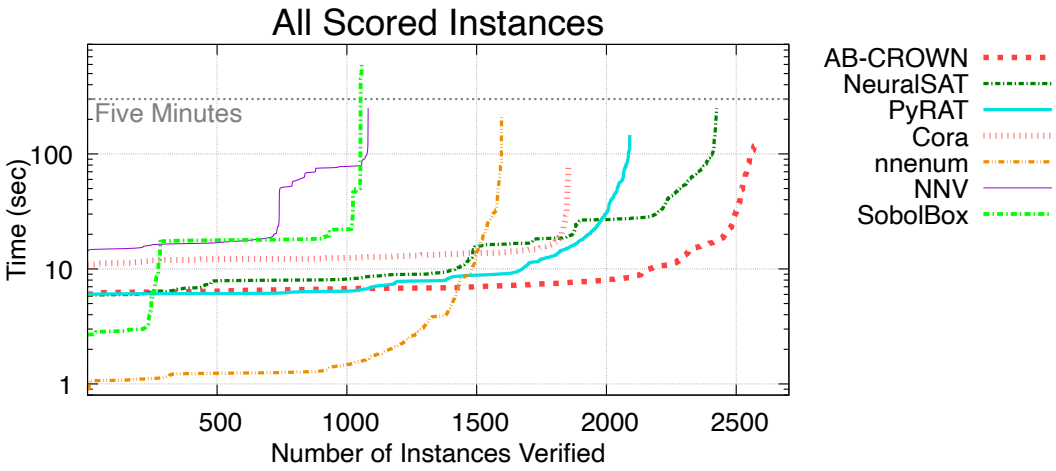

Figure 8: Cactus Plot for All Scored Instances.

5.2.3 Other Stats

This section presents other statistics related to the measurements that are interesting but did not play a direct role in scoring this year. The results reflect the tool performance on the regular track.

Table 14: Overhead

#	Tool	Seconds
1	nnenum	0.9
2	SobolBox	2.7
3	NeuralSAT	5.9
4	α-β-CROWN	6.0
5	PyRAT	6.0
6	CORA	10.9
7	NNV	14.2

Table 15: Num Benchmarks Participated

#	Tool	Count
1	NeuralSAT	16
2	α-β-CROWN	16
3	PyRAT	15
4	NNV	15
5	CORA	14
6	nnenum	11
7	SobolBox	9

Table 16: Num Instances Verified

#	Tool	Count
1	α-β-CROWN	2575
2	NeuralSAT	2425
3	PyRAT	2090
4	CORA	1854
5	nnenum	1596
6	NNV	1082
7	SobolBox	1057

Table 17: Num SAT

#	Tool	Count
1	α-β-CROWN	1082
2	NeuralSAT	1055
3	PyRAT	1018
4	CORA	946
5	nnenum	786
6	NNV	354
7	SobolBox	317

Table 18: Num UNSAT

#	Tool	Count
1	α-β-CROWN	1493
2	NeuralSAT	1370
3	PyRAT	1072
4	CORA	908
5	nnenum	810
6	SobolBox	740
7	NNV	728

6 Conclusion and Ideas for Future Competitions

This report summarizes the 6$^{\text{th}}$ Verification of Neural Networks Competition (VNN-COMP), held in 2025. While we observed a significant increase in the diversity, complexity, and scale of the proposed benchmarks, the best-performing tools seem to converge to GPU-enabled linear bound propagation methods using a branch-and-bound framework. In addition to the standardization of input formats (`onnx` and `vnnlib`) and evaluation hardware, introduced for VNN-COMP 2021, VNN-COMP 2025 also continued the standardized format for counter-examples and fully automated evaluation pipeline introduced in VNN-COMP 2022, requiring authors to provide complete installation scripts. We hope that this increased standardization and automatization does not only simplify the evaluation during the competition but also enables practitioners and researchers to more easily apply a range of state-of-the-art verification methods to their individual problems.

VNN-COMP 2025 successfully implemented a range of improvement opportunities identified during the previous iteration. These included requiring witnesses of found counter-examples to disambiguate tool disagreement, increasing automatization to enable a smoother final evaluation, and making a broader range of AWS instances available to allow for a better fit with tools' requirements. Additionally, we introduced the Competition Contribution papers included in the SAIV proceedings [6] for participants to summarize their approaches. However, some issues were identified in the evaluation particularly with respect to the criteria of accepting a counter-example as valid, as we observed cases where a counter-example violates the property on some hardware but does not violate the property on some other. This calls for a discussion

Table 19: Incorrect Results (or Missing CE)

#	Tool	Count
1	SobolBox	437
2	CORA	20
3	NNV	19
4	NeuralSAT	17
5	PyRAT	2

of how to handle such cases for future iterations. In addition, this might also motivate research to find counter-examples that are robust across different hardware platforms. In addition, in cases where the answer to a benchmark is known a priori, we will explore using the known correct results as the ground truth. Further ideas for future competitions include the use of scored benchmarks specifically designed for year-on-year progress tracking, the reduction of tool tuning, a batch-processing mode, and more rigorous soundness evaluation. Finally, as research on proof generation for neural network verification grows [49, 39, 33], a longer term goal is to require solvers to produce UNSAT proofs.

Acknowledgements

The 2025 competition was supported by CEA-List and MathWorks, which provided funds for computation costs.

Additionally, this research was supported in part by the Air Force Research Laboratory Information Directorate, through the Air Force Office of Scientific Research Summer Faculty Fellowship Program, Contract Numbers FA8750-15-3-6003, FA9550-15-0001 and FA9550-20-F-0005. This material is based upon work supported by the Air Force Office of Scientific Research under award numbers FA9550-19-1-0288, FA9550-21-1-0121, and FA9550-22-1-0019, the National Science Foundation (NSF) under grant numbers 2107035, 2220401, 2220418, 2220426, and 2238133, and the Defense Advanced Research Projects Agency (DARPA) Assured Neuro Symbolic Learning and Reasoning (ANSR) programs through contract number and FA8750-23-C-0518. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the United States Air Force, DARPA, nor NSF. This research was additionally supported by a grant from the project FAI (No. 286525601) funded by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG).

Tool and benchmark authors listed in Section 3 and Section 4 participated in the preparation and review of this report. Special thanks go to Volkan Şahin for his significant contributions to the development and maintenance of the evaluation system.

References

[1] Belgian Traffic Sign Database. https://www.kaggle.com/datasets/shazaelmorsh/trafficsigns. Accessed: March 25th, 2023.

[2] Chinese Traffic Sign Database. https://www.kaggle.com/datasets/dmitryyemelyanov/chinese-traffic-signs. Accessed: March 25th, 2023.

[3] German Traffic Sign Recognition Benchmark. https://www.kaggle.com/datasets/meowmeowmeowmeowmeow/gtsrb-german-traffic-sign?datasetId=82373&language=Python. Accessed: March 25th, 2023.

[4] IACS Neural Network Verification System. https://github.com/iacs-csu-2020/INNVerS.

[5] SobolBox. https://github.com/dassarthak18/SobolBox. VNNCOMP-2025 branch.

[6] *AI Verification: Second International Symposium, SAIV 2025, Zagreb, Croatia, July 21–22, 2025, Proceedings*, Berlin, Heidelberg, 2025. Springer-Verlag.

[7] *Computer Aided Verification: 37th International Conference, CAV 2025, Zagreb, Croatia, July 23-25, 2025, Proceedings, Part II*, Berlin, Heidelberg, 2025. Springer-Verlag.

[8] Gavin Abercrombie and Verena Rieser. Risk-graded safety for handling medical queries in conversational ai. In *Proceedings of the 2nd Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 12th International Joint Conference on Natural Language Processing*, pages 234–243, 2022.

[9] Matthias Althoff. An introduction to CORA 2015. In *Proc. of the Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH)*, pages 120–151, 2015.

[10] Ali ArjomandBigdeli, Andrew Mata, and Stanley Bak. *Verification of Neural Network Control Systems in Continuous Time*, page 100–115. Springer Nature Switzerland, 2024.

[11] Stanley Bak. Execution-guided overapproximation (ego) for improving scalability of neural network verification, 2020.

[12] Stanley Bak. nnenum: Verification of relu neural networks with optimized abstraction refinement. In *NASA Formal Methods Symposium*, pages 19–36. Springer, 2021.

[13] Stanley Bak, Changliu Liu, and Taylor Johnson. The second international verification of neural networks competition (vnn-comp 2021): Summary and results, 2021.

[14] Stanley Bak, Hoang-Dung Tran, Kerianne Hobbs, and Taylor T. Johnson. Improved geometric path enumeration for verifying ReLU neural networks. In *32nd International Conference on Computer-Aided Verification (CAV)*, July 2020.

[15] Timothy W Bickmore, Ha Trinh, Stefan Olafsson, Teresa K O'Leary, Reza Asadi, Nathaniel M Rickles, and Ricardo Cruz. Patient and consumer safety risks when using conversational assistants for medical information: an observational study of siri, alexa, and google assistant. *Journal of medical Internet research*, 20(9):e11510, 2018.

[16] Gregory Bonaert, Dimitar I Dimitrov, Maximilian Baader, and Martin Vechev. Fast and precise certification of transformers. In *Proceedings of the 42nd ACM SIGPLAN International Conference on Programming Language Design and Implementation*, pages 466–481, 2021.

[17] Christopher Brix, Stanley Bak, Taylor T. Johnson, and Haoze Wu. The fifth international verification of neural networks competition (VNN-COMP 2024): Summary and results. 2024.

[18] Christopher Brix, Stanley Bak, Changliu Liu, and Taylor T. Johnson. The fourth international verification of neural networks competition (vnn-comp 2023): Summary and results. 2023.

[19] Christopher Brix, Mark Niklas Müller, Stanley Bak, Taylor T. Johnson, and Changliu Liu. First three years of the international verification of neural networks competition (vnn-comp), 2023.

[20] Rudy Bunel, Ilker Turkaslan, Philip HS Torr, Pushmeet Kohli, and M Pawan Kumar. A unified view of piecewise linear neural network verification. *Advances in Neural Information Processing Systems*, 2018.

[21] Richard H. Byrd, Peihuang Lu, Jorge Nocedal, and Ciyou Zhu. A Limited Memory Algorithm

for Bound Constrained Optimization. *SIAM Journal on Scientific Computing*, 16(5):1190–1208, 1995.

[22] Marco Casadio, Luca Arnaboldi, Matthew L Daggitt, Omri Isac, Tanvi Dinkar, Daniel Kienitz, Verena Rieser, and Ekaterina Komendantskaya. Antonio: Towards a systematic method for generating nlp benchmarks for verification. In *Proceedings of the 6th Workshop on Formal*, volume 16, pages 59–70, 2023.

[23] Marco Casadio, Tanvi Dinkar, Ekaterina Komendantskaya, Luca Arnaboldi, Omri Isac, Matthew L Daggitt, Guy Katz, Verena Rieser, and Oliver Lemon. Nlp verification: Towards a general methodology for certifying robustness. *arXiv preprint arXiv:2403.10144*, 2024.

[24] Marco Casadio, Ekaterina Komendantskaya, Matthew L. Daggitt, Wen Kokke, Guy Katz, Guy Amir, and Idan Refaeli. Neural network robustness as a verification property: A principled case study. In Sharon Shoham and Yakir Vizel, editors, *Computer Aided Verification - 34th International Conference, CAV 2022, Haifa, Israel, August 7-10, 2022, Proceedings, Part I*, volume 13371 of *Lecture Notes in Computer Science*, pages 219–231. Springer, 2022.

[25] Wei-Lin Chiang, Zhuohan Li, Zi Lin, Ying Sheng, Zhanghao Wu, Hao Zhang, Lianmin Zheng, Siyuan Zhuang, Yonghao Zhuang, Joseph E. Gonzalez, Ion Stoica, and Eric P. Xing. Vicuna: An open-source chatbot impressing gpt-4 with 90%* chatgpt quality, March 2023.

[26] Sarthak Das. Sobolbox: Boxed refinement of sobol sequence samples for neural network verification (competition contribution). In Mirco Giacobbe and Anna Lukina, editors, *AI Verification*, pages 272–277, Cham, 2026. Springer Nature Switzerland.

[27] Stefano Demarchi, Dario Guidotti, Luca Pulina, and Armando Tacchella. Supporting standardization of neural networks verification with vnnlib and coconet. In Nina Narodytska, Guy Amir, Guy Katz, and Omri Isac, editors, *Proceedings of the 6th Workshop on Formal Methods for ML-Enabled Autonomous Systems*, volume 16 of *Kalpa Publications in Computing*, pages 47–58. EasyChair, 2023.

[28] Alexey Dosovitskiy, Lucas Beyer, Alexander Kolesnikov, Dirk Weissenborn, Xiaohua Zhai, Thomas Unterthiner, Mostafa Dehghani, Matthias Minderer, Georg Heigold, Sylvain Gelly, et al. An image is worth 16x16 words: Transformers for image recognition at scale. In *International Conference on Learning Representations*, 2020.

[29] Tianyu Du, Shouling Ji, Lujia Shen, Yao Zhang, Jinfeng Li, Jie Shi, Chengfang Fang, Jianwei Yin, Raheem Beyah, and Ting Wang. Cert-rnn: Towards certifying the robustness of recurrent neural networks. *CCS*, 21(2021):15–19, 2021.

[30] Hai Duong, Linhan Li, ThanhVu Nguyen, and Matthew Dwyer. A DPLL(T) Framework for Verifying Deep Neural Networks, 2023. arXiv, 25 pages.

[31] Hai Duong and ThanhVu Nguyen. Neuralsat: Scaling constraint solving for dnn verification (competition contribution). In *International Symposium on AI Verification*, pages 253–259. Springer, 2025.

[32] Hai Duong and ThanhVu Nguyen. Neuralsat: Scaling constraint solving for dnn verification (competition contribution). In Mirco Giacobbe and Anna Lukina, editors, *AI Verification*, pages 253–259, Cham, 2026. Springer Nature Switzerland.

[33] Hai Duong, ThanhVu Nguyen, and Matthew Dwyer. Generating and checking dnn verification proofs. *Advances in Neural Information Processing Systems*, page to appear, 2025.

[34] Hai Duong, ThanhVu Nguyen, and Matthew B Dwyer. Neuralsat: A high-performance verification tool for deep neural networks. In *International Conference on Computer Aided Verification*, pages 409–423. Springer, 2025.

[35] Hai Duong, David Shriver, ThanhVu Nguyen, and Matthew Dwyer. Compositional neural network verification via assume-guarantee reasoning. *Advances in Neural Information Processing Systems*, page to appear, 2025.

[36] Hai Duong, Dong Xu, ThanhVu Nguyen, and Matthew B Dwyer. Harnessing neuron stability to improve dnn verification. *Proceedings of the ACM on Software Engineering*, 1(FSE):859–881,

2024.

[37] Serge Durand, Augustin Lemesle, Zakaria Chihani, Caterina Urban, and François Terrier. Reciph: Relational coefficients for input partitioning heuristic. In *1st Workshop on Formal Verification of Machine Learning (WFVML 2022)*, 2022.

[38] EASA and Collins Aerospace. Formal Methods use for Learning Assurance (ForMuLA). Technical report, April 2023.

[39] Yizhak Yisrael Elboher, Omri Isac, Guy Katz, Tobias Ladner, and Haoze Wu. Abstraction-based proof production in formal verification of neural networks. In *International Symposium on AI Verification*, pages 203–220. Springer, 2025.

[40] James Ferlez, Haitham Khedr, and Yasser Shoukry. Fast BATLLNN: fast box analysis of two-level lattice neural networks. In Ezio Bartocci and Sylvie Putot, editors, *HSCC '22: 25th ACM International Conference on Hybrid Systems: Computation and Control, Milan, Italy, May 4 - 6, 2022*, pages 23:1–23:11. ACM, 2022.

[41] Sven Gowal, Krishnamurthy Dvijotham, Robert Stanforth, Rudy Bunel, Chongli Qin, Jonathan Uesato, Relja Arandjelovic, Timothy Mann, and Pushmeet Kohli. On the effectiveness of interval bound propagation for training verifiably robust models. *arXiv preprint arXiv:1810.12715*, 2018.

[42] David Gros, Yu Li, and Zhou Yu. The rua-robot dataset: Helping avoid chatbot deception by detecting user questions about human or non-human identity. In *Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing (Volume 1: Long Papers)*, pages 6999–7013, 2021.

[43] Navid Hashemi, Samuel Sasaki · Ipek Oguz, Meiyi Ma, and Taylor Johnsonk. Scaling data-driven probabilistic robustness analysis for semantic segmentation neural networks. *NeurIPS*, 2025.

[44] Hanjiang Hu, Changliu Liu, and Ding Zhao. Robustness verification for perception models against camera motion perturbations. In *International conference on machine learning (ICML) Workshop on Formal Verification of Machine Learning (WFVML)*, 2023.

[45] Hanjiang Hu, Zuxin Liu, Linyi Li, Jiacheng Zhu, and Ding Zhao. Robustness certification of visual perception models via camera motion smoothing. In *Conference on Robot Learning*, pages 1309–1320. PMLR, 2022.

[46] Hanjiang Hu, Zuxin Liu, Linyi Li, Jiacheng Zhu, and Ding Zhao. Pixel-wise smoothing for certified robustness against camera motion perturbations. In *International Conference on Artificial Intelligence and Statistics*, pages 217–225. PMLR, 2024.

[47] Po-Sen Huang, Robert Stanforth, Johannes Welbl, Chris Dyer, Dani Yogatama, Sven Gowal, Krishnamurthy Dvijotham, and Pushmeet Kohli. Achieving verified robustness to symbol substitutions via interval bound propagation. In *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP)*, pages 4083–4093, 2019.

[48] Itay Hubara, Matthieu Courbariaux, Daniel Soudry, Ran El-Yaniv, and Yoshua Bengio. Binarized Neural Networks. *Advances in Neural Information Processing Systems*, 29, 2016.

[49] Omri Isac, Clark W. Barrett, Min Zhang, and Guy Katz. Neural network verification with proof production. In Alberto Griggio and Neha Rungta, editors, *22nd Formal Methods in Computer-Aided Design, FMCAD 2022, Trento, Italy, October 17-21, 2022*, pages 38–48. IEEE, 2022.

[50] Robin Jia, Aditi Raghunathan, Kerem Göksel, and Percy Liang. Certified robustness to adversarial word substitutions. In *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP)*, pages 4129–4142, 2019.

[51] Guy Katz, Clark Barrett, David L Dill, Kyle Julian, and Mykel J Kochenderfer. Reluplex: An efficient smt solver for verifying deep neural networks. In *International Conference on Computer Aided Verification*, pages 97–117. Springer, 2017.

[52] Guy Katz, Derek A Huang, Duligur Ibeling, Kyle Julian, Christopher Lazarus, Rachel Lim,

Parth Shah, Shantanu Thakoor, Haoze Wu, Aleksandar Zeljić, et al. The marabou framework for verification and analysis of deep neural networks. In *International Conference on Computer Aided Verification*, pages 443–452. Springer, 2019.

[53] Sydney M. Katz, Anthony L. Corso, Christopher A. Strong, and Mykel J. Kochenderfer. Verification of image-based neural network controllers using generative models, 2021.

[54] Dmitrii Kirov and Simone Fulvio Rollini. Benchmark: remaining useful life predictor for aircraft equipment. In *International Conference on Bridging the Gap between AI and Reality*, pages 299–304. Springer, 2023.

[55] Dmitrii Kirov, Simone Fulvio Rollini, Luigi Di Guglielmo, and Darren Cofer. Formal verification of a neural network based prognostics system for aircraft equipment. In *International Conference on Bridging the Gap between AI and Reality*, pages 225–240. Springer, 2023.

[56] Ching-Yun Ko, Zhaoyang Lyu, Lily Weng, Luca Daniel, Ngai Wong, and Dahua Lin. Popqorn: Quantifying robustness of recurrent neural networks. In *International Conference on Machine Learning*, pages 3468–3477. PMLR, 2019.

[57] Niklas Kochdumper, Christian Schilling, Matthias Althoff, and Stanley Bak. Open- and closed-loop neural network verification using polynomial zonotopes. In *NASA Formal Methods*, pages 16–36, 2023.

[58] Lukas Koller, Tobias Ladner, and Matthias Althoff. Out of the shadows: Exploring a latent space for neural network verification. *arXiv*, 2025.

[59] Lukas Koller, Tobias Ladner, and Matthias Althoff. Set-based training for neural network verification. *TMLR*, 2025.

[60] Mauritz Kop. Eu artificial intelligence act: The european approach to ai, 2021.

[61] Tim Kraska, Alex Beutel, Ed H Chi, Jeffrey Dean, and Neoklis Polyzotis. The case for learned index structures. In *Proceedings of the 2018 International Conference on Management of Data*, 2018.

[62] Alp Kucukelbir, Dustin Tran, Rajesh Ranganath, Andrew Gelman, and David M. Blei. Automatic differentiation variational inference. *J. Mach. Learn. Res.*, 18(1):430–474, January 2017.

[63] Tobias Ladner and Matthias Althoff. Automatic abstraction refinement in neural network verification using sensitivity analysis. In *Proc. of the Int. Conf. on Hybrid Systems: Computation and Control (HSCC)*, pages 1–13, 2023.

[64] Augustin Lemesle, Julien Lehmann, Tristan Le Gall, and Zakaria Chihani. Pyrat: Verifying neural networks with abstract interpretation (competition contribution). In Mirco Giacobbe and Anna Lukina, editors, *AI Verification*, pages 266–271, Cham, 2026. Springer Nature Switzerland.

[65] Augustin Lemesle, Julien Lehmann, and Le Gall Tristan. Neural Network Verification with PyRAT. *arXiv preprint arXiv:2410.23903*, 2024.

[66] Haoyu Li, Xiangru Zhong, Bin Hu, and Huan Zhang. Two-stage learning of stabilizing neural controllers via zubov sampling and iterative domain expansion. *arXiv preprint arXiv:2506.01356*, 2025.

[67] Linhan Li and ThanhVu Nguyen. Destabilizing neurons to generate challenging neural network verification benchmarks. In *Proceedings of the 40th IEEE/ACM International Conference on Automated Software Engineering (ASE)*, ASE '25, 2025. To appear.

[68] Diego Manzanas Lopez, Sung Woo Choi, Hoang-Dung Tran, and Taylor T. Johnson. NNV 2.0: The neural network verification tool. In *35th International Conference on Computer-Aided Verification (CAV)*, July 2023.

[69] Diego Manzanas Lopez, Samuel Sasaki, and Taylor T. Johnson. Nnv: A star set reachability approach (competition contribution). In Mirco Giacobbe and Anna Lukina, editors, *AI Verification*, pages 260–265, Cham, 2026. Springer Nature Switzerland.

[70] Aleksander Madry, Aleksandar Makelov, Ludwig Schmidt, Dimitris Tsipras, and Adrian Vladu. Towards deep learning models resistant to adversarial attacks. *arXiv preprint arXiv:1706.06083*,

2017.

[71] Aleksander Madry, Aleksandar Makelov, Ludwig Schmidt, Dimitris Tsipras, and Adrian Vladu. Towards deep learning models resistant to adversarial attacks. In *International Conference on Learning Representations*, 2018.

[72] Diego Manzanas Lopez, Patrick Musau, Nathaniel Hamilton, and Taylor Johnson. Reachability analysis of a general class of neural ordinary differential equation. In *Proceedings of the 20th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS 2022), Co-Located with CONCUR, FMICS, and QEST as part of CONFEST 2022.*, Warsaw, Poland, September 2022.

[73] Milad Moradi and Matthias Samwald. Evaluating the robustness of neural language models to input perturbations. In *Proceedings of the 2021 Conference on Empirical Methods in Natural Language Processing*, pages 1558–1570, 2021.

[74] Mark Niklas Müller, Christopher Brix, Stanley Bak, Changliu Liu, and Taylor T Johnson. The third international verification of neural networks competition (vnn-comp 2022): Summary and results. *arXiv preprint arXiv:2212.10376*, 2022.

[75] Andreea Postovan and Mădălina Eraşcu. Architecturing binarized neural networks for traffic sign recognition. *arXiv preprint arXiv:2303.15005*, 2023.

[76] Nils Reimers and Iryna Gurevych. Sentence-BERT: Sentence embeddings using Siamese BERT-networks. In *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP)*, pages 3982–3992, Hong Kong, China, November 2019. Association for Computational Linguistics.

[77] Zhouxing Shi, Cho-Jui Hsieh, and Huan Zhang. Certified training with branch-and-bound: A case study on lyapunov-stable neural control. *arXiv preprint arXiv:2411.18235*, 2024.

[78] Zhouxing Shi, Qirui Jin, Zico Kolter, Suman Jana, Cho-Jui Hsieh, and Huan Zhang. Neural network verification with branch-and-bound for general nonlinearities. *arXiv preprint arXiv:2405.21063*, 2024.

[79] Zhouxing Shi, Yihan Wang, Huan Zhang, Jinfeng Yi, and Cho-Jui Hsieh. Fast certified robust training with short warmup. *Advances in Neural Information Processing Systems*, 34:18335–18349, 2021.

[80] Zhouxing Shi, Huan Zhang, Kai-Wei Chang, Minlie Huang, and Cho-Jui Hsieh. Robustness verification for transformers. In *International Conference on Learning Representations*, 2019.

[81] Zhouxing Shi, Huan Zhang, Kai-Wei Chang, Minlie Huang, and Cho-Jui Hsieh. Robustness verification for transformers, 2020.

[82] Karen Simonyan and Andrew Zisserman. Very deep convolutional networks for large-scale image recognition. *arXiv preprint arXiv:1409.1556*, 2014.

[83] Ilya M. Sobol'. On the Distribution of Points in a Cube and the Approximate Evaluation of Integrals. *Ussr Computational Mathematics and Mathematical Physics*, 7:86–112, 1967.

[84] Christian Szegedy, Wojciech Zaremba, Ilya Sutskever, Joan Bruna, Dumitru Erhan, Ian Goodfellow, and Rob Fergus. Intriguing Properties of Neural Networks. *arXiv preprint arXiv:1312.6199*, 2013.

[85] Vincent Tjeng, Kai Y. Xiao, and Russ Tedrake. Evaluating robustness of neural networks with mixed integer programming. In *ICLR*, 2019.

[86] H. D. Tran, N. Pal, D. Lopez, P. Musau, X. Yang, W. Xiang L. Nguyen, S. Bak, , and T. T. Johnson. Verification of piecewise deep neural networks: A star set approach with zonotope pre-filter. *Formal aspects of computing*, 2021.

[87] Hoang-Dung Tran, Stanley Bak, Weiming Xiang, and Taylor T. Johnson. Verification of deep convolutional neural networks using imagestars. In *32nd International Conference on Computer-Aided Verification (CAV)*. Springer, July 2020.

[88] Hoang-Dung Tran, Feiyang Cei, Diego Manzanas Lopez, Taylor T. Johnson, and Xenofon Koutsoukos. Safety verification of cyber-physical systems with reinforcement learning control. In *ACM SIGBED International Conference on Embedded Software (EMSOFT'19)*. ACM, October 2019.

[89] Hoang Dung Tran, SungWoo Choi, Tomoya Yamaguchi, Bardh Hoxha, and Danil Prokhorov. Verification of recurrent neural networks using star reachability. In *The 26th ACM International Conference on Hybrid Systems: Computation and Control (HSCC)*, May 2023.

[90] Hoang-Dung Tran, Patrick Musau, Diego Manzanas Lopez, Xiaodong Yang, Luan Viet Nguyen, Weiming Xiang, and Taylor T. Johnson. Star-based reachability analysis for deep neural networks. In *23rd International Symposium on Formal Methods (FM'19)*. Springer International Publishing, October 2019.

[91] Hoang-Dung Tran, Neelanjana Pal, Patrick Musau, Xiaodong Yang, Nathaniel P. Hamilton, Diego Manzanas Lopez, Stanley Bak, and Taylor T. Johnson. Robustness verification of semantic segmentation neural networks using relaxed reachability. In *33rd International Conference on Computer-Aided Verification (CAV)*. Springer, July 2021.

[92] Hoang-Dung Tran, Xiaodong Yang, Diego Manzanas Lopez, Patrick Musau, Luan Viet Nguyen, Weiming Xiang, Stanley Bak, and Taylor T. Johnson. NNV: The neural network verification tool for deep neural networks and learning-enabled cyber-physical systems. In *32nd International Conference on Computer-Aided Verification (CAV)*, July 2020.

[93] Ashish Vaswani, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N Gomez, Łukasz Kaiser, and Illia Polosukhin. Attention is all you need. *Advances in neural information processing systems*, 30, 2017.

[94] Shiqi Wang, Huan Zhang, Kaidi Xu, Xue Lin, Suman Jana, Cho-Jui Hsieh, and Zico Kolter. Beta-CROWN: Efficient bound propagation with per-neuron split constraints for complete and incomplete neural network verification. *arXiv preprint arXiv:2103.06624*, 2021.

[95] Yibin Wang, Yichen Yang, Di He, and Kun He. Robustness-aware word embedding improves certified robustness to adversarial word substitutions. In *Findings of the Association for Computational Linguistics: ACL 2023*, pages 673–687, 2023.

[96] Johannes Welbl, Po-Sen Huang, Robert Stanforth, Sven Gowal, Krishnamurthy Dj Dvijotham, Martin Szummer, and Pushmeet Kohli. Towards verified robustness under text deletion interventions. 2020.

[97] Manuel Wendl, Lukas Koller, Tobias Ladner, and Matthias Althoff. Training verifiably robust agents using set-based reinforcement learning. *arXiv preprint arXiv:2408.09112*, 2024.

[98] Haoze Wu, Teruhiro Tagomori, Alexander Robey, Fengjun Yang, Nikolai Matni, George Pappas, Hamed Hassani, Corina Pasareanu, and Clark Barrett. Toward certified robustness against real-world distribution shifts. *arXiv preprint arXiv:2206.03669*, 2022.

[99] Kaidi Xu, Zhouxing Shi, Huan Zhang, Yihan Wang, Kai-Wei Chang, Minlie Huang, Bhavya Kailkhura, Xue Lin, and Cho-Jui Hsieh. Automatic perturbation analysis for scalable certified robustness and beyond. *Advances in Neural Information Processing Systems*, 33, 2020.

[100] Kaidi Xu, Huan Zhang, Shiqi Wang, Yihan Wang, Suman Jana, Xue Lin, and Cho-Jui Hsieh. Fast and Complete: Enabling complete neural network verification with rapid and massively parallel incomplete verifiers. In *International Conference on Learning Representations*, 2021.

[101] Lujie Yang, Hongkai Dai, Zhouxing Shi, Cho-Jui Hsieh, Russ Tedrake, and Huan Zhang. Lyapunov-stable neural control for state and output feedback: A novel formulation. In *Forty-first International Conference on Machine Learning*, 2024.

[102] Yujie Yang, Hanjiang Hu, Tianhao Wei, Shengbo Eben Li, and Changliu Liu. Scalable synthesis of formally verified neural value function for hamilton-jacobi reachability analysis. *Journal of Artificial Intelligence Research*, 83, 2025.

[103] Huan Zhang*, Shiqi Wang*, Kaidi Xu*, Linyi Li, Bo Li, Suman Jana, Cho-Jui Hsieh, and J Zico Kolter. General cutting planes for bound-propagation-based neural network verification. *Advances in Neural Information Processing Systems (NeurIPS)*, 2022.

[104] Huan Zhang, Tsui-Wei Weng, Pin-Yu Chen, Cho-Jui Hsieh, and Luca Daniel. Efficient neural network robustness certification with general activation functions. *Advances in Neural Information Processing Systems*, 31:4939–4948, 2018.

[105] Jianming Zhang, Wei Wang, Chaoquan Lu, Jin Wang, and Arun Kumar Sangaiah. Lightweight Deep Network for Traffic Sign Classification. *Annals of Telecommunications*, 75:369–379, 2020.

[106] Yuhao Zhang, Aws Albarghouthi, and Loris D'Antoni. Certified robustness to programmable transformations in lstms. In *Proceedings of the 2021 Conference on Empirical Methods in Natural Language Processing*, pages 1068–1083, 2021.

[107] Duo Zhou, Christopher Brix, Grani A Hanasusanto, and Huan Zhang. Scalable neural network verification with branch-and-bound inferred cutting planes. In *The Thirty-eighth Annual Conference on Neural Information Processing Systems*, 2024.

[108] Xingjian Zhou, Hongji Xu, Andy Xu, Zhouxing Shi, Cho-Jui Hsieh, and Huan Zhang. Testing neural network verifiers: A soundness benchmark with hidden counterexamples. *arXiv preprint arXiv:2412.03154*, 2024.

A Benchmark Results

In this section, we provide more fine-grained results.

A.1 Zero Tolerance

A.1.1 Regular Track

Table 20: Benchmark `2025-acasxu-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	nnenum	139	47	0	0	1860	100.0	100.0%
2	NeuralSAT	139	47	0	0	1860	100.0	100.0%
3	α-β-CROWN	139	47	0	0	1860	100.0	100.0%
4	PyRAT	139	46	0	0	1850	99.5	99.5%
5	CORA	137	46	0	0	1830	98.4	98.4%
6	SobolBox	118	43	0	1	1460	78.5	86.6%
7	NNV	71	39	0	0	1100	59.1	59.1%

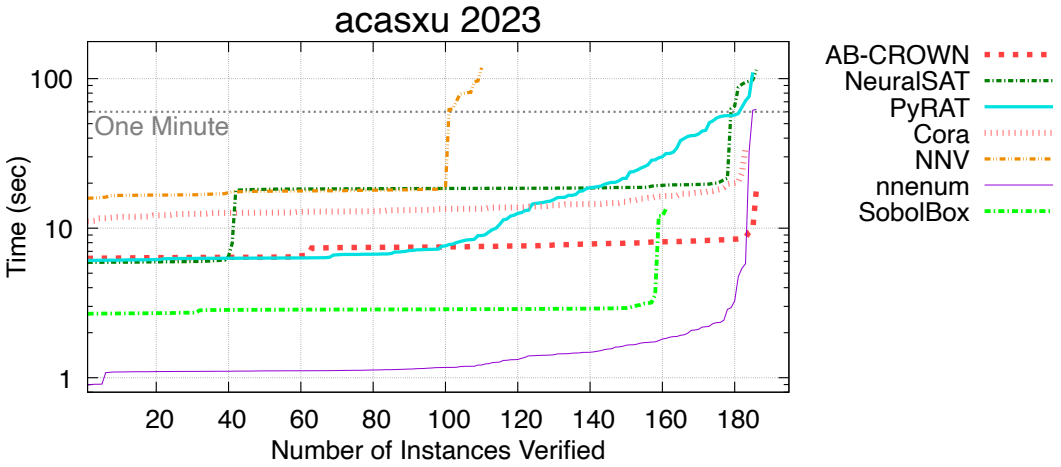

Figure 9: Cactus Plot for acasxu 2023.

Table 21: Benchmark `2025-cersyve`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	6	6	0	0	120	100.0	100.0%
2	NeuralSAT	4	6	0	0	100	83.3	83.3%
3	PyRAT	2	6	0	0	80	66.7	66.7%
4	SobolBox	0	6	0	0	60	50.0	50.0%
5	NNV	0	3	0	0	30	25.0	25.0%
6	CORA	6	5	0	1	-40	0	91.7%

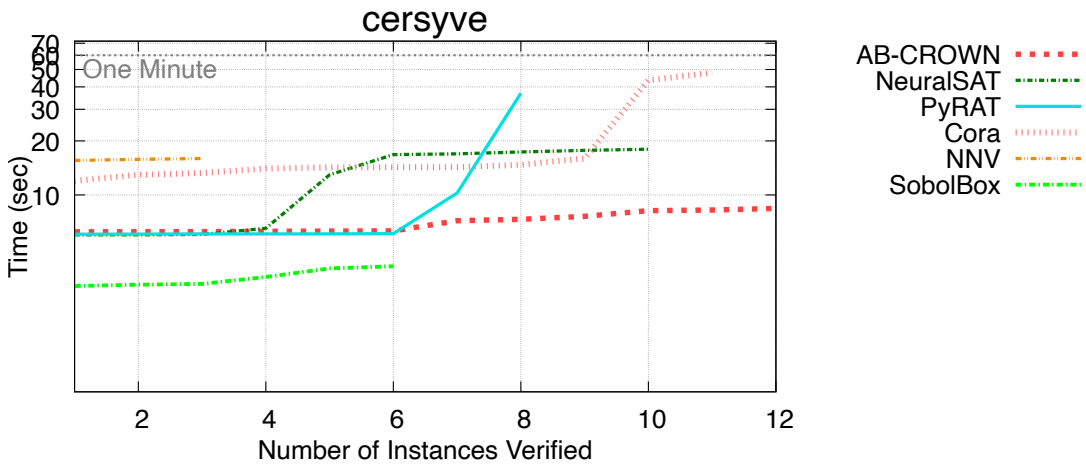

Figure 10: Cactus Plot for cersyve.

Table 22: Benchmark `2025-cgan-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	PyRAT	9	12	0	0	210	100.0	100.0%
2	NeuralSAT	9	12	0	0	210	100.0	100.0%
3	α-β-CROWN	9	12	0	0	210	100.0	100.0%
4	SobolBox	9	10	0	0	190	90.5	90.5%
5	nnenum	7	10	0	0	170	81.0	81.0%
6	NNV	5	11	0	0	160	76.2	76.2%

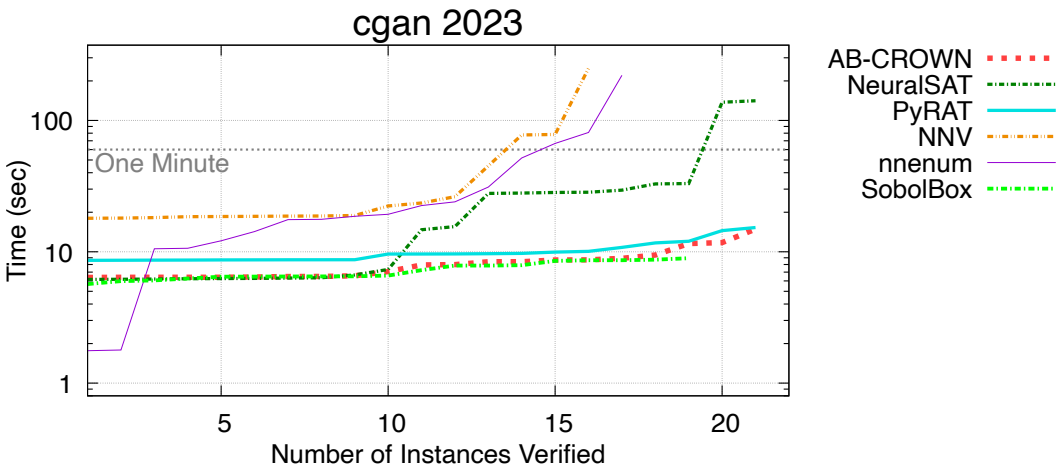

Figure 11: Cactus Plot for cgan 2023.

Table 23: Benchmark `2025-cifar100-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NNV	190	0	0	0	1900	100.0	95.0%
2	α-β-CROWN	100	29	0	0	1290	67.9	64.5%
3	PyRAT	61	25	0	0	860	45.3	43.0%
4	NeuralSAT	87	25	0	4	520	27.4	56.0%
5	CORA	0	10	0	0	100	5.3	5.0%

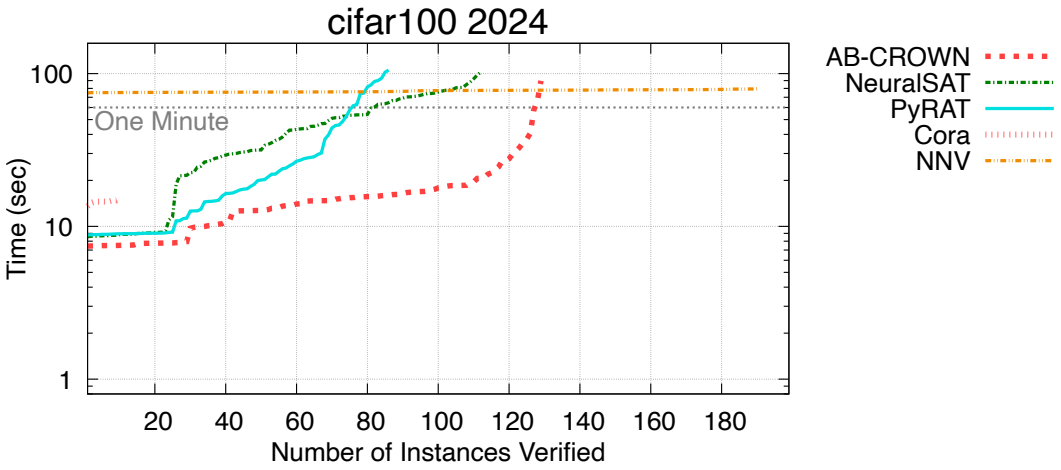

Figure 12: Cactus Plot for cifar100 2024.

Table 24: Benchmark `2025-collins-rul-cnn-2022`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	nnenum	39	23	0	0	620	100.0	100.0%
2	PyRAT	39	23	0	0	620	100.0	100.0%
3	NeuralSAT	39	23	0	0	620	100.0	100.0%
4	NNV	39	23	0	0	620	100.0	100.0%
5	CORA	39	23	0	0	620	100.0	100.0%
6	α-β-CROWN	39	23	0	0	620	100.0	100.0%
7	SobolBox	19	15	0	0	340	54.8	54.8%

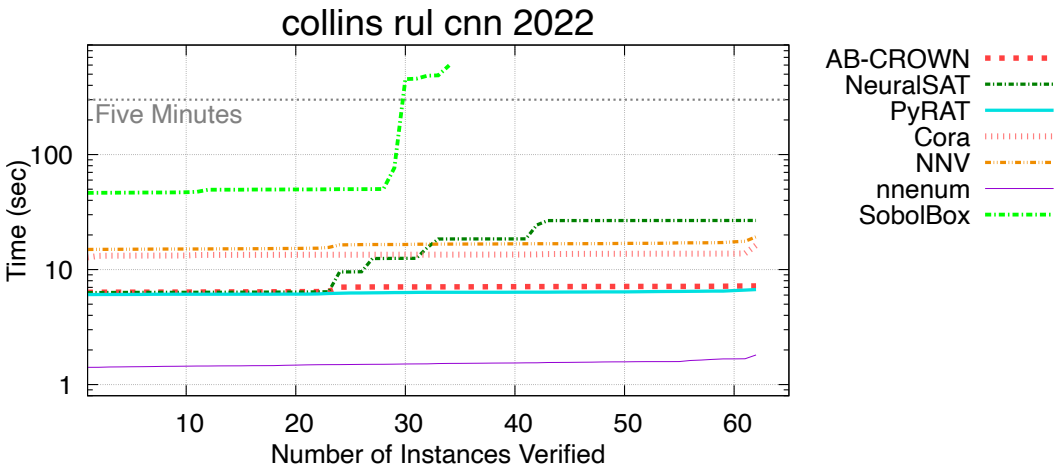

Figure 13: Cactus Plot for collins rul cnn 2022.

Table 25: Benchmark `2025-cora-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	22	131	0	0	1530	100.0	85.0%
2	NeuralSAT	21	131	0	0	1520	99.3	84.4%
3	PyRAT	20	128	0	0	1480	96.7	82.2%
4	CORA	19	124	0	0	1430	93.5	79.4%
5	NNV	19	57	0	0	760	49.7	42.2%
6	nnenum	19	4	0	0	230	15.0	12.8%

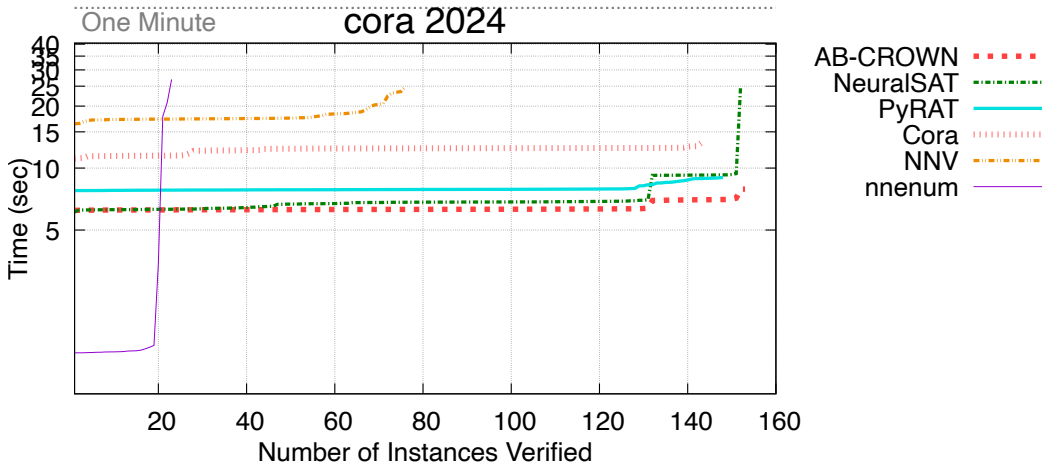

Figure 14: Cactus Plot for cora 2024.

Table 26: Benchmark `2025-dist-shift-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NeuralSAT	65	7	0	0	720	100.0	100.0%
2	CORA	65	7	0	0	720	100.0	100.0%
3	α-β-CROWN	65	7	0	0	720	100.0	100.0%
4	PyRAT	64	7	0	0	710	98.6	98.6%
5	NNV	50	4	0	0	540	75.0	75.0%

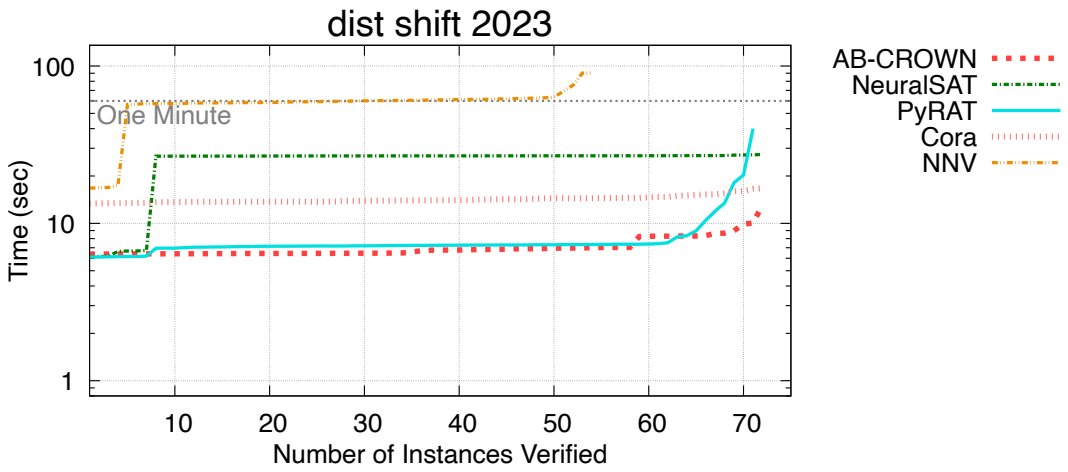

Figure 15: Cactus Plot for dist shift 2023.

Table 27: Benchmark `2025-linearizenn-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	nnenum	59	1	0	0	600	100.0	100.0%
2	SobolBox	59	1	0	0	600	100.0	100.0%
3	PyRAT	59	1	0	0	600	100.0	100.0%
4	NeuralSAT	59	1	0	0	600	100.0	100.0%
5	CORA	59	1	0	0	600	100.0	100.0%
6	α-β-CROWN	59	1	0	0	600	100.0	100.0%
7	NNV	40	1	0	0	410	68.3	68.3%

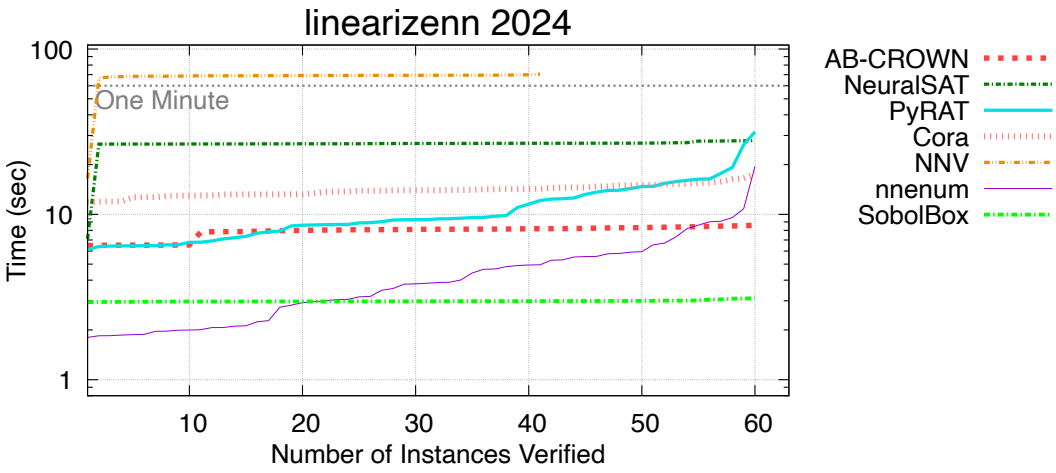

Figure 16: Cactus Plot for linearizenn 2024.

Table 28: Benchmark `2025-malbeware`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	131	19	0	0	1500	100.0	100.0%
2	NeuralSAT	127	19	0	0	1460	97.3	97.3%
3	PyRAT	121	18	0	0	1390	92.7	92.7%
4	nnenum	125	12	0	0	1370	91.3	91.3%
5	CORA	88	9	0	0	970	64.7	64.7%
6	NNV	49	4	0	0	530	35.3	35.3%

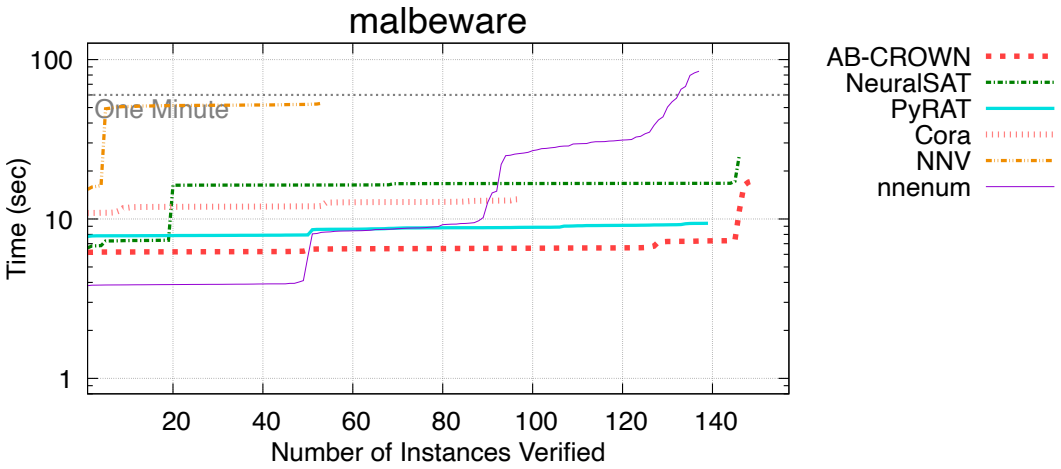

Figure 17: Cactus Plot for malbeware.

Table 29: Benchmark `2025-metaroom-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	PyRAT	97	3	0	0	1000	100.0	100.0%
2	NeuralSAT	94	5	0	0	990	99.0	99.0%
3	α-β-CROWN	94	5	0	0	990	99.0	99.0%
4	CORA	92	5	0	0	970	97.0	97.0%
5	NNV	93	2	0	0	950	95.0	95.0%
6	nnenum	50	1	0	0	510	51.0	51.0%

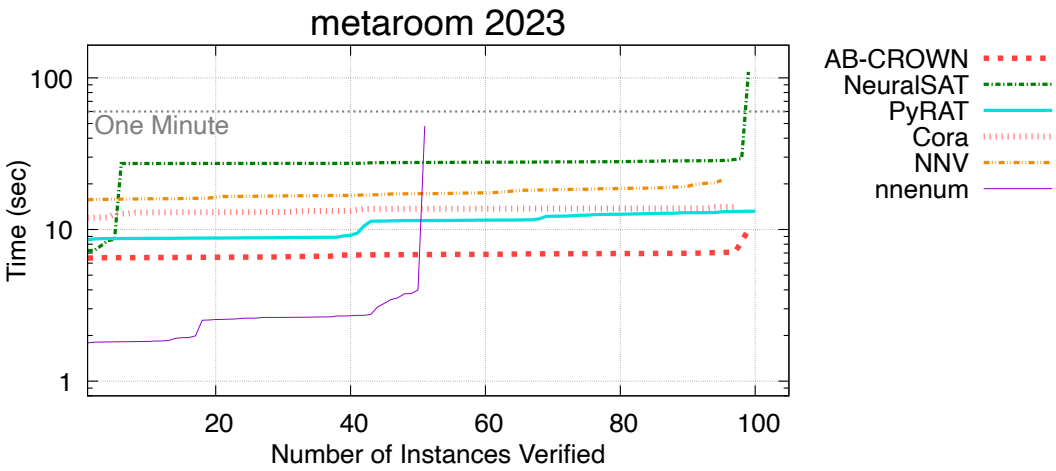

Figure 18: Cactus Plot for metaroom 2023.

Table 30: Benchmark `2025-nn4sys`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	194	0	0	0	1940	100.0	100.0%
2	NeuralSAT	120	0	0	0	1200	61.9	61.9%
3	SobolBox	107	0	0	0	1070	55.2	55.2%
4	PyRAT	40	0	0	0	400	20.6	20.6%
5	nnenum	22	0	0	0	220	11.3	11.3%
6	NNV	17	0	0	0	170	8.8	8.8%

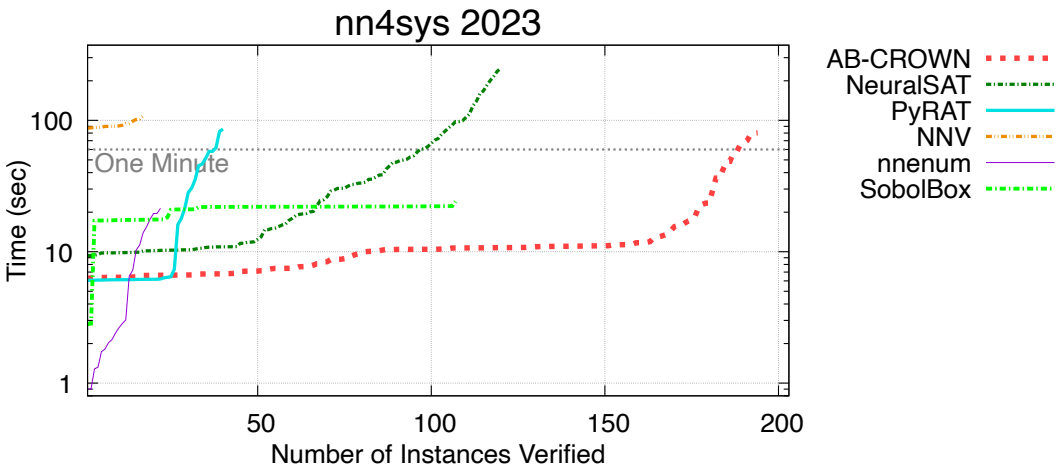

Figure 19: Cactus Plot for nn4sys 2023.

Table 31: Benchmark `2025-safenlp-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	433	647	0	0	10800	100.0	100.0%
2	NeuralSAT	425	645	0	0	10700	99.1	99.1%
3	PyRAT	331	647	0	0	9780	90.6	90.6%
4	nnenum	340	636	0	0	9760	90.4	90.4%
5	CORA	338	644	0	1	9670	89.5	90.9%
6	SobolBox	795	215	0	21	6950	64.4	93.5%
7	NNV	172	176	0	0	3480	32.2	32.2%

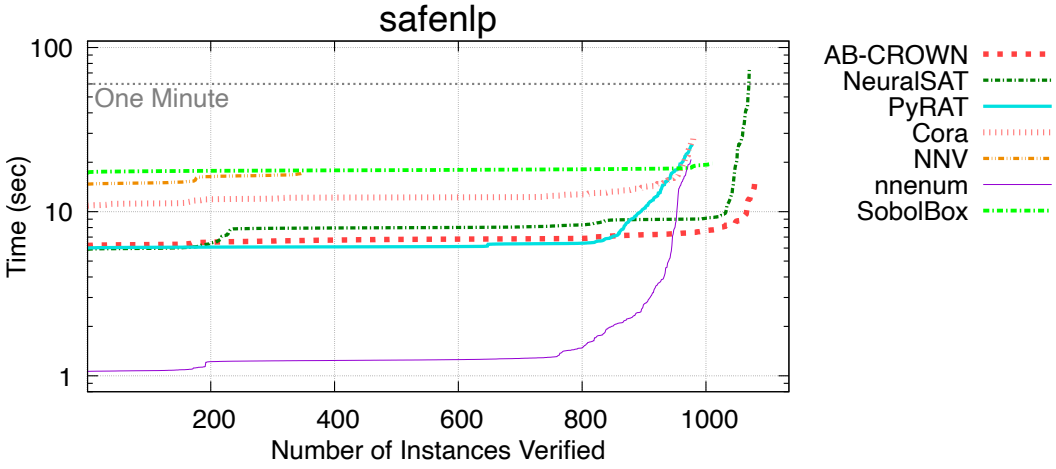

Figure 20: Cactus Plot for safenlp.

Table 32: Benchmark `2025-sat-relu`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NeuralSAT	50	50	0	0	1000	100.0	100.0%
2	CORA	50	50	0	0	1000	100.0	100.0%
3	α-β-CROWN	50	50	0	0	1000	100.0	100.0%
4	PyRAT	9	50	0	0	590	59.0	59.0%
5	nnenum	9	35	0	0	440	44.0	44.0%
6	NNV	2	16	0	0	180	18.0	18.0%
7	SobolBox	0	10	0	33	-4850	0	10.0%

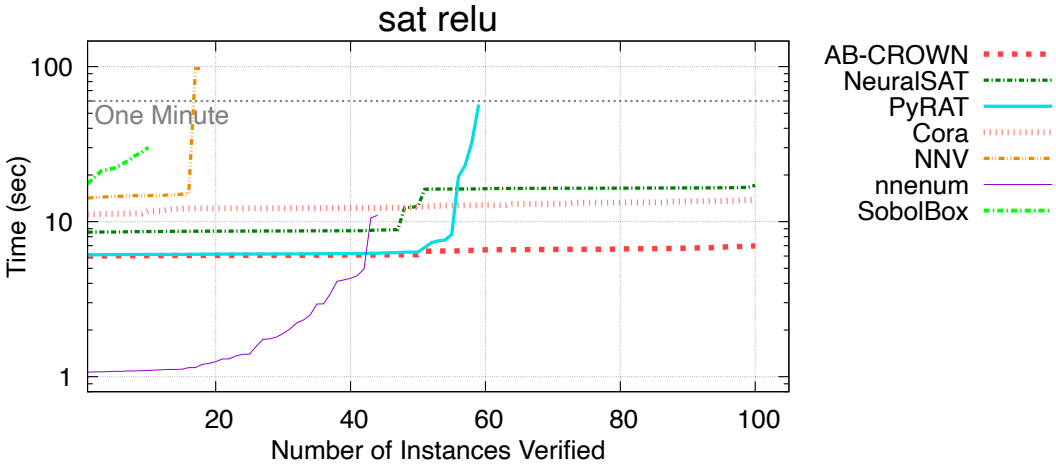

Figure 21: Cactus Plot for sat relu.

Table 33: Benchmark `2025-soundnessbench`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	0	50	0	0	500	100.0	100.0%
2	NeuralSAT	12	30	0	0	420	84.0	84.0%
3	CORA	18	0	0	0	180	36.0	36.0%

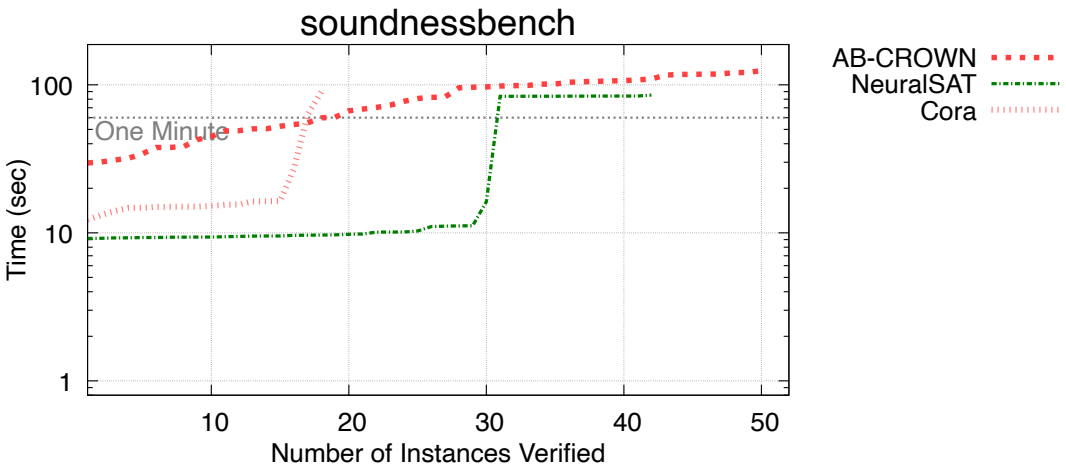

Figure 22: Cactus Plot for soundnessbench.

Table 34: Benchmark `2025-tinyimagenet-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	137	38	0	0	1750	100.0	87.5%
2	NeuralSAT	116	37	0	1	1380	78.9	76.5%
3	PyRAT	68	35	0	0	1030	58.9	51.5%
4	CORA	0	5	0	0	50	2.9	2.5%
5	NNV	0	1	0	0	10	0.6	0.5%

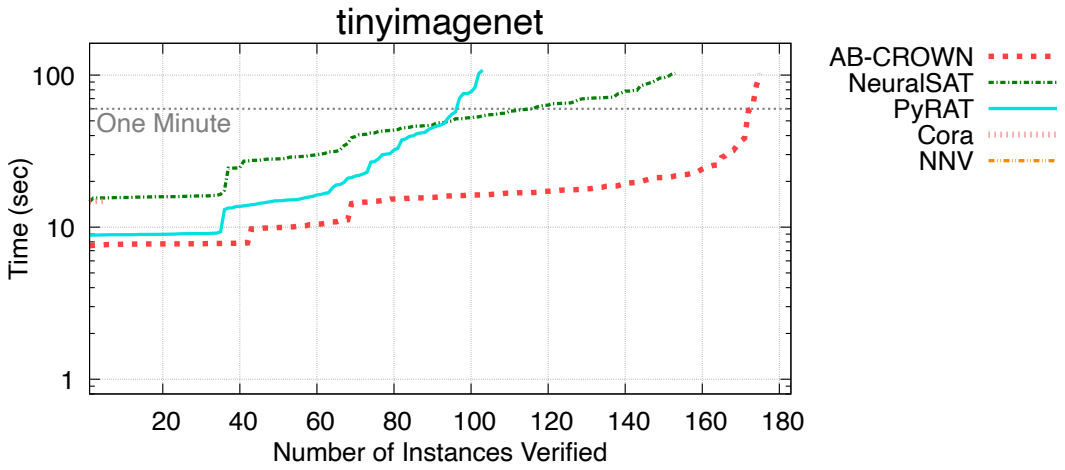

Figure 23: Cactus Plot for tinyimagenet.

Table 35: Benchmark `2025-tllverifybench-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	SobolBox	15	17	0	0	320	100.0	100.0%
2	PyRAT	15	17	0	0	320	100.0	100.0%
3	NeuralSAT	15	17	0	0	320	100.0	100.0%
4	CORA	15	17	0	0	320	100.0	100.0%
5	α-β-CROWN	15	17	0	0	320	100.0	100.0%
6	nnenum	1	17	0	0	180	56.2	56.2%
7	NNV	0	17	0	0	170	53.1	53.1%

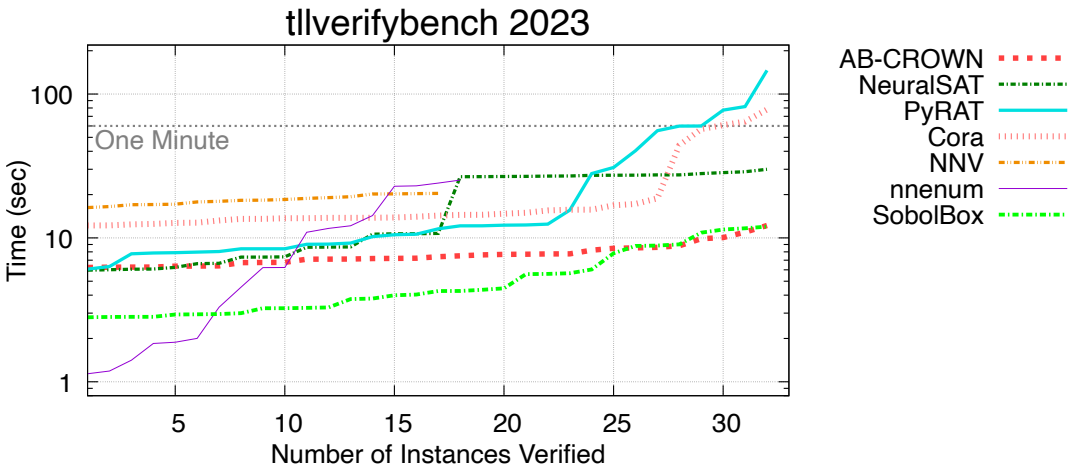

Figure 24: Cactus Plot for tllverifybench 2023.

A.1.2 Extended Track

Table 36: Benchmark `2025-cctsdb-yolo-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	PyRAT	11	28	0	0	390	100.0	100.0%
2	α-β-CROWN	11	28	0	0	390	100.0	100.0%

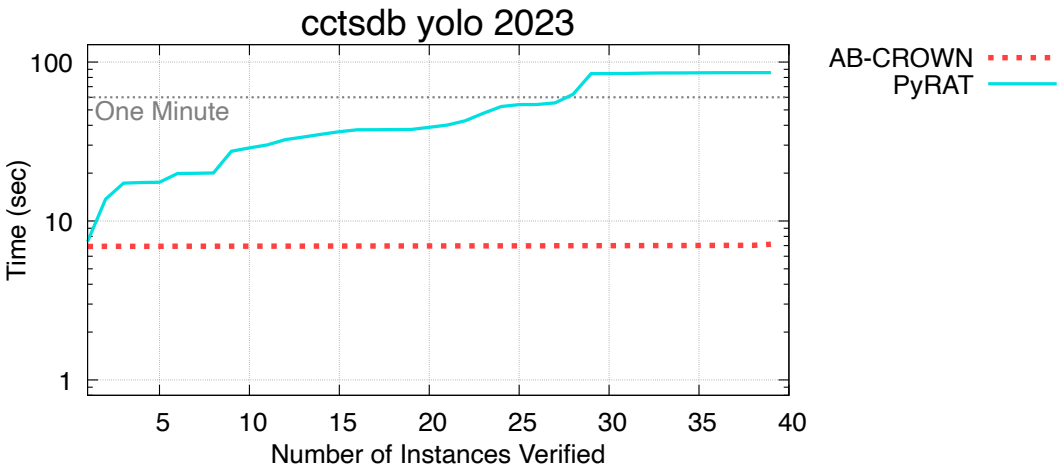

Figure 25: Cactus Plot for cctsdb yolo 2023.

Table 37: Benchmark `2025-collins-aerospace-benchmark`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	PyRAT	0	6	0	0	60	100.0	100.0%
2	α-β-CROWN	0	6	0	0	60	100.0	100.0%

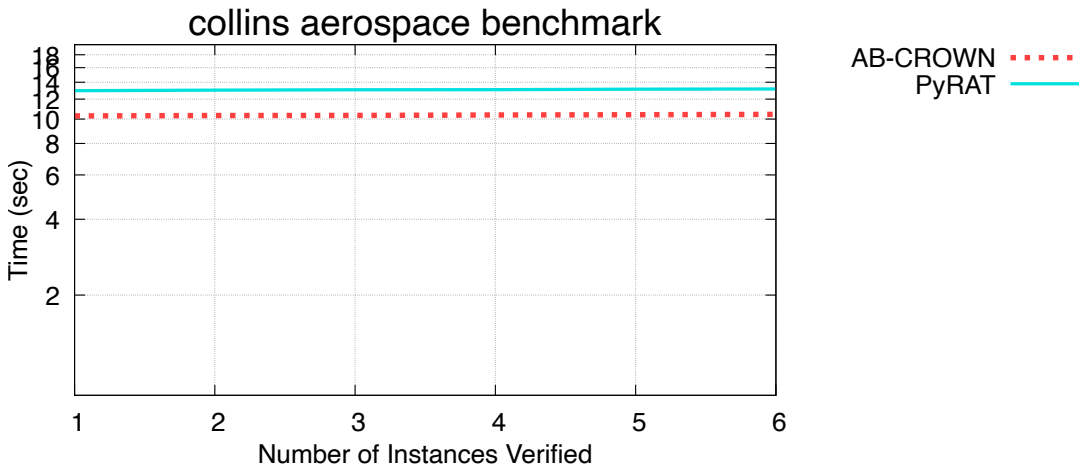

Figure 26: Cactus Plot for collins aerospace benchmark.

Table 38: Benchmark `2025-lsnc-relu`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	68	12	0	0	800	100.0	100.0%

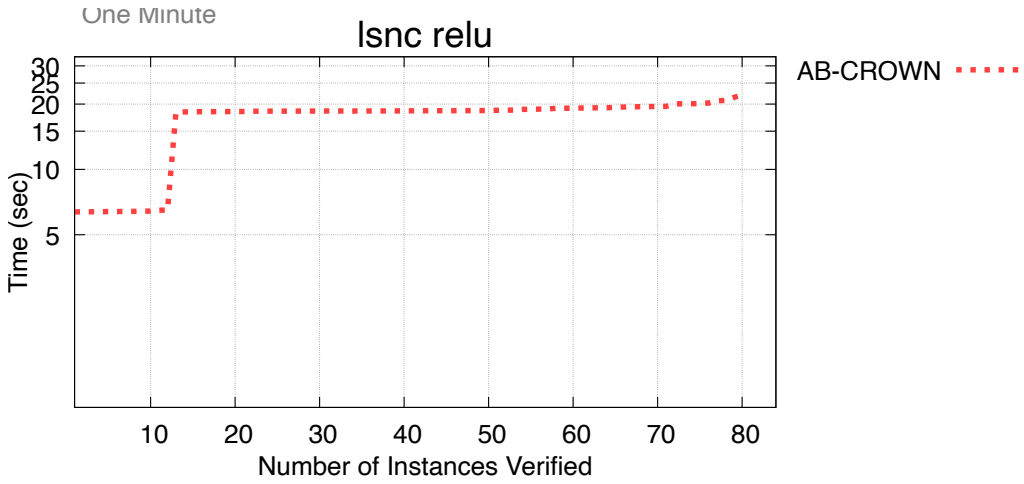

Figure 27: Cactus Plot for lsnc relu.

Table 39: Benchmark `2025-ml4acopf-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	58	5	0	0	630	100.0	91.3%
2	SobolBox	54	3	0	0	570	90.5	82.6%
3	PyRAT	36	3	0	0	390	61.9	56.5%
4	NNV	17	0	0	0	170	27.0	24.6%

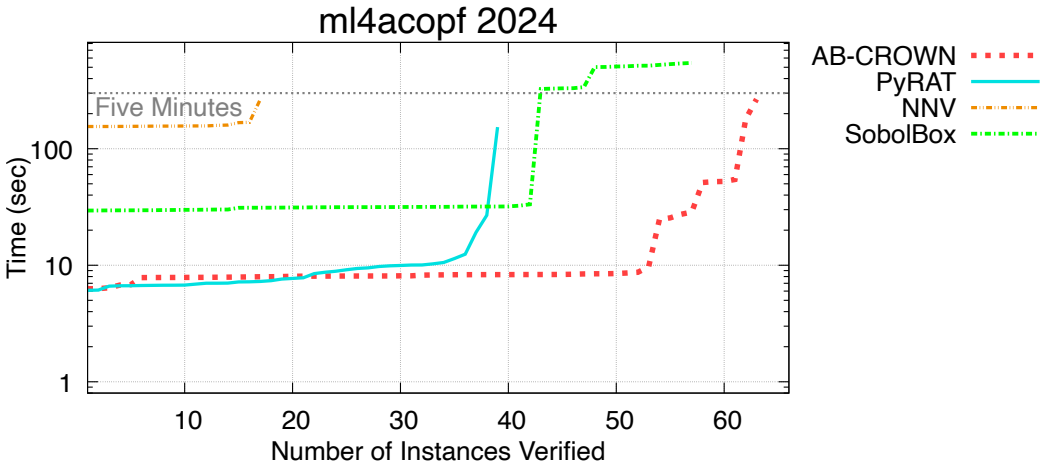

Figure 28: Cactus Plot for ml4acopf 2024.

Table 40: Benchmark `2025-relusplitter`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	151	20	0	0	1710	100.0	77.7%
2	PyRAT	61	16	0	0	770	45.0	35.0%
3	nnenum	22	2	0	0	240	14.0	10.9%
4	CORA	6	0	0	0	60	3.5	2.7%
5	NNV	0	4	0	0	40	2.3	1.8%

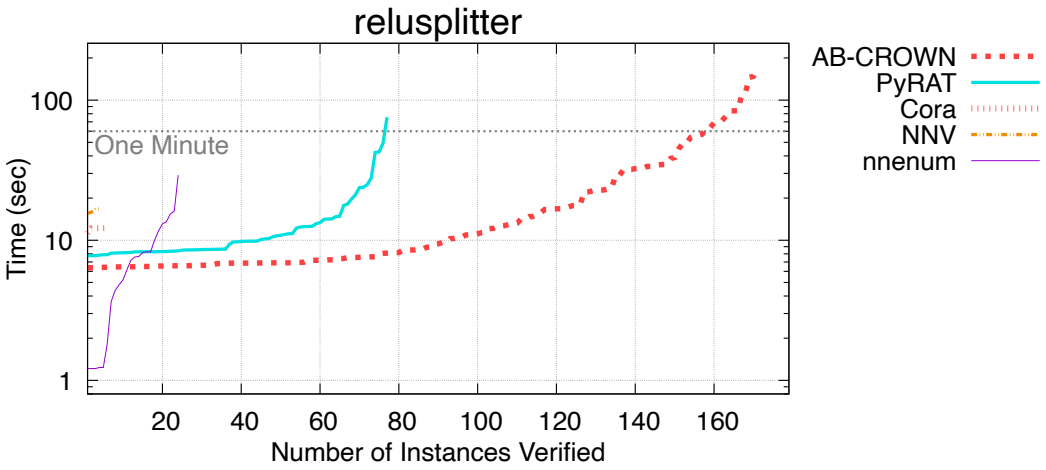

Figure 29: Cactus Plot for relusplitter.

Table 41: Benchmark `2025-traffic-signs-recognition-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	0	43	0	0	430	100.0	95.6%

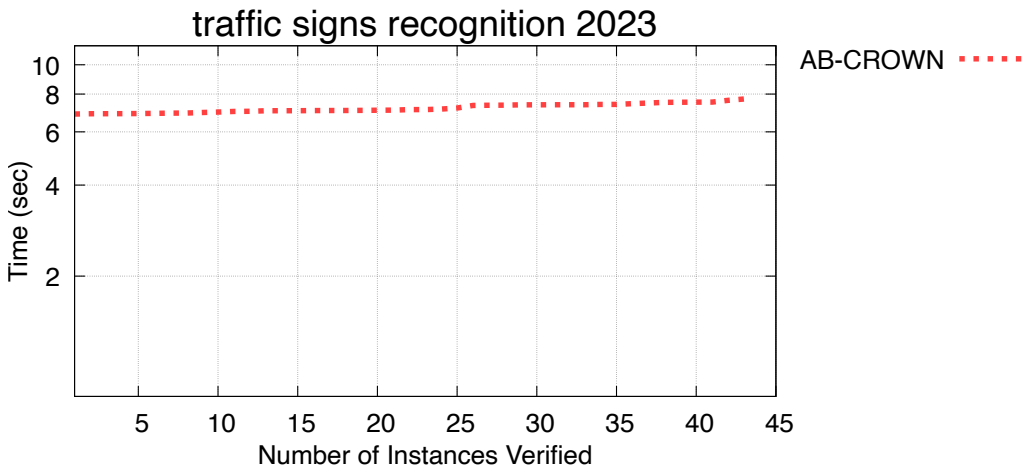

Figure 30: Cactus Plot for traffic signs recognition 2023.

Table 42: Benchmark `2025-vggnet16-2022`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	17	1	0	0	180	100.0	100.0%
2	nnenum	14	1	0	0	150	83.3	83.3%
3	PyRAT	13	1	0	0	140	77.8	77.8%
4	NNV	0	1	0	0	10	5.6	5.6%

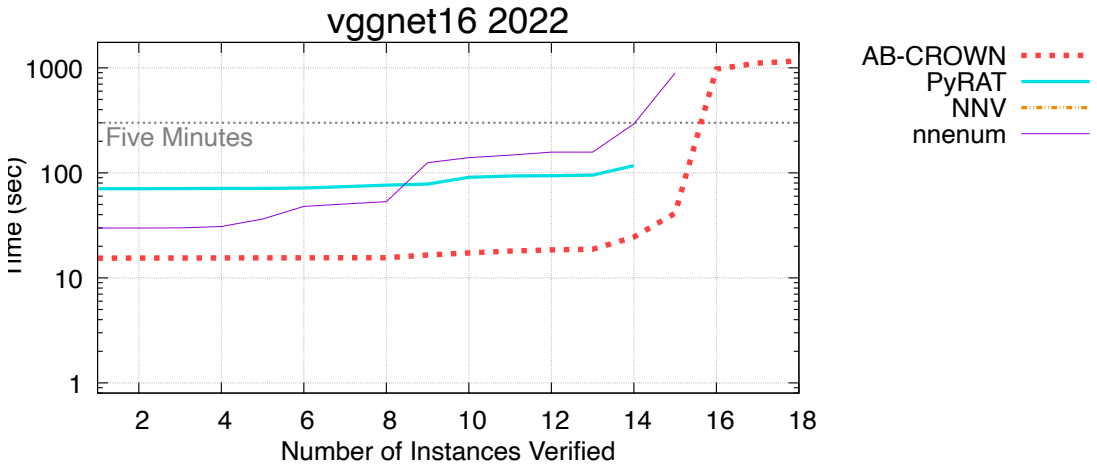

Figure 31: Cactus Plot for vggnet16 2022.

Table 43: Benchmark `2025-vit-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	125	0	0	0	1250	100.0	62.5%
2	PyRAT	83	0	0	0	830	66.4	41.5%
3	NeuralSAT	67	0	0	0	670	53.6	33.5%

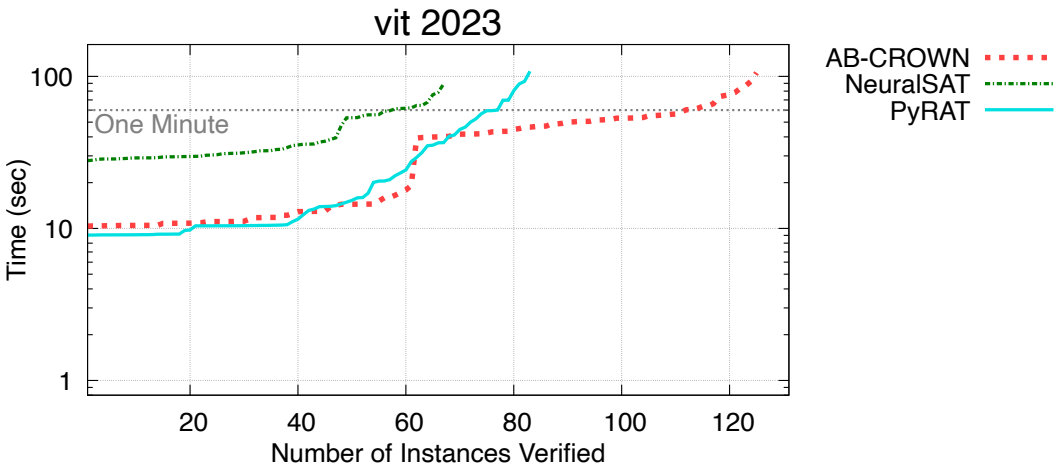

Figure 32: Cactus Plot for vit 2023.

Table 44: Benchmark `2025-yolo-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NNV	71	0	0	0	710	100.0	98.6%
2	α-β-CROWN	61	0	0	0	610	85.9	84.7%
3	NeuralSAT	52	0	0	0	520	73.2	72.2%
4	PyRAT	40	0	0	0	400	56.3	55.6%

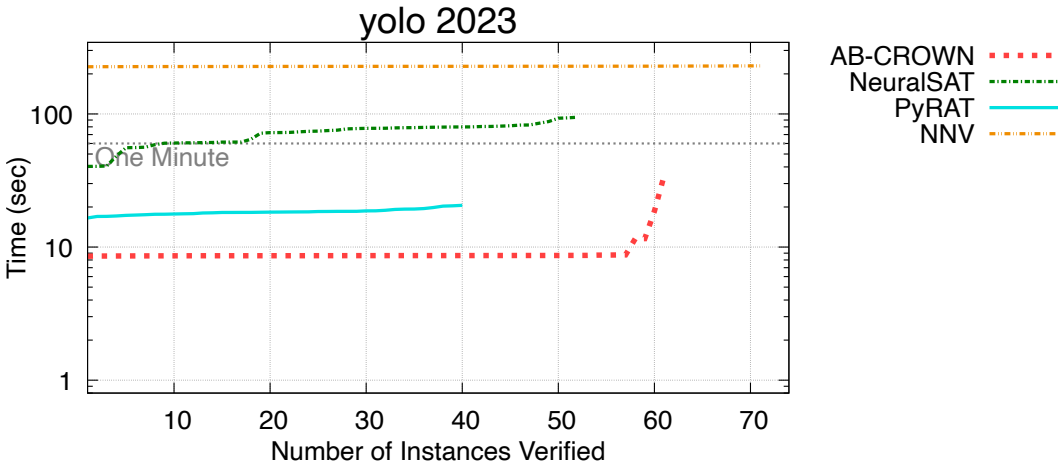

Figure 33: Cactus Plot for yolo 2023.

A.2 Small Tolerance

A.2.1 Regular Track

Table 45: Benchmark `2025-acasxu-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	nnenum	139	47	0	0	1860	100.0	100.0%
2	NeuralSAT	139	47	0	0	1860	100.0	100.0%
3	α-β-CROWN	139	47	0	0	1860	100.0	100.0%
4	PyRAT	139	46	0	0	1850	99.5	99.5%
5	CORA	137	46	0	0	1830	98.4	98.4%
6	SobolBox	118	43	0	1	1460	78.5	86.6%
7	NNV	71	39	0	0	1100	59.1	59.1%

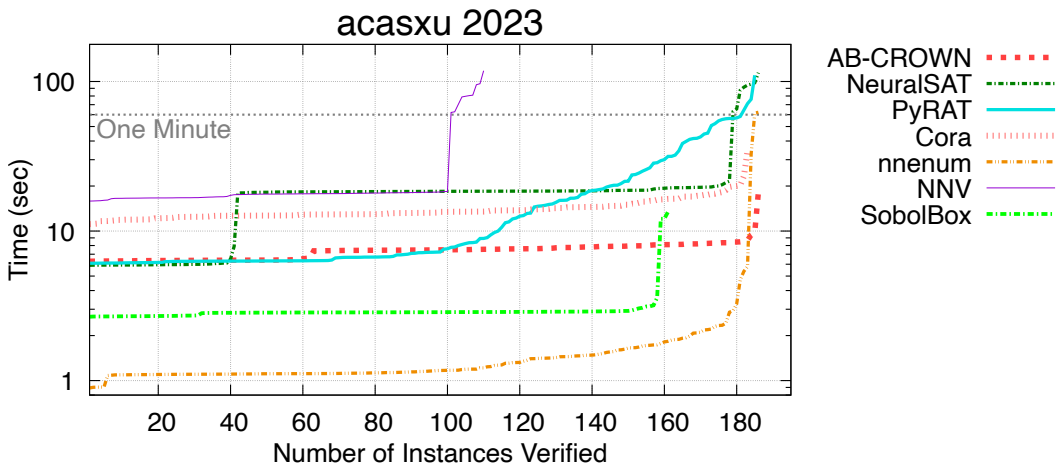

Figure 34: Cactus Plot for acasxu 2023.

Table 46: Benchmark `2025-cersyve`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	6	6	0	0	120	100.0	100.0%
2	NeuralSAT	4	6	0	0	100	83.3	83.3%
3	PyRAT	2	6	0	0	80	66.7	66.7%
4	SobolBox	0	6	0	0	60	50.0	50.0%
5	NNV	0	3	0	0	30	25.0	25.0%
6	CORA	6	5	0	1	-40	0	91.7%

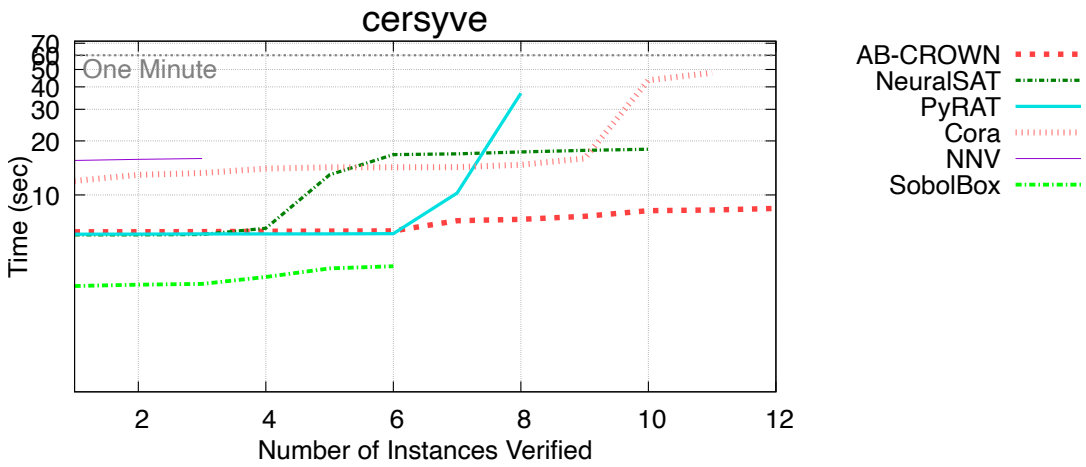

Figure 35: Cactus Plot for cersyve.

Table 47: Benchmark `2025-cgan-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	PyRAT	9	12	0	0	210	100.0	100.0%
2	NeuralSAT	9	12	0	0	210	100.0	100.0%
3	α-β-CROWN	9	12	0	0	210	100.0	100.0%
4	SobolBox	9	10	0	0	190	90.5	90.5%
5	nnenum	7	10	0	0	170	81.0	81.0%
6	NNV	5	11	0	0	160	76.2	76.2%

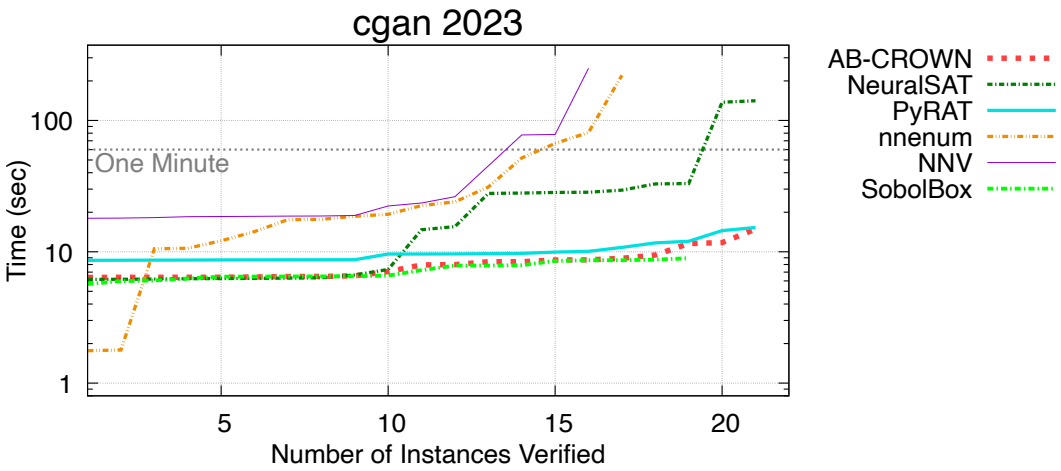

Figure 36: Cactus Plot for cgan 2023.

Table 48: Benchmark `2025-cifar100-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	100	29	0	0	1290	100.0	64.5%
2	PyRAT	61	25	0	0	860	66.7	43.0%
3	NeuralSAT	87	25	0	4	520	40.3	56.0%
4	CORA	0	10	0	0	100	7.8	5.0%
5	NNV	171	0	0	19	-1140	0	85.5%

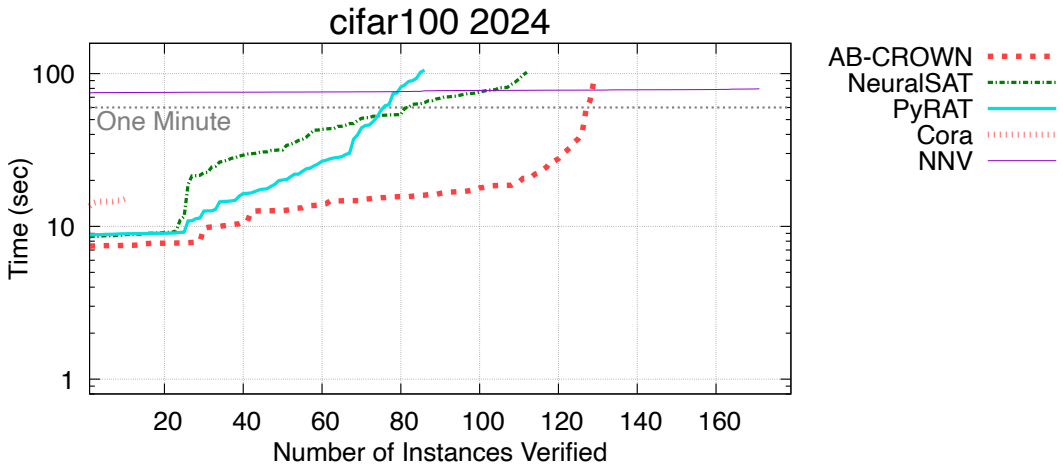

Figure 37: Cactus Plot for cifar100 2024.

Table 49: Benchmark `2025-collins-rul-cnn-2022`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	nnenum	39	23	0	0	620	100.0	100.0%
2	PyRAT	39	23	0	0	620	100.0	100.0%
3	NeuralSAT	39	23	0	0	620	100.0	100.0%
4	NNV	39	23	0	0	620	100.0	100.0%
5	CORA	39	23	0	0	620	100.0	100.0%
6	α-β-CROWN	39	23	0	0	620	100.0	100.0%
7	SobolBox	19	15	0	0	340	54.8	54.8%

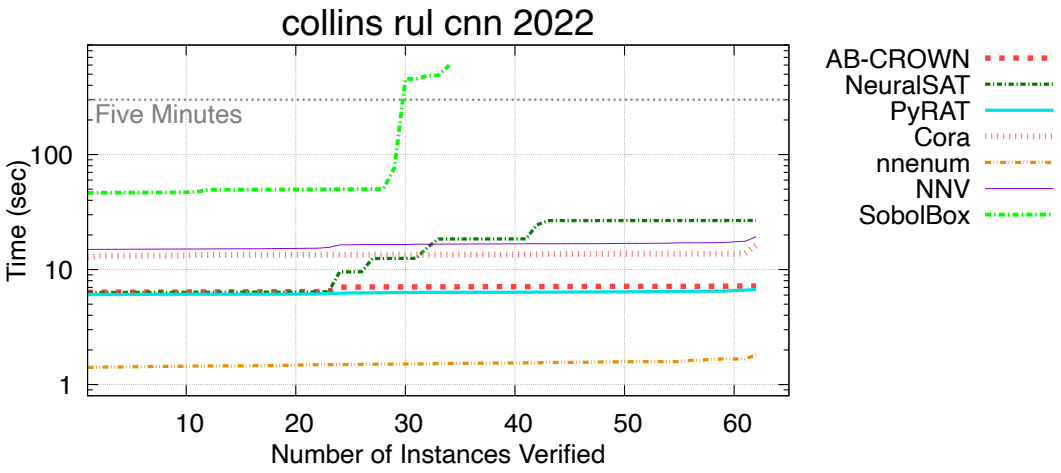

Figure 38: Cactus Plot for collins rul cnn 2022.

Table 50: Benchmark `2025-cora-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	22	131	0	0	1530	100.0	85.0%
2	NeuralSAT	21	131	0	0	1520	99.3	84.4%
3	PyRAT	20	128	0	0	1480	96.7	82.2%
4	CORA	19	124	0	0	1430	93.5	79.4%
5	NNV	19	57	0	0	760	49.7	42.2%
6	nnenum	19	4	0	0	230	15.0	12.8%

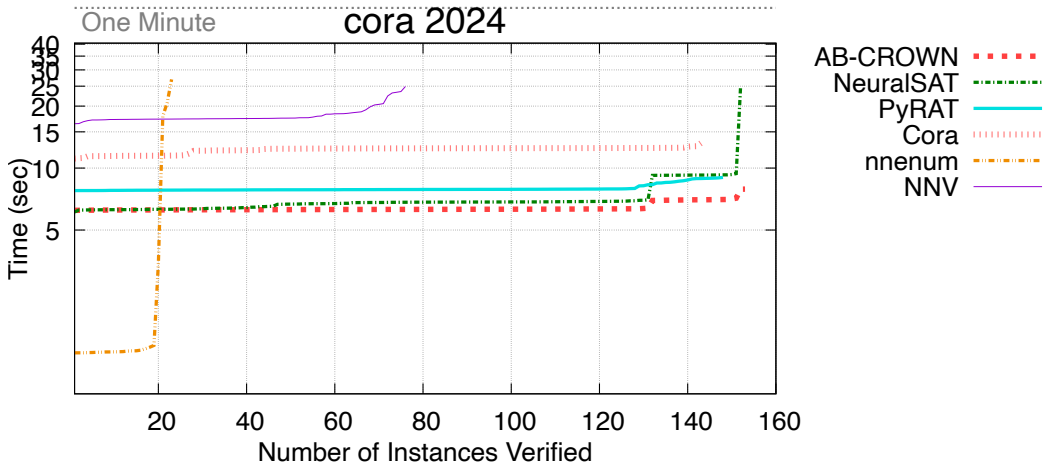

Figure 39: Cactus Plot for cora 2024.

Table 51: Benchmark `2025-dist-shift-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NeuralSAT	65	7	0	0	720	100.0	100.0%
2	CORA	65	7	0	0	720	100.0	100.0%
3	α-β-CROWN	65	7	0	0	720	100.0	100.0%
4	PyRAT	64	7	0	0	710	98.6	98.6%
5	NNV	50	4	0	0	540	75.0	75.0%

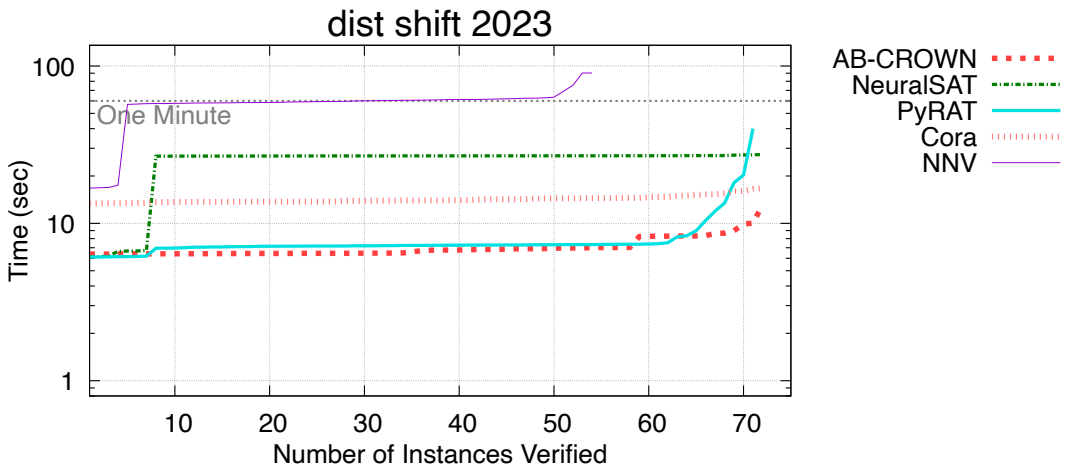

Figure 40: Cactus Plot for dist shift 2023.

Table 52: Benchmark `2025-linearizenn-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	nnenum	59	1	0	0	600	100.0	100.0%
2	SobolBox	59	1	0	0	600	100.0	100.0%
3	PyRAT	59	1	0	0	600	100.0	100.0%
4	NeuralSAT	59	1	0	0	600	100.0	100.0%
5	CORA	59	1	0	0	600	100.0	100.0%
6	α-β-CROWN	59	1	0	0	600	100.0	100.0%
7	NNV	40	1	0	0	410	68.3	68.3%

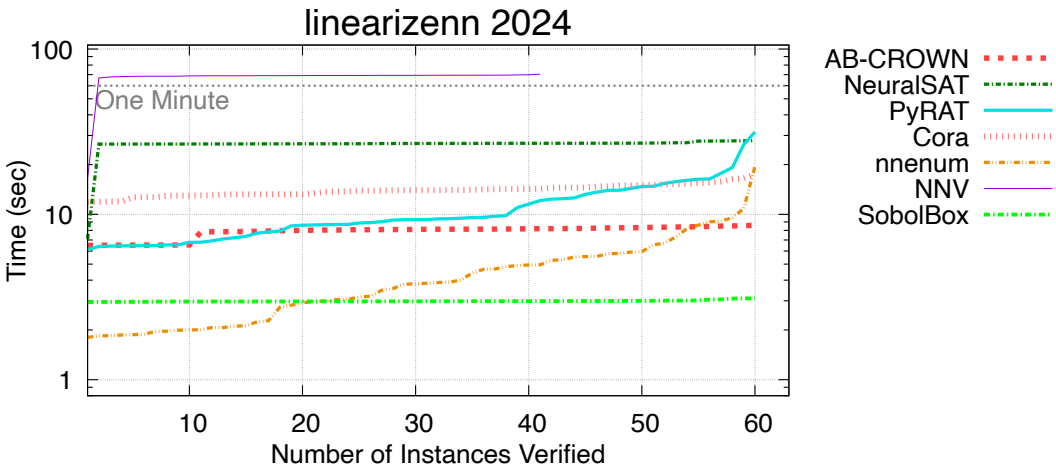

Figure 41: Cactus Plot for linearizenn 2024.

Table 53: Benchmark `2025-malbeware`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	131	19	0	0	1500	100.0	100.0%
2	NeuralSAT	127	19	0	0	1460	97.3	97.3%
3	PyRAT	121	18	0	0	1390	92.7	92.7%
4	nnenum	125	12	0	0	1370	91.3	91.3%
5	CORA	88	9	0	0	970	64.7	64.7%
6	NNV	49	4	0	0	530	35.3	35.3%

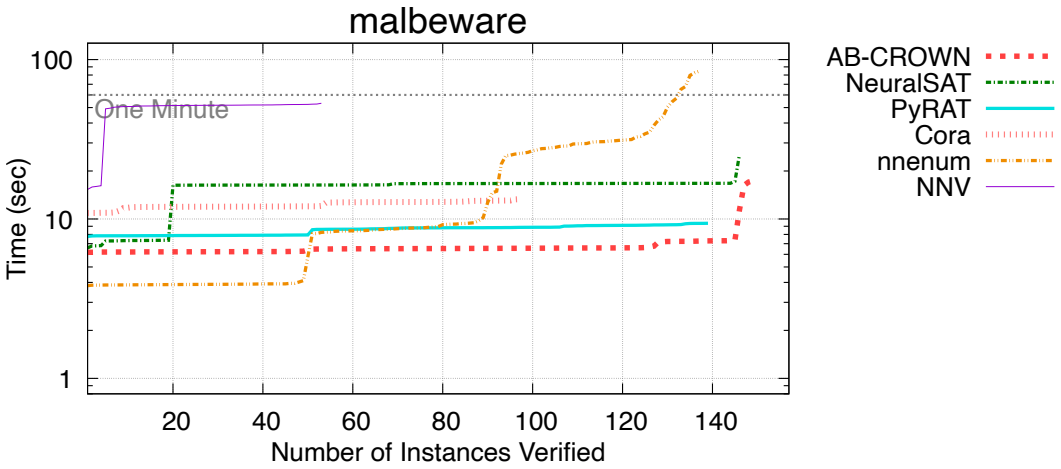

Figure 42: Cactus Plot for malbeware.

Table 54: Benchmark `2025-metaroom-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NeuralSAT	94	5	0	0	990	100.0	99.0%
2	α-β-CROWN	94	5	0	0	990	100.0	99.0%
3	CORA	92	5	0	0	970	98.0	97.0%
4	NNV	93	2	0	0	950	96.0	95.0%
5	PyRAT	95	3	0	2	680	68.7	98.0%
6	nnenum	50	1	0	0	510	51.5	51.0%

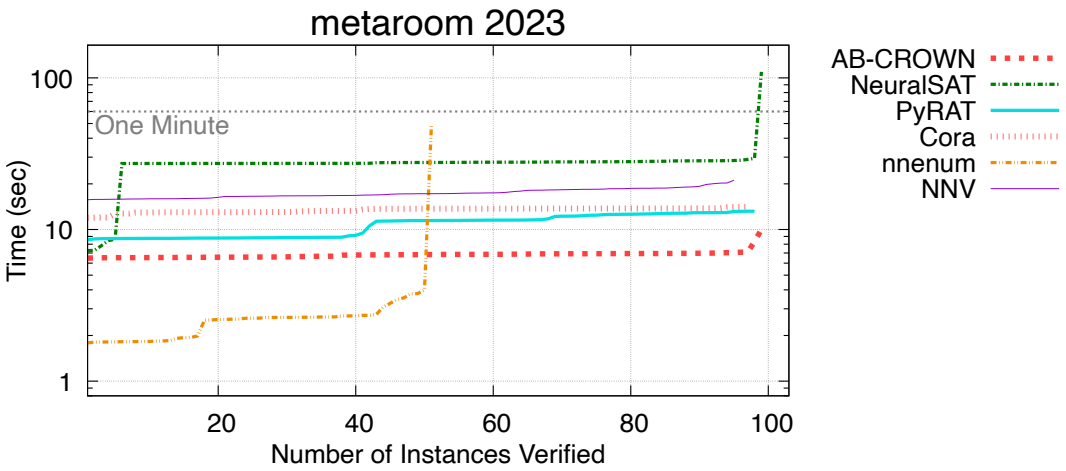

Figure 43: Cactus Plot for metaroom 2023.

Table 55: Benchmark `2025-nn4sys`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	194	0	0	0	1940	100.0	100.0%
2	NeuralSAT	120	0	0	0	1200	61.9	61.9%
3	SobolBox	107	0	0	0	1070	55.2	55.2%
4	PyRAT	40	0	0	0	400	20.6	20.6%
5	nnenum	22	0	0	0	220	11.3	11.3%
6	NNV	17	0	0	0	170	8.8	8.8%

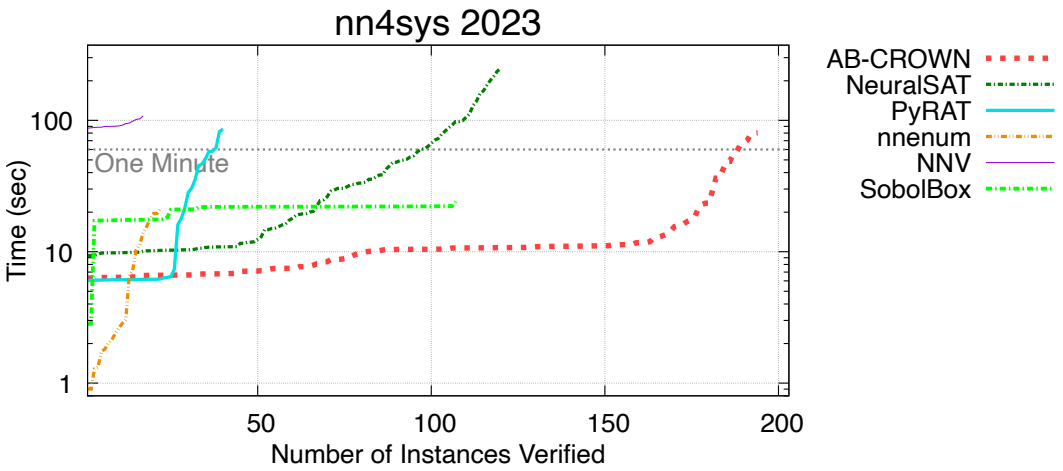

Figure 44: Cactus Plot for nn4sys 2023.

Table 56: Benchmark `2025-safenlp-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	433	647	0	0	10800	100.0	100.0%
2	NeuralSAT	425	645	0	0	10700	99.1	99.1%
3	PyRAT	331	647	0	0	9780	90.6	90.6%
4	nnenum	340	636	0	0	9760	90.4	90.4%
5	CORA	338	644	0	1	9670	89.5	90.9%
6	NNV	172	176	0	0	3480	32.2	32.2%
7	SobolBox	413	215	0	403	-54170	0	58.1%

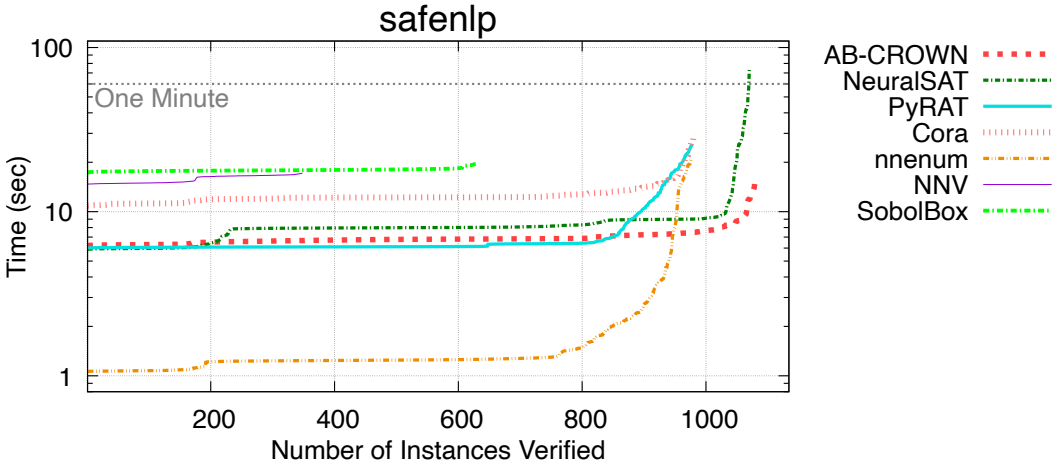

Figure 45: Cactus Plot for safenlp.

Table 57: Benchmark `2025-sat-relu`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NeuralSAT	50	50	0	0	1000	100.0	100.0%
2	CORA	50	50	0	0	1000	100.0	100.0%
3	α-β-CROWN	50	50	0	0	1000	100.0	100.0%
4	PyRAT	9	50	0	0	590	59.0	59.0%
5	nnenum	9	35	0	0	440	44.0	44.0%
6	NNV	2	16	0	0	180	18.0	18.0%
7	SobolBox	0	10	0	33	-4850	0	10.0%

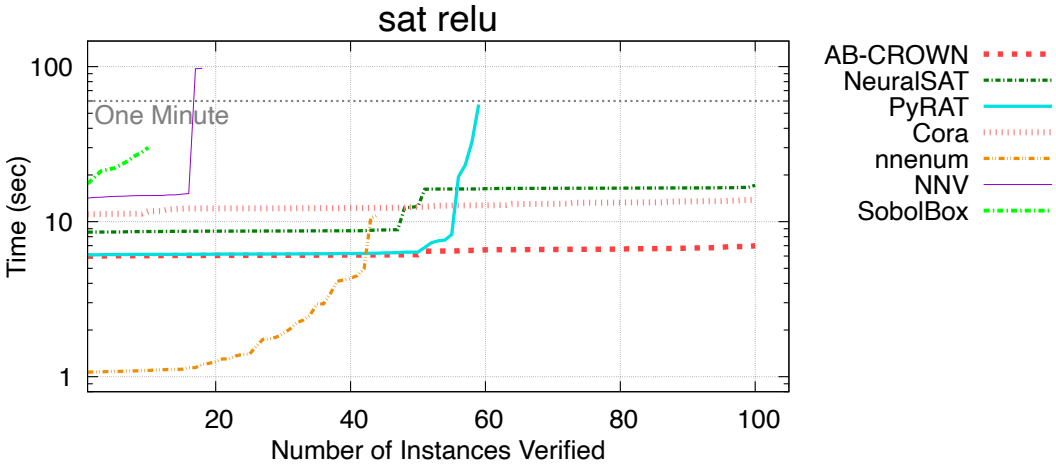

Figure 46: Cactus Plot for sat relu.

Table 58: Benchmark `2025-soundnessbench`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	0	50	0	0	500	100.0	100.0%
2	NeuralSAT	0	30	0	12	-1500	0	60.0%
3	CORA	0	0	0	18	-2700	0	0.0%

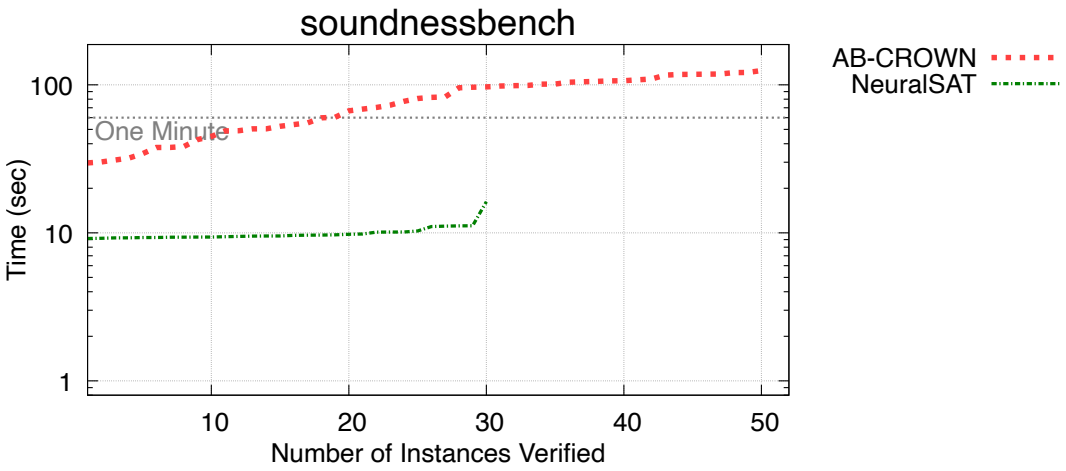

Figure 47: Cactus Plot for soundnessbench.

Table 59: Benchmark `2025-tinyimagenet-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	137	38	0	0	1750	100.0	87.5%
2	NeuralSAT	116	37	0	1	1380	78.9	76.5%
3	PyRAT	68	35	0	0	1030	58.9	51.5%
4	CORA	0	5	0	0	50	2.9	2.5%
5	NNV	0	1	0	0	10	0.6	0.5%

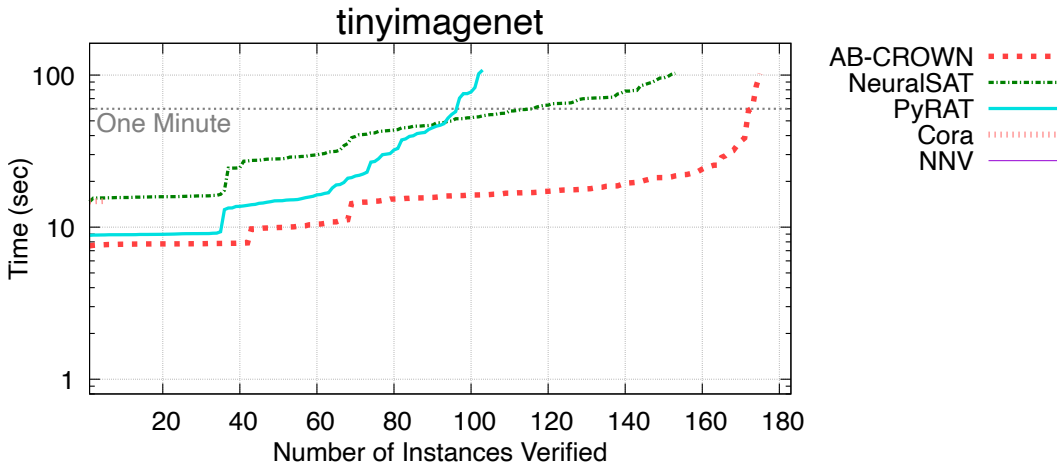

Figure 48: Cactus Plot for tinyimagenet.

Table 60: Benchmark `2025-tllverifybench-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	SobolBox	15	17	0	0	320	100.0	100.0%
2	PyRAT	15	17	0	0	320	100.0	100.0%
3	NeuralSAT	15	17	0	0	320	100.0	100.0%
4	CORA	15	17	0	0	320	100.0	100.0%
5	α-β-CROWN	15	17	0	0	320	100.0	100.0%
6	nnenum	1	17	0	0	180	56.2	56.2%
7	NNV	0	17	0	0	170	53.1	53.1%

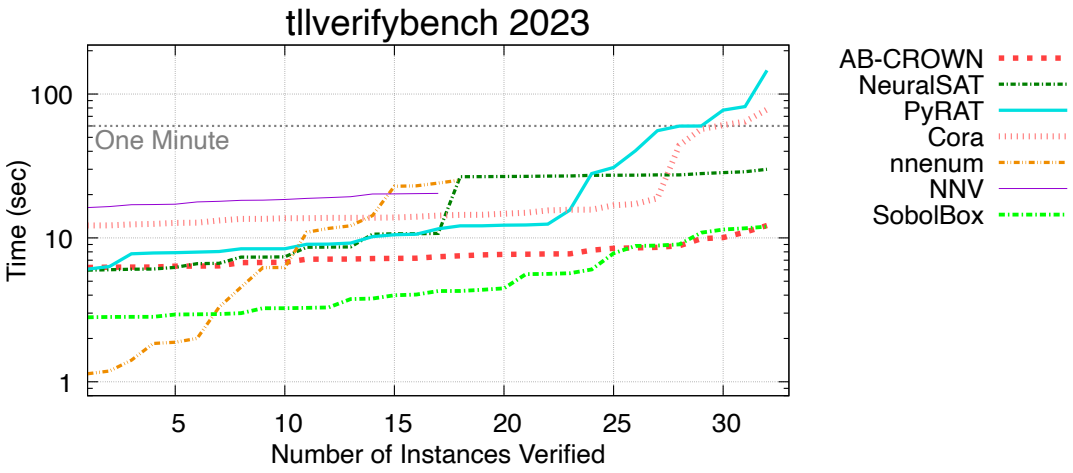

Figure 49: Cactus Plot for tllverifybench 2023.

A.2.2 Extended Track

Table 61: Benchmark `2025-cctsdb-yolo-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	PyRAT	11	28	0	0	390	100.0	100.0%
2	α-β-CROWN	11	28	0	0	390	100.0	100.0%

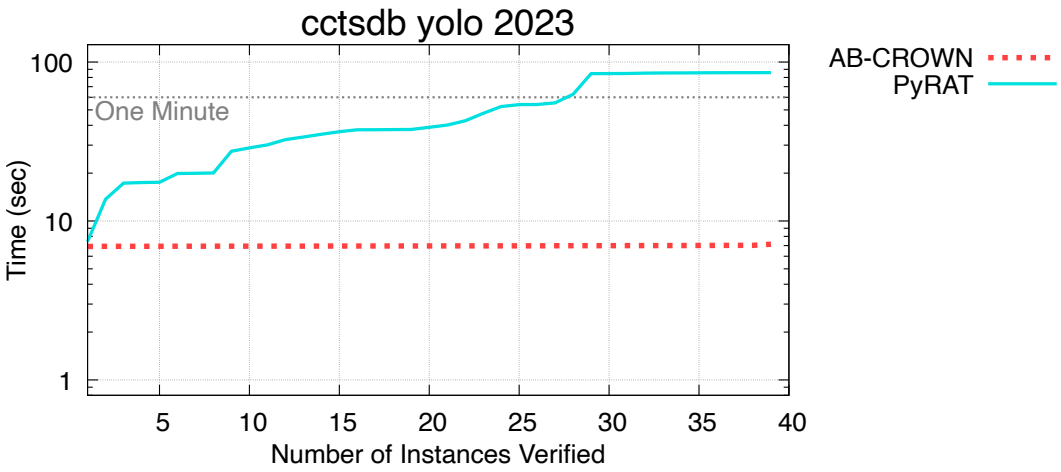

Figure 50: Cactus Plot for cctsdb yolo 2023.

Table 62: Benchmark `2025-collins-aerospace-benchmark`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	PyRAT	0	6	0	0	60	100.0	100.0%
2	α-β-CROWN	0	6	0	0	60	100.0	100.0%

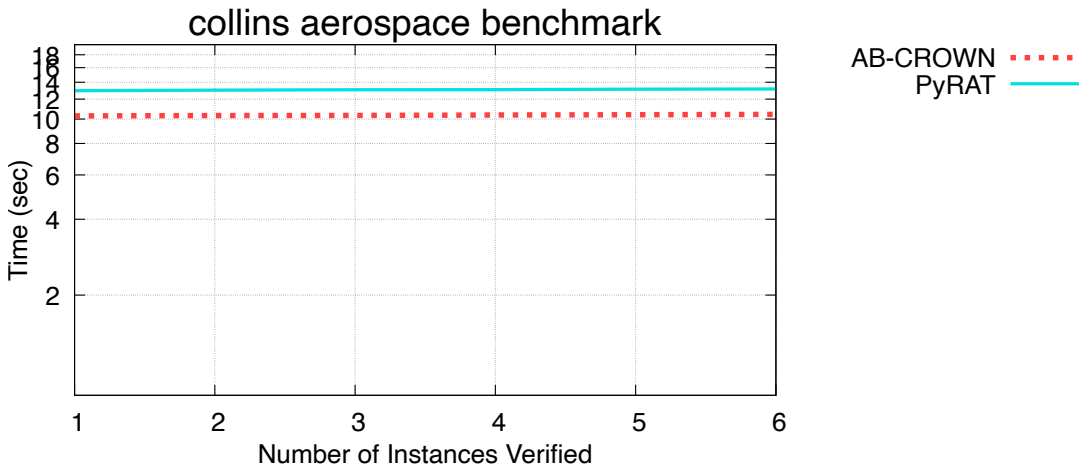

Figure 51: Cactus Plot for collins aerospace benchmark.

Table 63: Benchmark `2025-lsnc-relu`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	68	12	0	0	800	100.0	100.0%

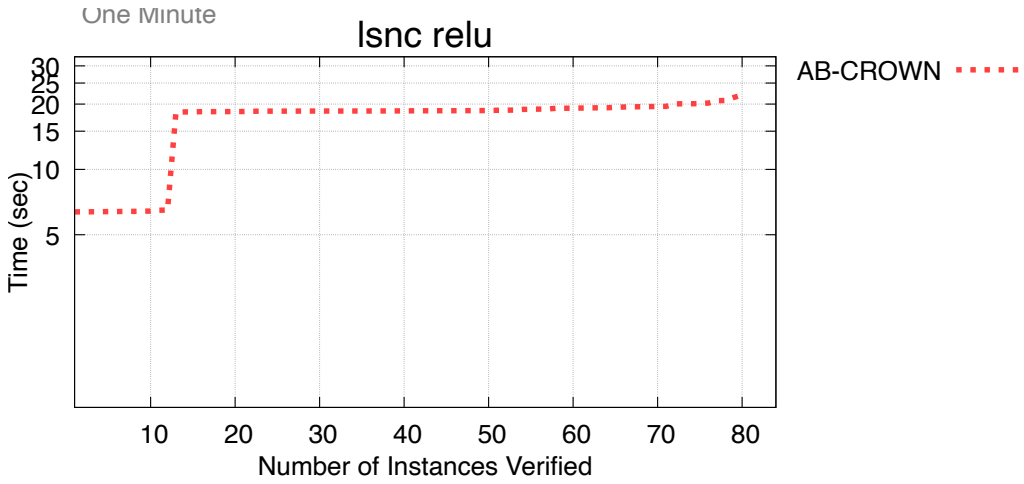

Figure 52: Cactus Plot for lsnc relu.

Table 64: Benchmark `2025-ml4acopf-2024`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	58	5	0	0	630	100.0	91.3%
2	SobolBox	54	3	0	0	570	90.5	82.6%
3	PyRAT	36	3	0	0	390	61.9	56.5%
4	NNV	17	0	0	0	170	27.0	24.6%

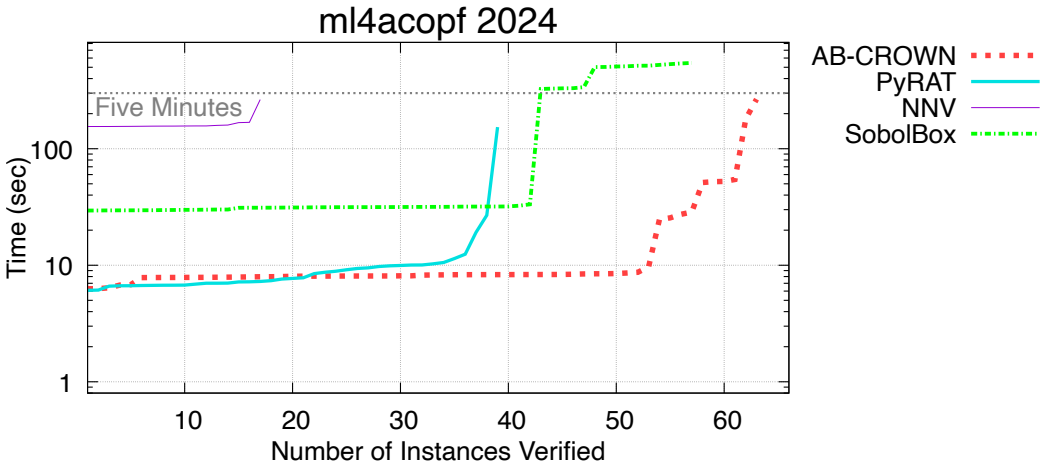

Figure 53: Cactus Plot for ml4acopf 2024.

Table 65: Benchmark `2025-relusplitter`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	151	20	0	0	1710	100.0	77.7%
2	PyRAT	61	16	0	0	770	45.0	35.0%
3	nnenum	22	2	0	0	240	14.0	10.9%
4	CORA	6	0	0	0	60	3.5	2.7%
5	NNV	0	4	0	0	40	2.3	1.8%

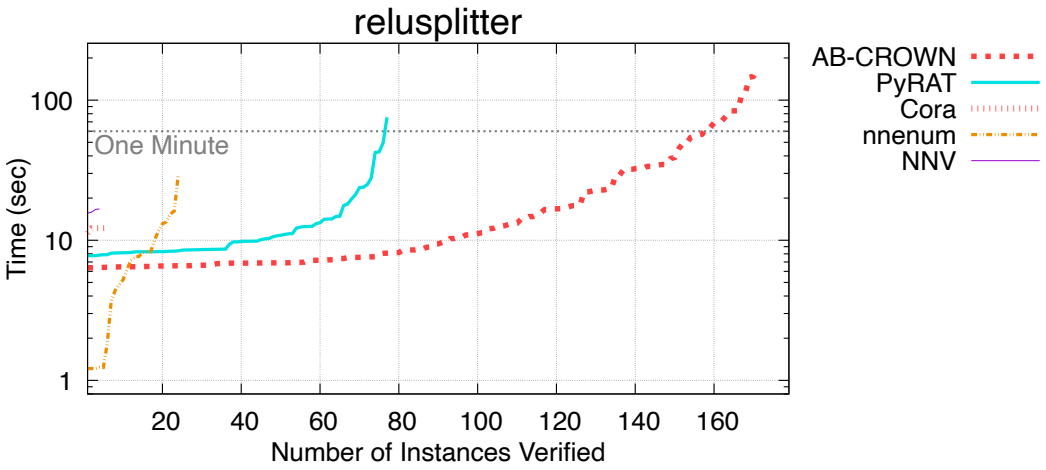

Figure 54: Cactus Plot for relusplitter.

Table 66: Benchmark `2025-traffic-signs-recognition-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	0	43	0	0	430	100.0	95.6%

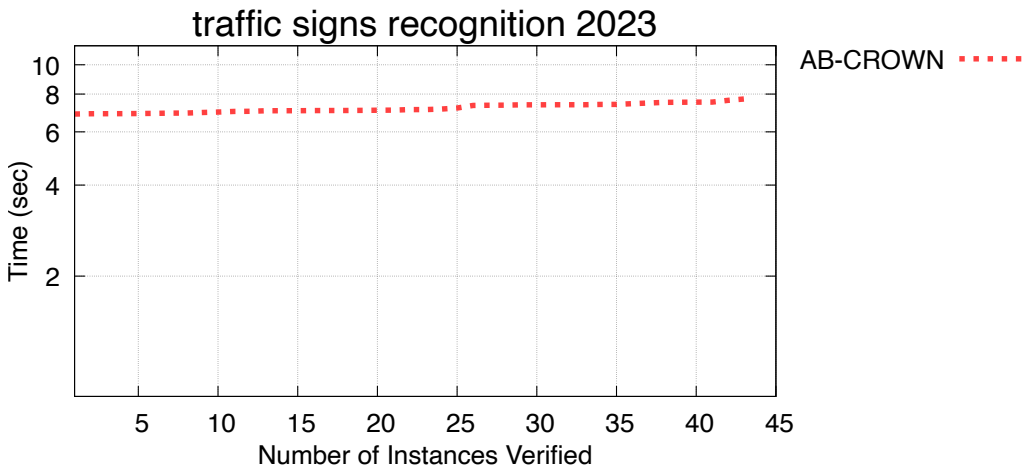

Figure 55: Cactus Plot for traffic signs recognition 2023.

Table 67: Benchmark `2025-vggnet16-2022`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	17	1	0	0	180	100.0	100.0%
2	nnenum	14	1	0	0	150	83.3	83.3%
3	PyRAT	13	1	0	0	140	77.8	77.8%
4	NNV	0	1	0	0	10	5.6	5.6%

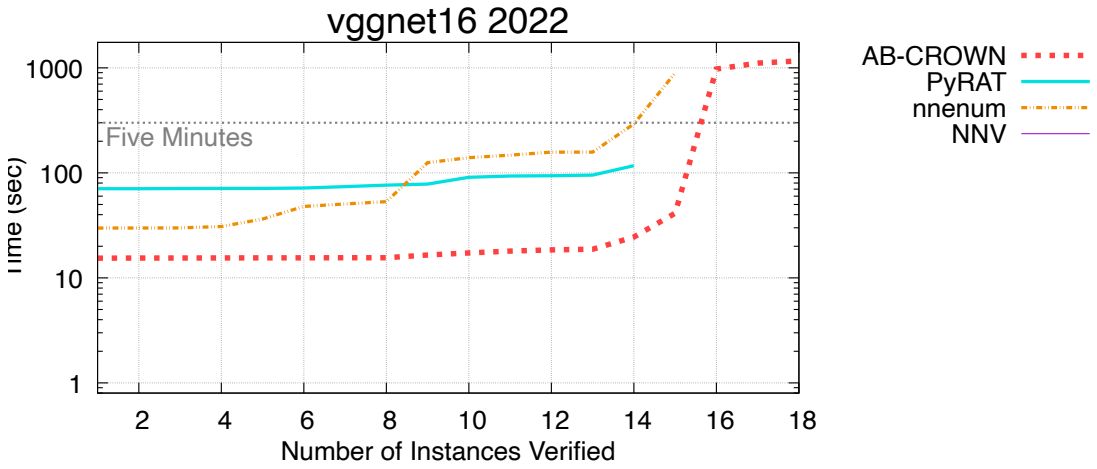

Figure 56: Cactus Plot for vggnet16 2022.

Table 68: Benchmark `2025-vit-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	α-β-CROWN	125	0	0	0	1250	100.0	62.5%
2	PyRAT	83	0	0	0	830	66.4	41.5%
3	NeuralSAT	67	0	0	0	670	53.6	33.5%

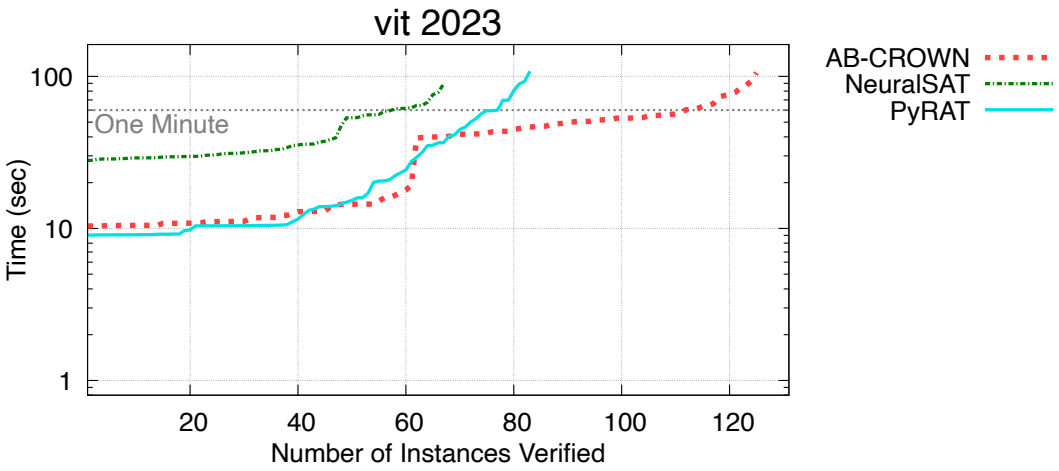

Figure 57: Cactus Plot for vit 2023.

Table 69: Benchmark `2025-yolo-2023`

#	Tool	Verified	Falsified	Fastest	Penalty	Points	Score	Solved
1	NNV	71	0	0	0	710	100.0	98.6%
2	α-β-CROWN	61	0	0	0	610	85.9	84.7%
3	NeuralSAT	52	0	0	0	520	73.2	72.2%
4	PyRAT	40	0	0	0	400	56.3	55.6%

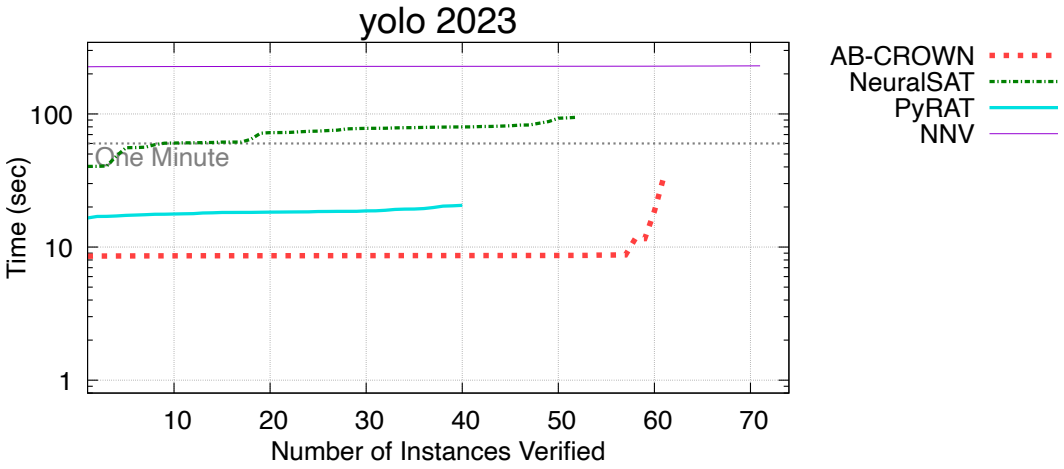

Figure 58: Cactus Plot for yolo 2023.

B Instance Results

B.1 Zero Tolerance

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Acasxu 2023	0	UNSAT	8.45	18.1	13.2	15.9	-	1.42	3.04
2025 Acasxu 2023	1	UNSAT	7.76	18.1	16.1	14.0	-	1.45	2.84
2025 Acasxu 2023	2	UNSAT	7.90	18.3	18.9	14.0	-	1.52	2.84
2025 Acasxu 2023	3	UNSAT	7.92	18.3	16.0	12.7	-	1.41	2.83
2025 Acasxu 2023	4	UNSAT	7.77	18.2	12.7	13.8	-	1.45	2.88
2025 Acasxu 2023	5	UNSAT	7.83	18.1	16.6	13.5	-	1.65	2.82
2025 Acasxu 2023	6	UNSAT	7.75	18.0	13.1	13.5	-	1.32	2.87
2025 Acasxu 2023	7	UNSAT	7.76	18.0	10.6	12.3	-	1.48	2.85
2025 Acasxu 2023	8	UNSAT	7.61	18.0	9.78	13.2	-	1.40	2.85
2025 Acasxu 2023	9	UNSAT	7.83	18.2	20.2	13.8	-	1.60	2.84
2025 Acasxu 2023	10	UNSAT	7.97	18.3	26.5	13.9	-	1.94	2.84
2025 Acasxu 2023	11	UNSAT	7.88	18.3	18.8	13.7	-	1.74	2.87
2025 Acasxu 2023	12	UNSAT	7.80	18.3	15.5	14.0	-	1.41	2.90
2025 Acasxu 2023	13	UNSAT	8.08	18.3	30.0	14.7	-	1.98	2.89
2025 Acasxu 2023	14	UNSAT	8.11	18.3	28.6	15.2	-	1.92	2.89
2025 Acasxu 2023	15	UNSAT	8.35	19.5	56.6	16.4	-	2.34	2.87
2025 Acasxu 2023	16	UNSAT	8.27	63.0	56.3	17.8	-	2.18	2.88
2025 Acasxu 2023	17	UNSAT	8.35	19.5	58.4	17.5	-	62.3	2.88
2025 Acasxu 2023	18	UNSAT	7.92	18.3	20.0	15.0	-	1.70	3.14
2025 Acasxu 2023	19	UNSAT	8.14	18.4	19.1	13.5	-	1.54	2.89
2025 Acasxu 2023	20	UNSAT	7.91	18.3	20.3	14.5	-	1.56	2.86
2025 Acasxu 2023	21	UNSAT	7.95	18.3	14.9	14.2	-	1.44	2.85
2025 Acasxu 2023	22	UNSAT	8.03	18.4	23.7	15.2	-	1.72	2.91
2025 Acasxu 2023	23	UNSAT	8.15	18.6	41.0	16.5	-	2.34	2.88
2025 Acasxu 2023	24	UNSAT	8.14	18.4	44.6	17.0	-	2.19	3.13
2025 Acasxu 2023	25	UNSAT	8.31	18.6	41.7	17.0	-	2.11	2.88
2025 Acasxu 2023	26	UNSAT	8.52	19.7	39.8	16.3	-	1.89	2.87
2025 Acasxu 2023	27	UNSAT	7.96	19.3	24.4	14.4	-	1.83	2.85
2025 Acasxu 2023	28	UNSAT	7.85	18.4	23.9	14.5	-	1.72	2.86
2025 Acasxu 2023	29	UNSAT	7.89	18.3	18.4	14.5	-	1.73	2.87
2025 Acasxu 2023	30	UNSAT	7.96	18.3	16.0	14.0	-	1.48	2.88
2025 Acasxu 2023	31	UNSAT	8.01	18.3	29.5	15.0	-	1.77	2.88
2025 Acasxu 2023	32	UNSAT	8.29	18.7	54.6	17.4	-	2.87	2.84
2025 Acasxu 2023	33	UNSAT	8.36	19.5	71.1	17.2	-	2.31	2.87
2025 Acasxu 2023	34	UNSAT	8.24	19.5	42.6	17.0	-	2.08	2.86
2025 Acasxu 2023	35	UNSAT	8.66	20.4	76.1	19.9	-	3.26	2.85
2025 Acasxu 2023	36	UNSAT	7.83	18.3	20.8	13.8	-	1.49	2.85
2025 Acasxu 2023	37	UNSAT	7.92	18.3	18.7	13.5	-	1.66	2.89
2025 Acasxu 2023	38	UNSAT	7.89	18.2	17.8	13.8	-	1.41	2.84
2025 Acasxu 2023	39	UNSAT	7.76	18.2	14.7	13.0	-	1.56	2.85
2025 Acasxu 2023	40	UNSAT	7.97	18.3	25.8	14.7	-	1.62	2.87
2025 Acasxu 2023	41	UNSAT	8.11	19.3	38.5	14.5	-	2.08	2.86
2025 Acasxu 2023	42	UNSAT	8.11	18.4	34.4	16.2	-	1.88	2.90
2025 Acasxu 2023	43	UNSAT	8.30	21.5	57.1	17.3	-	61.5	2.86
2025 Acasxu 2023	44	UNSAT	8.20	19.5	50.8	16.3	-	2.42	2.85
2025 Acasxu 2023	45	UNSAT	8.45	19.9	14.5	19.7	-	1.50	-
2025 Acasxu 2023	46	SAT	6.34	7.91	28.4	15.9	-	1.19	12.1
2025 Acasxu 2023	47	SAT	6.40	96.1	52.3	18.7	-	1.61	✗
2025 Acasxu 2023	48	SAT	6.40	6.12	12.6	13.2	-	1.24	3.58
2025 Acasxu 2023	49	SAT	6.57	114	-	17.7	-	1.17	-
2025 Acasxu 2023	50	SAT	6.37	65.6	45.1	17.0	-	1.45	12.1
2025 Acasxu 2023	51	UNSAT	8.20	19.6	16.8	18.0	-	1.68	-
2025 Acasxu 2023	52	UNSAT	8.21	19.6	17.6	16.5	-	2.21	-
2025 Acasxu 2023	53	UNSAT	8.21	19.7	19.7	16.4	-	1.81	-
2025 Acasxu 2023	54	SAT	6.39	5.99	8.00	12.7	17.0	1.12	2.69
2025 Acasxu 2023	55	SAT	6.44	6.03	6.14	12.6	16.6	1.10	2.67
2025 Acasxu 2023	56	SAT	6.41	5.95	6.15	13.0	16.7	1.11	2.69
2025 Acasxu 2023	57	SAT	6.37	5.95	6.14	12.7	16.7	1.17	2.72
2025 Acasxu 2023	58	SAT	6.53	5.99	6.12	12.7	16.6	1.10	2.70
2025 Acasxu 2023	59	SAT	6.38	5.92	6.16	11.6	16.7	1.11	2.68
2025 Acasxu 2023	60	SAT	6.39	5.98	6.15	13.7	16.6	1.11	2.71

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Acasxu 2023	61	SAT	6.39	5.96	8.13	14.3	16.7	1.10	2.69
2025 Acasxu 2023	62	SAT	6.38	5.98	21.5	14.7	16.6	1.19	2.72
2025 Acasxu 2023	63	SAT	6.40	5.95	7.00	11.9	16.6	1.10	2.72
2025 Acasxu 2023	64	SAT	6.41	6.02	31.6	12.9	-	1.14	13.4
2025 Acasxu 2023	65	UNSAT	18.2	91.6	110	-	-	5.38	-
2025 Acasxu 2023	66	SAT	6.36	6.00	15.1	13.0	16.9	1.10	2.69
2025 Acasxu 2023	67	SAT	6.39	5.97	9.44	12.7	16.7	1.10	2.70
2025 Acasxu 2023	68	SAT	6.38	5.93	25.2	13.5	16.7	1.11	3.07
2025 Acasxu 2023	69	SAT	6.36	6.50	32.2	12.7	16.9	1.46	2.69
2025 Acasxu 2023	70	SAT	6.36	5.97	7.24	12.7	16.7	1.10	2.68
2025 Acasxu 2023	71	SAT	6.38	5.97	6.15	12.7	16.8	1.12	2.70
2025 Acasxu 2023	72	SAT	6.37	6.07	6.15	12.7	16.7	1.11	2.70
2025 Acasxu 2023	73	UNSAT	9.80	21.1	56.6	34.3	-	5.78	-
2025 Acasxu 2023	74	SAT	6.35	5.95	6.13	11.7	16.9	1.11	2.69
2025 Acasxu 2023	75	SAT	6.44	6.00	12.1	11.7	16.4	1.12	2.69
2025 Acasxu 2023	76	SAT	6.35	6.07	7.21	12.7	16.6	1.11	2.70
2025 Acasxu 2023	77	SAT	6.39	5.92	6.11	12.6	16.5	1.10	2.68
2025 Acasxu 2023	78	SAT	6.41	5.94	6.13	13.8	16.7	1.10	2.68
2025 Acasxu 2023	79	SAT	6.41	5.93	6.17	14.2	16.7	1.12	2.72
2025 Acasxu 2023	80	SAT	6.37	6.11	15.2	14.7	16.8	1.22	2.71
2025 Acasxu 2023	81	SAT	6.38	5.90	6.11	12.7	16.7	1.11	2.70
2025 Acasxu 2023	82	SAT	6.35	5.97	12.2	12.7	16.6	1.10	2.72
2025 Acasxu 2023	83	UNSAT	6.59	98.0	55.7	20.1	-	1.66	-
2025 Acasxu 2023	84	SAT	6.34	5.91	9.04	12.9	16.9	1.10	2.73
2025 Acasxu 2023	85	SAT	6.38	5.91	7.09	13.5	16.6	1.10	2.69
2025 Acasxu 2023	86	SAT	6.37	5.95	6.11	11.7	16.7	1.13	2.71
2025 Acasxu 2023	87	SAT	6.39	5.93	6.16	14.1	16.6	1.11	2.70
2025 Acasxu 2023	88	SAT	6.39	5.93	8.25	12.9	16.6	1.10	2.70
2025 Acasxu 2023	89	SAT	6.38	5.93	9.99	14.4	16.5	1.11	2.69
2025 Acasxu 2023	90	UNSAT	8.12	19.6	41.6	18.2	-	1.46	-
2025 Acasxu 2023	91	UNSAT	7.58	18.7	8.36	14.4	-	1.48	-
2025 Acasxu 2023	92	UNSAT	7.66	19.4	8.43	-	-	1.31	-
2025 Acasxu 2023	93	UNSAT	7.64	18.5	6.29	13.3	18.0	1.14	2.86
2025 Acasxu 2023	94	UNSAT	7.38	18.4	6.32	13.5	17.7	1.17	2.87
2025 Acasxu 2023	95	UNSAT	6.31	18.4	6.29	12.4	17.6	1.10	2.85
2025 Acasxu 2023	96	SAT	6.32	5.93	6.11	12.4	16.1	1.11	2.86
2025 Acasxu 2023	97	SAT	6.30	5.96	6.09	12.2	15.9	1.09	2.87
2025 Acasxu 2023	98	SAT	6.39	5.91	6.09	11.2	15.9	1.08	2.85
2025 Acasxu 2023	99	UNSAT	7.73	18.6	7.23	13.5	-	1.41	-
2025 Acasxu 2023	100	UNSAT	7.68	18.7	7.17	14.4	118	1.27	-
2025 Acasxu 2023	101	UNSAT	7.66	18.7	7.82	12.7	-	1.32	2.85
2025 Acasxu 2023	102	UNSAT	6.35	18.4	6.27	12.4	17.7	0.91	2.88
2025 Acasxu 2023	103	UNSAT	7.47	18.4	6.32	11.9	18.0	1.11	2.84
2025 Acasxu 2023	104	UNSAT	6.31	18.3	6.33	12.4	17.6	1.10	2.88
2025 Acasxu 2023	105	UNSAT	6.32	18.5	6.33	11.9	17.8	1.09	2.88
2025 Acasxu 2023	106	UNSAT	6.29	18.4	6.27	12.9	17.5	1.11	2.89
2025 Acasxu 2023	107	UNSAT	6.30	18.3	6.26	12.2	17.3	0.89	2.83
2025 Acasxu 2023	108	UNSAT	7.48	18.7	6.29	13.5	17.8	1.10	2.86
2025 Acasxu 2023	109	UNSAT	7.56	18.5	7.60	13.3	-	1.42	-
2025 Acasxu 2023	110	UNSAT	7.54	18.5	6.34	13.7	18.3	1.26	2.85
2025 Acasxu 2023	111	UNSAT	7.59	18.4	6.70	12.5	81.0	1.13	2.85
2025 Acasxu 2023	112	UNSAT	7.49	18.4	6.31	12.0	18.2	1.11	2.86
2025 Acasxu 2023	113	UNSAT	7.51	18.7	6.69	13.2	78.8	1.11	2.85
2025 Acasxu 2023	114	UNSAT	6.34	18.4	6.32	12.4	17.8	1.16	2.87
2025 Acasxu 2023	115	UNSAT	7.45	18.6	6.63	13.0	17.6	1.10	2.88
2025 Acasxu 2023	116	UNSAT	7.46	18.5	6.34	12.9	17.7	1.12	2.86
2025 Acasxu 2023	117	UNSAT	7.56	18.6	7.10	13.5	80.4	1.13	2.89
2025 Acasxu 2023	118	UNSAT	7.61	18.7	7.78	14.5	-	1.32	-
2025 Acasxu 2023	119	UNSAT	7.79	18.5	7.57	14.5	-	1.40	2.95
2025 Acasxu 2023	120	UNSAT	7.45	18.4	6.33	12.9	18.0	1.12	2.86
2025 Acasxu 2023	121	UNSAT	6.43	18.3	6.28	12.9	17.5	1.09	2.86
2025 Acasxu 2023	122	UNSAT	7.41	18.5	6.70	13.5	18.4	1.12	2.86
2025 Acasxu 2023	123	UNSAT	7.45	18.5	6.30	11.9	17.7	1.11	2.89
2025 Acasxu 2023	124	UNSAT	6.30	18.5	6.25	12.9	17.7	1.13	2.86
2025 Acasxu 2023	125	UNSAT	7.58	18.4	6.30	11.9	17.8	1.12	2.92
2025 Acasxu 2023	126	UNSAT	7.61	18.8	8.92	14.3	-	1.31	-
2025 Acasxu 2023	127	UNSAT	7.62	18.5	6.67	13.5	17.9	1.14	2.90
2025 Acasxu 2023	128	UNSAT	7.40	18.5	6.66	13.2	18.1	1.17	2.86

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Acasxu 2023	129	UNSAT	7.44	18.3	6.31	12.7	17.7	1.10	2.90
2025 Acasxu 2023	130	UNSAT	7.43	18.6	6.32	12.9	17.7	1.10	2.87
2025 Acasxu 2023	131	UNSAT	7.37	18.4	6.34	13.0	17.8	1.10	2.85
2025 Acasxu 2023	132	UNSAT	6.32	18.3	6.29	11.2	17.5	0.90	2.85
2025 Acasxu 2023	133	UNSAT	7.45	18.5	6.70	13.4	17.8	1.10	2.84
2025 Acasxu 2023	134	UNSAT	7.43	18.5	6.30	13.2	17.6	0.90	2.89
2025 Acasxu 2023	135	UNSAT	7.63	18.7	11.5	15.7	-	1.37	-
2025 Acasxu 2023	136	UNSAT	7.60	19.2	8.37	14.8	-	1.35	-
2025 Acasxu 2023	137	UNSAT	7.60	18.5	8.91	14.5	-	1.27	-
2025 Acasxu 2023	138	UNSAT	7.56	18.5	7.16	13.4	62.7	1.13	2.86
2025 Acasxu 2023	139	UNSAT	7.49	18.5	6.61	13.2	-	1.24	2.90
2025 Acasxu 2023	140	UNSAT	7.45	18.4	6.93	12.2	18.2	1.19	2.90
2025 Acasxu 2023	141	SAT	6.31	5.92	6.10	11.1	15.9	1.09	2.86
2025 Acasxu 2023	142	SAT	6.34	5.93	6.11	12.5	16.1	1.16	2.85
2025 Acasxu 2023	143	SAT	6.28	5.92	6.09	12.2	16.0	1.10	2.91
2025 Acasxu 2023	144	UNSAT	7.46	18.5	7.19	12.5	95.2	1.17	-
2025 Acasxu 2023	145	UNSAT	7.51	18.7	7.21	13.2	96.7	1.19	2.86
2025 Acasxu 2023	146	UNSAT	7.39	18.5	6.72	12.0	17.9	1.11	2.85
2025 Acasxu 2023	147	UNSAT	7.42	18.5	6.27	12.9	17.9	1.09	2.88
2025 Acasxu 2023	148	UNSAT	7.49	18.4	6.31	12.5	18.0	1.15	2.92
2025 Acasxu 2023	149	UNSAT	7.42	18.5	6.27	13.0	18.0	1.12	2.90
2025 Acasxu 2023	150	UNSAT	7.42	18.3	6.30	12.9	17.7	1.10	2.92
2025 Acasxu 2023	151	UNSAT	7.60	18.5	6.77	13.2	79.7	1.15	2.91
2025 Acasxu 2023	152	UNSAT	6.36	18.3	6.28	12.5	17.8	0.90	2.84
2025 Acasxu 2023	153	UNSAT	7.46	18.7	6.67	12.9	17.9	1.12	2.86
2025 Acasxu 2023	154	UNSAT	7.50	18.4	6.67	13.2	17.7	1.19	2.86
2025 Acasxu 2023	155	UNSAT	6.35	18.3	6.35	13.7	17.7	1.11	2.86
2025 Acasxu 2023	156	UNSAT	7.44	18.2	6.32	12.9	17.7	1.11	2.87
2025 Acasxu 2023	157	UNSAT	7.44	18.5	6.72	13.2	18.1	1.14	2.86
2025 Acasxu 2023	158	UNSAT	7.56	18.5	6.40	11.9	18.1	1.11	2.85
2025 Acasxu 2023	159	UNSAT	7.45	18.5	6.29	12.7	17.7	1.13	2.84
2025 Acasxu 2023	160	UNSAT	7.54	18.5	6.93	13.2	62.1	1.13	2.86
2025 Acasxu 2023	161	UNSAT	7.48	18.4	6.68	12.9	18.2	1.22	2.84
2025 Acasxu 2023	162	UNSAT	6.30	18.6	6.25	11.8	17.7	1.10	-
2025 Acasxu 2023	163	UNSAT	7.55	18.4	6.67	13.2	18.0	1.13	2.87
2025 Acasxu 2023	164	UNSAT	7.48	18.4	6.96	12.2	18.0	1.15	2.88
2025 Acasxu 2023	165	UNSAT	7.46	18.5	6.73	12.9	70.3	1.14	2.87
2025 Acasxu 2023	166	UNSAT	7.42	18.5	6.32	12.7	18.4	1.09	2.88
2025 Acasxu 2023	167	UNSAT	7.51	18.2	6.30	12.7	18.2	1.10	2.85
2025 Acasxu 2023	168	UNSAT	7.38	18.6	6.28	13.0	17.8	1.12	2.86
2025 Acasxu 2023	169	UNSAT	7.47	18.4	6.30	13.7	18.2	1.10	2.87
2025 Acasxu 2023	170	UNSAT	7.50	18.5	6.34	12.9	18.1	1.11	2.87
2025 Acasxu 2023	171	UNSAT	7.43	18.5	6.31	11.9	18.0	1.11	2.86
2025 Acasxu 2023	172	UNSAT	7.47	18.5	6.28	12.7	17.8	1.11	2.87
2025 Acasxu 2023	173	UNSAT	7.44	18.4	6.29	12.6	17.9	1.11	2.86
2025 Acasxu 2023	174	UNSAT	7.39	18.4	6.29	13.0	17.9	1.10	2.87
2025 Acasxu 2023	175	UNSAT	7.54	18.5	6.29	12.0	17.9	1.11	2.89
2025 Acasxu 2023	176	UNSAT	6.29	18.5	6.30	12.7	17.8	1.11	2.86
2025 Acasxu 2023	177	UNSAT	6.34	18.4	6.29	12.6	17.7	1.10	2.89
2025 Acasxu 2023	178	UNSAT	7.46	18.4	6.70	13.0	18.1	1.11	2.86
2025 Acasxu 2023	179	UNSAT	7.38	18.5	6.31	12.7	17.7	1.17	2.89
2025 Acasxu 2023	180	UNSAT	8.47	20.0	14.7	20.3	-	1.87	-
2025 Acasxu 2023	181	UNSAT	9.43	19.7	64.4	23.3	-	4.74	3.19
2025 Acasxu 2023	182	SAT	6.37	94.6	31.6	13.7	-	32.7	-
2025 Acasxu 2023	183	SAT	6.35	87.6	16.6	-	17.0	1.17	2.88
2025 Acasxu 2023	184	UNSAT	8.26	19.5	21.5	15.7	-	2.94	-
2025 Acasxu 2023	185	UNSAT	8.09	19.1	11.4	15.5	-	1.46	3.00
2025 Cersyve	0	SAT	6.31	12.9	6.07	14.7	-	-	3.19
2025 Cersyve	1	SAT	6.24	5.99	6.09	12.9	15.6	-	3.11
2025 Cersyve	2	UNSAT	7.60	17.4	-	14.2	-	-	-
2025 Cersyve	3	UNSAT	8.17	-	-	43.6	-	-	-
2025 Cersyve	4	SAT	6.27	17.7	6.05	✗	-	-	3.90
2025 Cersyve	5	SAT	6.29	6.02	6.06	14.3	16.0	-	3.49
2025 Cersyve	6	UNSAT	7.19	16.8	10.2	12.0	-	-	-
2025 Cersyve	7	UNSAT	8.24	18.0	-	16.0	-	-	-
2025 Cersyve	8	SAT	6.24	6.52	6.04	13.3	-	-	4.01
2025 Cersyve	9	SAT	6.23	5.99	6.07	14.0	15.8	-	3.16
2025 Cersyve	10	UNSAT	7.31	16.9	36.9	14.3	-	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Cersyve	11	UNSAT	8.41	-	-	47.9	-	-	-
2025 Cgan 2023	0	SAT	7.07	7.34	9.72	-	18.9	10.5	5.98
2025 Cgan 2023	1	UNSAT	7.99	28.3	9.61	-	26.3	14.3	6.05
2025 Cgan 2023	2	SAT	6.40	6.20	8.67	-	18.1	18.6	6.59
2025 Cgan 2023	3	UNSAT	7.94	28.0	9.67	-	23.5	12.1	6.26
2025 Cgan 2023	4	UNSAT	8.68	29.5	10.8	-	-	22.5	6.50
2025 Cgan 2023	5	UNSAT	8.66	27.8	9.62	-	22.3	10.6	6.46
2025 Cgan 2023	6	UNSAT	9.45	32.9	9.63	-	250	24.0	6.48
2025 Cgan 2023	7	SAT	6.38	6.16	8.68	-	18.0	19.3	6.47
2025 Cgan 2023	8	SAT	6.49	6.34	8.70	-	18.7	51.8	7.85
2025 Cgan 2023	9	SAT	6.40	6.23	8.65	-	18.7	1.76	8.62
2025 Cgan 2023	10	SAT	6.39	6.27	8.60	-	18.5	1.79	7.85
2025 Cgan 2023	11	UNSAT	6.39	6.30	8.69	-	18.6	66.8	7.90
2025 Cgan 2023	12	SAT	6.43	6.25	8.62	-	18.6	31.1	8.93
2025 Cgan 2023	13	UNSAT	14.9	141	10.1	-	-	81.0	8.52
2025 Cgan 2023	14	SAT	6.56	6.66	8.69	-	-	17.6	8.62
2025 Cgan 2023	15	UNSAT	11.7	138	9.94	-	45.1	221	8.71
2025 Cgan 2023	16	UNSAT	8.91	28.4	11.7	-	-	-	6.49
2025 Cgan 2023	17	SAT	6.48	6.17	8.64	-	18.2	17.7	7.25
2025 Cgan 2023	18	UNSAT	11.5	33.1	12.0	-	-	-	5.68
2025 Cgan 2023	19	UNSAT	8.40	15.6	15.3	-	78.2	-	-
2025 Cgan 2023	20	UNSAT	8.40	14.7	14.5	-	77.5	-	-
2025 Cifar100 2024	0	UNSAT	-	-	-	-	75.3	-	-
2025 Cifar100 2024	1	UNSAT	16.1	46.0	-	-	75.1	-	-
2025 Cifar100 2024	2	UNSAT	7.48	8.75	8.91	-	76.1	-	-
2025 Cifar100 2024	3	UNSAT	12.6	31.4	17.5	-	76.3	-	-
2025 Cifar100 2024	4	UNSAT	18.5	53.8	-	-	75.5	-	-
2025 Cifar100 2024	5	UNSAT	-	-	-	-	75.1	-	-
2025 Cifar100 2024	6	UNSAT	14.7	43.7	-	-	75.8	-	-
2025 Cifar100 2024	7	UNSAT	13.7	34.5	30.2	-	75.5	-	-
2025 Cifar100 2024	8	UNSAT	-	-	-	-	75.3	-	-
2025 Cifar100 2024	9	UNSAT	12.7	31.6	14.8	-	75.1	-	-
2025 Cifar100 2024	10	UNSAT	10.3	22.6	11.2	-	75.5	-	-
2025 Cifar100 2024	11	UNSAT	7.47	11.0	-	-	75.8	-	-
2025 Cifar100 2024	12	UNSAT	-	-	-	-	75.4	-	-
2025 Cifar100 2024	13	UNSAT	37.3	76.8	-	-	75.3	-	-
2025 Cifar100 2024	14	UNSAT	22.4	63.3	-	-	76.1	-	-
2025 Cifar100 2024	15	UNSAT	13.2	29.7	16.6	-	75.6	-	-
2025 Cifar100 2024	16	UNSAT	14.7	47.0	81.6	-	75.6	-	-
2025 Cifar100 2024	17	UNSAT	12.9	29.9	14.7	-	75.6	-	-
2025 Cifar100 2024	18	UNSAT	-	-	-	-	76.0	-	-
2025 Cifar100 2024	19	UNSAT	18.0	49.2	-	-	75.5	-	-
2025 Cifar100 2024	20	UNSAT	13.2	33.9	45.7	-	75.1	-	-
2025 Cifar100 2024	21	UNSAT	-	-	-	-	75.3	-	-
2025 Cifar100 2024	22	UNSAT	-	-	-	-	76.0	-	-
2025 Cifar100 2024	23	UNSAT	-	-	-	-	75.9	-	-
2025 Cifar100 2024	24	UNSAT	-	-	-	-	75.3	-	-
2025 Cifar100 2024	25	UNSAT	-	-	-	-	75.3	-	-
2025 Cifar100 2024	26	UNSAT	7.49	8.68	8.88	13.5	-	-	-
2025 Cifar100 2024	27	UNSAT	12.7	27.9	14.6	-	75.5	-	-
2025 Cifar100 2024	28	UNSAT	9.99	21.6	11.3	-	75.2	-	-
2025 Cifar100 2024	29	UNSAT	9.94	21.4	10.9	-	75.8	-	-
2025 Cifar100 2024	30	UNSAT	21.9	51.4	-	-	75.2	-	-
2025 Cifar100 2024	31	UNSAT	7.55	8.88	9.03	-	76.6	-	-
2025 Cifar100 2024	32	UNSAT	-	-	-	-	75.7	-	-
2025 Cifar100 2024	33	UNSAT	13.8	47.1	46.1	-	75.7	-	-
2025 Cifar100 2024	34	UNSAT	-	-	-	-	75.2	-	-
2025 Cifar100 2024	35	UNSAT	-	-	-	-	75.6	-	-
2025 Cifar100 2024	36	UNSAT	33.0	70.4	-	-	76.5	-	-
2025 Cifar100 2024	37	UNSAT	18.5	53.7	-	-	75.6	-	-
2025 Cifar100 2024	38	UNSAT	12.6	28.8	12.6	-	75.9	-	-
2025 Cifar100 2024	39	UNSAT	7.53	8.83	8.81	14.5	-	-	-
2025 Cifar100 2024	40	UNSAT	-	-	-	-	75.3	-	-
2025 Cifar100 2024	41	UNSAT	14.6	43.2	84.3	-	76.0	-	-
2025 Cifar100 2024	42	UNSAT	-	-	-	-	77.2	-	-
2025 Cifar100 2024	43	UNSAT	7.49	8.69	8.87	14.5	-	-	-
2025 Cifar100 2024	44	UNSAT	-	-	-	-	75.6	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Cifar100 2024	45	UNSAT	-	-	-	-	75.9	-	-
2025 Cifar100 2024	46	UNSAT	13.6	37.1	37.2	-	75.9	-	-
2025 Cifar100 2024	47	UNSAT	15.6	43.4	-	-	75.7	-	-
2025 Cifar100 2024	48	UNSAT	7.52	8.55	8.83	14.5	-	-	-
2025 Cifar100 2024	49	UNSAT	-	-	-	-	75.0	-	-
2025 Cifar100 2024	50	UNSAT	12.7	27.1	12.6	-	75.6	-	-
2025 Cifar100 2024	51	UNSAT	23.4	52.6	-	-	75.8	-	-
2025 Cifar100 2024	52	UNSAT	14.7	35.3	102	-	75.7	-	-
2025 Cifar100 2024	53	UNSAT	12.8	30.5	14.5	-	75.1	-	-
2025 Cifar100 2024	54	UNSAT	7.54	✗	9.13	-	75.0	-	-
2025 Cifar100 2024	55	UNSAT	40.7	84.9	-	-	76.1	-	-
2025 Cifar100 2024	56	UNSAT	27.7	59.4	-	-	76.4	-	-
2025 Cifar100 2024	57	UNSAT	-	-	-	-	76.5	-	-
2025 Cifar100 2024	58	UNSAT	-	-	-	-	75.4	-	-
2025 Cifar100 2024	59	UNSAT	-	-	-	-	75.9	-	-
2025 Cifar100 2024	60	UNSAT	31.2	66.6	-	-	75.6	-	-
2025 Cifar100 2024	61	UNSAT	7.43	8.61	8.83	14.3	-	-	-
2025 Cifar100 2024	62	UNSAT	20.6	69.0	-	-	75.5	-	-
2025 Cifar100 2024	63	UNSAT	-	-	-	-	74.7	-	-
2025 Cifar100 2024	64	UNSAT	7.44	8.68	8.96	-	75.5	-	-
2025 Cifar100 2024	65	UNSAT	7.45	8.62	8.81	14.5	-	-	-
2025 Cifar100 2024	66	UNSAT	89.7	-	-	-	75.7	-	-
2025 Cifar100 2024	67	UNSAT	-	-	-	-	75.2	-	-
2025 Cifar100 2024	68	UNSAT	66.4	-	-	-	75.8	-	-
2025 Cifar100 2024	69	UNSAT	7.50	8.74	9.02	-	75.5	-	-
2025 Cifar100 2024	70	UNSAT	13.7	45.2	62.6	-	75.8	-	-
2025 Cifar100 2024	71	UNSAT	15.7	40.6	-	-	76.3	-	-
2025 Cifar100 2024	72	UNSAT	12.6	28.2	16.9	-	75.1	-	-
2025 Cifar100 2024	73	UNSAT	-	-	-	-	76.0	-	-
2025 Cifar100 2024	74	UNSAT	-	-	-	-	76.2	-	-
2025 Cifar100 2024	75	UNSAT	12.6	30.7	18.2	-	75.4	-	-
2025 Cifar100 2024	76	UNSAT	10.3	22.5	10.9	-	75.7	-	-
2025 Cifar100 2024	77	UNSAT	-	-	-	-	76.0	-	-
2025 Cifar100 2024	78	UNSAT	-	-	-	-	75.8	-	-
2025 Cifar100 2024	79	UNSAT	-	-	-	-	75.8	-	-
2025 Cifar100 2024	80	UNSAT	13.1	36.5	28.0	-	75.9	-	-
2025 Cifar100 2024	81	UNSAT	-	-	-	-	76.5	-	-
2025 Cifar100 2024	82	UNSAT	14.0	31.6	29.5	-	75.5	-	-
2025 Cifar100 2024	83	UNSAT	7.51	11.6	8.99	-	76.9	-	-
2025 Cifar100 2024	84	UNSAT	12.7	29.3	12.9	-	76.2	-	-
2025 Cifar100 2024	85	UNSAT	58.0	-	-	-	75.6	-	-
2025 Cifar100 2024	86	UNSAT	-	-	-	-	76.0	-	-
2025 Cifar100 2024	87	UNSAT	26.6	77.7	-	-	75.6	-	-
2025 Cifar100 2024	88	UNSAT	15.2	53.7	-	-	75.5	-	-
2025 Cifar100 2024	89	UNSAT	26.8	62.9	-	-	75.7	-	-
2025 Cifar100 2024	90	UNSAT	-	-	-	-	75.5	-	-
2025 Cifar100 2024	91	UNSAT	-	-	-	-	75.7	-	-
2025 Cifar100 2024	92	UNSAT	14.1	38.4	73.9	-	76.1	-	-
2025 Cifar100 2024	93	UNSAT	12.5	31.5	12.6	-	75.3	-	-
2025 Cifar100 2024	94	UNSAT	17.1	43.6	-	-	75.4	-	-
2025 Cifar100 2024	95	UNSAT	-	-	-	-	75.9	-	-
2025 Cifar100 2024	96	UNSAT	-	-	-	-	75.5	-	-
2025 Cifar100 2024	97	UNSAT	7.48	8.66	8.87	14.6	-	-	-
2025 Cifar100 2024	98	UNSAT	18.4	45.1	-	-	75.9	-	-
2025 Cifar100 2024	99	UNSAT	35.6	68.2	-	-	75.6	-	-
2025 Cifar100 2024	100	UNSAT	10.4	26.7	17.3	-	78.4	-	-
2025 Cifar100 2024	101	UNSAT	15.3	70.8	28.3	-	77.1	-	-
2025 Cifar100 2024	102	UNSAT	14.7	51.0	21.1	-	77.4	-	-
2025 Cifar100 2024	103	UNSAT	16.2	80.8	24.1	-	77.7	-	-
2025 Cifar100 2024	104	UNSAT	-	-	-	-	78.0	-	-
2025 Cifar100 2024	105	UNSAT	16.4	53.3	-	-	77.6	-	-
2025 Cifar100 2024	106	UNSAT	-	-	-	-	77.7	-	-
2025 Cifar100 2024	107	UNSAT	-	-	-	-	77.4	-	-
2025 Cifar100 2024	108	UNSAT	-	-	-	-	78.0	-	-
2025 Cifar100 2024	109	UNSAT	-	-	-	-	77.9	-	-
2025 Cifar100 2024	110	UNSAT	7.76	✗	-	-	78.0	-	-
2025 Cifar100 2024	111	UNSAT	-	-	-	-	77.6	-	-
2025 Cifar100 2024	112	UNSAT	18.6	60.3	-	-	77.4	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Cifar100 2024	113	UNSAT	9.85	21.5	14.6	-	78.0	-	-
2025 Cifar100 2024	114	UNSAT	7.77	9.36	9.16	-	77.7	-	-
2025 Cifar100 2024	115	UNSAT	-	-	-	-	78.4	-	-
2025 Cifar100 2024	116	UNSAT	14.7	52.6	27.1	-	77.2	-	-
2025 Cifar100 2024	117	UNSAT	-	-	-	-	77.4	-	-
2025 Cifar100 2024	118	UNSAT	7.78	8.98	8.95	14.8	-	-	-
2025 Cifar100 2024	119	UNSAT	7.77	9.13	8.97	-	78.4	-	-
2025 Cifar100 2024	120	UNSAT	10.7	30.8	20.3	-	77.9	-	-
2025 Cifar100 2024	121	UNSAT	-	-	-	-	78.0	-	-
2025 Cifar100 2024	122	UNSAT	-	-	-	-	77.5	-	-
2025 Cifar100 2024	123	UNSAT	29.7	97.8	-	-	77.7	-	-
2025 Cifar100 2024	124	UNSAT	7.83	8.89	8.96	-	77.6	-	-
2025 Cifar100 2024	125	UNSAT	19.3	-	-	-	78.5	-	-
2025 Cifar100 2024	126	UNSAT	24.4	-	-	-	77.9	-	-
2025 Cifar100 2024	127	UNSAT	15.7	70.4	90.0	-	78.8	-	-
2025 Cifar100 2024	128	UNSAT	14.7	54.0	20.1	-	77.9	-	-
2025 Cifar100 2024	129	UNSAT	16.2	72.1	19.9	-	78.5	-	-
2025 Cifar100 2024	130	UNSAT	-	-	-	-	78.5	-	-
2025 Cifar100 2024	131	UNSAT	-	-	-	-	78.3	-	-
2025 Cifar100 2024	132	UNSAT	10.1	24.4	15.8	-	77.8	-	-
2025 Cifar100 2024	133	UNSAT	20.9	73.2	-	-	77.9	-	-
2025 Cifar100 2024	134	UNSAT	15.6	42.7	39.6	-	78.6	-	-
2025 Cifar100 2024	135	UNSAT	16.6	102	52.3	-	78.0	-	-
2025 Cifar100 2024	136	UNSAT	-	-	-	-	79.2	-	-
2025 Cifar100 2024	137	UNSAT	14.6	42.6	26.7	-	78.6	-	-
2025 Cifar100 2024	138	UNSAT	16.8	-	61.6	-	77.8	-	-
2025 Cifar100 2024	139	UNSAT	20.6	-	-	-	77.6	-	-
2025 Cifar100 2024	140	UNSAT	-	-	-	-	78.0	-	-
2025 Cifar100 2024	141	UNSAT	16.8	74.1	74.6	-	77.6	-	-
2025 Cifar100 2024	142	UNSAT	-	-	-	-	77.9	-	-
2025 Cifar100 2024	143	UNSAT	-	-	-	-	78.6	-	-
2025 Cifar100 2024	144	UNSAT	-	-	-	-	77.6	-	-
2025 Cifar100 2024	145	UNSAT	-	-	-	-	77.3	-	-
2025 Cifar100 2024	146	UNSAT	-	-	-	-	77.5	-	-
2025 Cifar100 2024	147	UNSAT	15.9	78.6	105	-	77.7	-	-
2025 Cifar100 2024	148	UNSAT	7.85	9.07	8.94	14.8	-	-	-
2025 Cifar100 2024	149	UNSAT	-	-	-	-	78.4	-	-
2025 Cifar100 2024	150	UNSAT	-	-	-	-	77.7	-	-
2025 Cifar100 2024	151	UNSAT	19.5	-	-	-	77.7	-	-
2025 Cifar100 2024	152	UNSAT	15.8	-	93.3	-	77.9	-	-
2025 Cifar100 2024	153	UNSAT	-	-	-	-	79.2	-	-
2025 Cifar100 2024	154	UNSAT	15.4	74.0	25.7	-	78.3	-	-
2025 Cifar100 2024	155	UNSAT	7.78	9.01	9.04	-	77.7	-	-
2025 Cifar100 2024	156	UNSAT	10.7	30.0	16.4	-	78.3	-	-
2025 Cifar100 2024	157	UNSAT	17.2	87.8	-	-	79.6	-	-
2025 Cifar100 2024	158	UNSAT	-	-	-	-	78.3	-	-
2025 Cifar100 2024	159	UNSAT	-	-	-	-	77.8	-	-
2025 Cifar100 2024	160	UNSAT	7.88	✗	-	-	78.4	-	-
2025 Cifar100 2024	161	UNSAT	7.74	✗	-	-	77.6	-	-
2025 Cifar100 2024	162	UNSAT	15.4	81.0	22.0	-	77.9	-	-
2025 Cifar100 2024	163	UNSAT	14.7	53.4	27.7	-	78.4	-	-
2025 Cifar100 2024	164	UNSAT	7.78	8.88	8.96	-	78.7	-	-
2025 Cifar100 2024	165	UNSAT	-	-	-	-	78.3	-	-
2025 Cifar100 2024	166	UNSAT	7.94	9.14	9.02	-	78.4	-	-
2025 Cifar100 2024	167	UNSAT	10.1	26.4	16.4	-	77.6	-	-
2025 Cifar100 2024	168	UNSAT	15.7	51.5	23.8	-	77.8	-	-
2025 Cifar100 2024	169	UNSAT	-	-	-	-	77.7	-	-
2025 Cifar100 2024	170	UNSAT	17.5	-	-	-	77.6	-	-
2025 Cifar100 2024	171	UNSAT	-	-	-	-	78.6	-	-
2025 Cifar100 2024	172	UNSAT	-	-	-	-	78.8	-	-
2025 Cifar100 2024	173	UNSAT	17.9	-	48.6	-	78.6	-	-
2025 Cifar100 2024	174	UNSAT	15.6	63.5	22.9	-	78.2	-	-
2025 Cifar100 2024	175	UNSAT	18.2	92.4	-	-	78.5	-	-
2025 Cifar100 2024	176	UNSAT	15.3	78.1	44.1	-	78.0	-	-
2025 Cifar100 2024	177	UNSAT	18.5	75.8	-	-	79.2	-	-
2025 Cifar100 2024	178	UNSAT	-	-	-	-	78.7	-	-
2025 Cifar100 2024	179	UNSAT	9.71	24.8	18.8	-	79.3	-	-
2025 Cifar100 2024	180	UNSAT	-	-	-	-	78.3	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Cifar100 2024	181	UNSAT	7.73	9.16	9.01	-	78.5	-	-
2025 Cifar100 2024	182	UNSAT	-	-	-	-	79.1	-	-
2025 Cifar100 2024	183	UNSAT	7.76	9.05	8.94	15.1	-	-	-
2025 Cifar100 2024	184	UNSAT	15.1	64.5	24.9	-	78.4	-	-
2025 Cifar100 2024	185	UNSAT	-	-	-	-	78.4	-	-
2025 Cifar100 2024	186	UNSAT	16.7	74.7	28.6	-	77.9	-	-
2025 Cifar100 2024	187	UNSAT	9.91	18.8	17.6	-	79.3	-	-
2025 Cifar100 2024	188	UNSAT	-	-	-	-	78.4	-	-
2025 Cifar100 2024	189	UNSAT	18.6	-	-	-	77.5	-	-
2025 Cifar100 2024	190	UNSAT	16.9	71.2	-	-	79.2	-	-
2025 Cifar100 2024	191	UNSAT	-	-	-	-	78.4	-	-
2025 Cifar100 2024	192	UNSAT	-	-	-	-	78.8	-	-
2025 Cifar100 2024	193	UNSAT	-	-	-	-	78.3	-	-
2025 Cifar100 2024	194	UNSAT	7.70	9.03	9.02	-	78.2	-	-
2025 Cifar100 2024	195	UNSAT	-	-	-	-	77.7	-	-
2025 Cifar100 2024	196	UNSAT	16.0	-	57.7	-	77.9	-	-
2025 Cifar100 2024	197	UNSAT	16.9	81.2	88.9	-	78.5	-	-
2025 Cifar100 2024	198	UNSAT	16.0	66.4	22.0	-	78.4	-	-
2025 Cifar100 2024	199	UNSAT	7.75	8.87	9.07	-	78.0	-	-
2025 Collins Rul Cnn 2022	0	UNSAT	6.37	6.32	6.14	16.3	15.0	1.46	-
2025 Collins Rul Cnn 2022	1	UNSAT	7.06	9.55	6.29	13.4	16.4	1.50	-
2025 Collins Rul Cnn 2022	2	UNSAT	7.10	12.5	6.38	13.5	16.7	1.43	-
2025 Collins Rul Cnn 2022	3	UNSAT	7.08	12.5	6.40	13.2	16.7	1.45	-
2025 Collins Rul Cnn 2022	4	UNSAT	6.34	6.35	6.12	13.8	15.0	1.50	-
2025 Collins Rul Cnn 2022	5	UNSAT	6.36	6.34	6.12	13.5	15.1	1.44	-
2025 Collins Rul Cnn 2022	6	SAT	6.43	6.31	6.19	13.8	15.1	1.49	76.7
2025 Collins Rul Cnn 2022	7	UNSAT	6.42	6.38	6.10	13.7	15.3	1.56	46.5
2025 Collins Rul Cnn 2022	8	UNSAT	7.08	18.5	6.22	13.4	16.7	1.46	47.4
2025 Collins Rul Cnn 2022	9	UNSAT	7.07	18.5	6.35	13.2	16.7	1.52	46.6
2025 Collins Rul Cnn 2022	10	UNSAT	7.12	26.7	6.39	13.3	16.9	1.41	46.4
2025 Collins Rul Cnn 2022	11	UNSAT	7.04	26.7	6.50	13.5	16.8	1.42	46.6
2025 Collins Rul Cnn 2022	12	UNSAT	7.03	26.7	6.26	13.4	16.7	1.54	46.8
2025 Collins Rul Cnn 2022	13	UNSAT	6.36	6.35	6.10	13.5	15.2	1.41	47.0
2025 Collins Rul Cnn 2022	14	UNSAT	7.04	26.7	6.44	13.5	16.8	1.58	46.9
2025 Collins Rul Cnn 2022	15	UNSAT	6.36	6.32	6.08	13.7	15.1	1.63	46.8
2025 Collins Rul Cnn 2022	16	UNSAT	7.12	9.57	6.34	13.2	16.8	1.58	-
2025 Collins Rul Cnn 2022	17	UNSAT	7.07	18.5	6.31	13.2	16.5	1.55	46.8
2025 Collins Rul Cnn 2022	18	UNSAT	7.11	26.7	6.35	13.4	16.8	1.43	46.6
2025 Collins Rul Cnn 2022	19	SAT	6.36	6.37	6.08	13.7	15.0	1.44	597
2025 Collins Rul Cnn 2022	20	SAT	6.43	6.35	6.10	13.7	15.1	1.51	485
2025 Collins Rul Cnn 2022	21	SAT	6.39	6.36	6.11	13.7	15.3	1.81	453
2025 Collins Rul Cnn 2022	22	UNSAT	6.37	6.40	6.12	13.7	15.0	1.57	-
2025 Collins Rul Cnn 2022	23	UNSAT	7.15	9.54	6.26	13.4	16.9	1.53	-
2025 Collins Rul Cnn 2022	24	UNSAT	7.07	12.5	6.37	13.4	17.2	1.49	49.5
2025 Collins Rul Cnn 2022	25	UNSAT	7.08	18.4	6.35	13.5	16.8	1.49	49.5
2025 Collins Rul Cnn 2022	26	UNSAT	6.37	6.41	6.07	13.7	15.0	1.45	49.9
2025 Collins Rul Cnn 2022	27	UNSAT	6.37	6.34	6.11	13.7	15.1	1.43	49.7
2025 Collins Rul Cnn 2022	28	SAT	6.39	6.33	6.10	13.8	15.3	1.50	49.7
2025 Collins Rul Cnn 2022	29	UNSAT	6.40	6.33	6.11	12.7	15.1	1.67	49.6
2025 Collins Rul Cnn 2022	30	UNSAT	7.10	18.5	6.35	13.5	16.8	1.62	49.8
2025 Collins Rul Cnn 2022	31	UNSAT	7.11	26.7	6.35	13.5	16.8	1.47	49.5
2025 Collins Rul Cnn 2022	32	UNSAT	7.10	26.7	6.38	13.2	16.7	1.49	49.7
2025 Collins Rul Cnn 2022	33	UNSAT	7.08	26.7	6.47	13.2	17.0	1.58	49.5
2025 Collins Rul Cnn 2022	34	UNSAT	7.12	26.7	6.34	13.5	16.8	1.45	50.0
2025 Collins Rul Cnn 2022	35	UNSAT	6.40	6.33	6.11	13.7	15.1	1.66	50.2
2025 Collins Rul Cnn 2022	36	UNSAT	7.13	26.7	6.57	13.5	17.6	1.48	50.1
2025 Collins Rul Cnn 2022	37	UNSAT	6.44	6.37	6.07	13.7	15.0	1.50	50.0
2025 Collins Rul Cnn 2022	38	UNSAT	7.07	12.5	6.28	13.2	16.5	1.51	50.0
2025 Collins Rul Cnn 2022	39	UNSAT	7.07	24.4	6.33	13.2	16.6	1.45	49.6
2025 Collins Rul Cnn 2022	40	UNSAT	7.06	26.7	6.41	13.5	17.1	1.59	49.7
2025 Collins Rul Cnn 2022	41	SAT	6.47	6.35	6.11	13.7	15.3	1.48	488
2025 Collins Rul Cnn 2022	42	SAT	6.40	6.30	6.06	13.7	15.2	1.67	457
2025 Collins Rul Cnn 2022	43	UNSAT	7.14	12.5	6.39	13.5	16.7	1.46	-
2025 Collins Rul Cnn 2022	44	UNSAT	7.13	15.5	6.39	13.6	16.5	1.54	-
2025 Collins Rul Cnn 2022	45	UNSAT	7.13	18.5	6.43	13.5	16.9	1.54	-
2025 Collins Rul Cnn 2022	46	UNSAT	7.14	26.7	6.31	13.5	16.8	1.42	-
2025 Collins Rul Cnn 2022	47	UNSAT	6.36	6.37	6.11	13.8	15.6	1.58	-
2025 Collins Rul Cnn 2022	48	UNSAT	6.41	6.37	6.11	13.7	15.1	1.51	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Collins Rul Cnn 2022	49	UNSAT	7.12	18.5	6.34	13.5	16.4	1.55	-
2025 Collins Rul Cnn 2022	50	UNSAT	6.38	6.34	6.10	13.6	15.2	1.53	-
2025 Collins Rul Cnn 2022	51	UNSAT	7.21	18.5	6.36	13.5	16.7	1.68	-
2025 Collins Rul Cnn 2022	52	UNSAT	7.19	26.7	6.48	13.5	16.6	1.57	-
2025 Collins Rul Cnn 2022	53	UNSAT	7.20	26.7	6.50	13.5	16.9	1.56	-
2025 Collins Rul Cnn 2022	54	UNSAT	6.39	6.37	6.07	13.7	15.2	1.56	-
2025 Collins Rul Cnn 2022	55	UNSAT	7.14	26.7	6.45	13.4	17.1	1.56	-
2025 Collins Rul Cnn 2022	56	UNSAT	7.11	26.7	6.46	13.5	17.1	1.58	-
2025 Collins Rul Cnn 2022	57	UNSAT	7.16	26.7	6.63	13.5	17.4	1.58	-
2025 Collins Rul Cnn 2022	58	UNSAT	7.13	26.7	6.70	13.5	19.3	1.45	-
2025 Collins Rul Cnn 2022	59	UNSAT	7.14	18.5	6.36	13.4	16.5	1.53	-
2025 Collins Rul Cnn 2022	60	UNSAT	7.13	26.7	6.36	13.4	16.5	1.53	-
2025 Collins Rul Cnn 2022	61	UNSAT	7.13	26.7	6.34	13.4	17.1	1.46	-
2025 Cora 2024	0	SAT	6.26	6.68	7.84	12.4	-	-	-
2025 Cora 2024	1	SAT	6.23	6.74	7.89	12.4	-	-	-
2025 Cora 2024	2	UNSAT	6.97	9.25	8.89	12.2	23.4	1.29	-
2025 Cora 2024	3	SAT	6.26	6.12	7.82	12.4	16.8	-	-
2025 Cora 2024	4	?	-	-	-	-	-	-	-
2025 Cora 2024	5	UNSAT	6.99	9.27	8.68	11.2	22.4	1.28	-
2025 Cora 2024	6	SAT	6.30	6.71	7.89	12.5	-	-	-
2025 Cora 2024	7	?	-	-	-	-	-	-	-
2025 Cora 2024	8	UNSAT	7.02	9.26	8.21	12.2	18.4	1.35	-
2025 Cora 2024	9	?	-	-	-	-	-	-	-
2025 Cora 2024	10	?	-	-	-	-	-	-	-
2025 Cora 2024	11	UNSAT	7.07	9.25	8.31	12.2	18.4	1.32	-
2025 Cora 2024	12	SAT	6.31	6.74	7.87	11.4	-	-	-
2025 Cora 2024	13	?	-	-	-	-	-	-	-
2025 Cora 2024	14	UNSAT	7.04	9.23	8.92	12.2	20.4	1.28	-
2025 Cora 2024	15	SAT	6.27	6.80	7.89	-	-	-	-
2025 Cora 2024	16	?	-	-	-	-	-	-	-
2025 Cora 2024	17	UNSAT	7.00	9.22	8.46	11.2	18.3	1.30	-
2025 Cora 2024	18	SAT	6.29	6.72	7.88	11.4	-	-	-
2025 Cora 2024	19	?	-	-	-	-	-	-	-
2025 Cora 2024	20	UNSAT	7.01	9.25	8.53	11.1	18.7	1.28	-
2025 Cora 2024	21	SAT	6.30	6.71	7.82	12.4	-	-	-
2025 Cora 2024	22	?	-	-	-	-	-	-	-
2025 Cora 2024	23	UNSAT	6.98	9.24	8.19	12.2	18.6	1.27	-
2025 Cora 2024	24	SAT	6.30	6.72	7.83	12.4	-	-	-
2025 Cora 2024	25	?	-	-	-	-	-	-	-
2025 Cora 2024	26	UNSAT	7.01	9.25	8.52	12.2	19.2	1.29	-
2025 Cora 2024	27	SAT	6.30	6.71	7.78	12.4	-	-	-
2025 Cora 2024	28	?	-	-	-	-	-	-	-
2025 Cora 2024	29	UNSAT	6.97	9.25	8.91	12.2	23.2	1.30	-
2025 Cora 2024	30	SAT	6.28	6.67	7.86	-	-	-	-
2025 Cora 2024	31	?	-	-	-	-	-	-	-
2025 Cora 2024	32	UNSAT	7.01	9.30	8.63	12.2	18.8	1.27	-
2025 Cora 2024	33	SAT	6.33	6.91	7.82	-	-	-	-
2025 Cora 2024	34	?	-	-	-	-	-	-	-
2025 Cora 2024	35	UNSAT	7.01	9.23	8.30	12.2	18.5	1.27	-
2025 Cora 2024	36	SAT	6.32	6.72	7.85	13.2	-	-	-
2025 Cora 2024	37	?	-	-	-	-	-	-	-
2025 Cora 2024	38	UNSAT	7.01	9.27	8.86	12.2	23.5	1.27	-
2025 Cora 2024	39	SAT	6.24	6.71	7.78	11.4	16.4	-	-
2025 Cora 2024	40	?	-	-	-	-	-	-	-
2025 Cora 2024	41	UNSAT	7.03	9.24	8.57	12.1	19.8	1.28	-
2025 Cora 2024	42	?	-	-	-	-	-	-	-
2025 Cora 2024	43	?	-	-	-	-	-	-	-
2025 Cora 2024	44	UNSAT	6.99	9.25	8.75	12.2	18.3	1.27	-
2025 Cora 2024	45	SAT	6.26	6.71	7.91	12.4	-	-	-
2025 Cora 2024	46	?	-	-	-	-	-	-	-
2025 Cora 2024	47	SAT	6.29	6.69	7.84	12.4	-	17.8	-
2025 Cora 2024	48	SAT	6.26	6.28	7.86	12.4	16.5	-	-
2025 Cora 2024	49	SAT	6.36	6.73	-	-	-	-	-
2025 Cora 2024	50	UNSAT	7.03	9.21	8.94	12.2	20.3	1.38	-
2025 Cora 2024	51	SAT	6.31	6.68	7.80	12.4	-	-	-
2025 Cora 2024	52	?	-	-	-	-	-	-	-
2025 Cora 2024	53	UNSAT	6.98	9.23	8.47	12.2	18.4	1.27	-
2025 Cora 2024	54	SAT	6.30	6.68	7.78	11.5	17.0	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Cora 2024	55	?	-	-	-	-	-	-	-
2025 Cora 2024	56	UNSAT	7.02	9.24	8.90	12.1	20.6	1.28	-
2025 Cora 2024	57	SAT	6.28	6.67	7.82	12.4	-	-	-
2025 Cora 2024	58	?	-	-	-	-	-	-	-
2025 Cora 2024	59	UNSAT	6.96	9.22	8.96	12.1	24.9	1.27	-
2025 Cora 2024	60	SAT	6.29	6.87	7.87	12.8	17.3	-	-
2025 Cora 2024	61	SAT	6.29	6.87	7.86	12.5	-	-	-
2025 Cora 2024	62	SAT	6.32	6.87	7.87	12.4	17.9	-	-
2025 Cora 2024	63	SAT	6.23	6.32	7.83	12.5	17.2	-	-
2025 Cora 2024	64	SAT	6.28	6.84	7.86	12.5	-	-	-
2025 Cora 2024	65	SAT	6.26	6.31	7.82	12.5	17.5	-	-
2025 Cora 2024	66	SAT	6.31	6.28	7.83	12.5	17.5	-	-
2025 Cora 2024	67	SAT	6.33	6.42	7.88	12.5	17.4	-	-
2025 Cora 2024	68	SAT	6.27	6.27	7.80	12.5	17.2	-	-
2025 Cora 2024	69	SAT	6.27	7.01	7.87	12.5	17.4	-	-
2025 Cora 2024	70	SAT	6.34	6.38	7.86	12.5	17.4	-	-
2025 Cora 2024	71	SAT	6.25	6.26	7.85	11.5	17.4	3.43	-
2025 Cora 2024	72	SAT	6.29	6.38	7.86	12.5	17.6	-	-
2025 Cora 2024	73	SAT	6.26	6.29	7.84	12.4	17.5	-	-
2025 Cora 2024	74	SAT	6.26	6.83	7.87	12.5	17.4	-	-
2025 Cora 2024	75	SAT	6.29	6.39	7.81	12.5	17.3	-	-
2025 Cora 2024	76	SAT	6.25	6.28	7.80	12.5	17.3	-	-
2025 Cora 2024	77	SAT	6.28	6.83	7.85	12.5	-	-	-
2025 Cora 2024	78	SAT	6.32	6.97	7.84	12.5	17.4	-	-
2025 Cora 2024	79	SAT	6.28	6.43	7.80	12.5	17.4	-	-
2025 Cora 2024	80	SAT	6.30	6.84	7.83	12.4	-	-	-
2025 Cora 2024	81	SAT	6.25	6.38	7.81	12.5	17.6	-	-
2025 Cora 2024	82	SAT	6.30	6.34	7.77	11.5	17.3	-	-
2025 Cora 2024	83	SAT	6.25	6.25	7.78	12.5	17.3	-	-
2025 Cora 2024	84	SAT	6.30	6.32	7.78	12.5	17.3	-	-
2025 Cora 2024	85	SAT	6.30	6.32	7.79	12.5	17.4	-	-
2025 Cora 2024	86	SAT	6.31	6.80	7.84	12.5	-	-	-
2025 Cora 2024	87	SAT	6.29	6.37	7.80	12.5	17.2	-	-
2025 Cora 2024	88	SAT	6.27	6.37	7.78	12.5	17.3	-	-
2025 Cora 2024	89	SAT	6.30	6.85	7.85	12.5	17.3	-	-
2025 Cora 2024	90	SAT	6.29	6.31	7.79	11.6	17.3	-	-
2025 Cora 2024	91	SAT	6.27	6.25	7.79	12.5	17.2	-	-
2025 Cora 2024	92	SAT	6.30	6.84	7.81	12.5	-	-	-
2025 Cora 2024	93	SAT	6.27	6.31	7.81	12.5	17.1	-	-
2025 Cora 2024	94	SAT	6.24	6.52	7.78	11.4	17.4	-	-
2025 Cora 2024	95	SAT	6.33	6.84	7.85	12.4	-	-	-
2025 Cora 2024	96	SAT	6.29	6.46	7.85	12.5	17.5	-	-
2025 Cora 2024	97	SAT	6.30	6.30	7.83	12.5	17.6	-	-
2025 Cora 2024	98	SAT	6.32	6.85	7.82	11.5	17.2	-	-
2025 Cora 2024	99	SAT	6.27	6.30	7.84	12.4	17.3	-	-
2025 Cora 2024	100	SAT	6.31	6.89	7.83	12.5	17.4	-	-
2025 Cora 2024	101	SAT	6.33	6.81	7.85	12.5	-	-	-
2025 Cora 2024	102	SAT	6.29	6.40	7.85	11.5	17.4	-	-
2025 Cora 2024	103	SAT	6.28	6.32	7.84	12.5	17.4	-	-
2025 Cora 2024	104	SAT	6.26	6.45	7.87	12.5	17.1	-	-
2025 Cora 2024	105	SAT	6.28	6.31	7.89	11.5	17.4	-	-
2025 Cora 2024	106	SAT	6.26	6.34	7.82	12.5	17.4	-	-
2025 Cora 2024	107	SAT	6.29	6.31	7.84	12.5	17.2	-	-
2025 Cora 2024	108	SAT	6.26	6.27	7.86	11.4	17.3	-	-
2025 Cora 2024	109	SAT	6.25	6.28	7.82	12.5	17.3	-	-
2025 Cora 2024	110	SAT	6.28	6.40	7.82	12.5	17.3	-	-
2025 Cora 2024	111	SAT	6.26	6.28	7.87	12.5	17.7	-	-
2025 Cora 2024	112	SAT	6.29	6.29	7.81	11.5	17.4	-	-
2025 Cora 2024	113	SAT	6.34	6.51	7.80	12.6	17.3	-	-
2025 Cora 2024	114	SAT	6.39	6.29	7.88	12.5	17.4	-	-
2025 Cora 2024	115	SAT	6.31	6.50	7.82	12.5	17.1	-	-
2025 Cora 2024	116	SAT	6.34	6.83	7.88	12.5	-	-	-
2025 Cora 2024	117	SAT	6.24	6.28	7.86	12.5	17.9	-	-
2025 Cora 2024	118	SAT	6.26	6.26	7.84	11.5	17.3	-	-
2025 Cora 2024	119	SAT	6.27	6.86	7.86	12.5	-	-	-
2025 Cora 2024	120	SAT	6.32	6.90	7.87	12.5	-	-	-
2025 Cora 2024	121	SAT	6.29	6.81	-	12.5	-	-	-
2025 Cora 2024	122	SAT	6.34	6.86	7.88	12.4	-	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Cora 2024	123	SAT	6.31	6.84	7.84	11.5	-	-	-
2025 Cora 2024	124	SAT	6.29	6.88	7.87	12.5	-	-	-
2025 Cora 2024	125	SAT	6.29	6.82	7.90	11.5	-	-	-
2025 Cora 2024	126	SAT	6.34	6.80	7.86	12.7	-	-	-
2025 Cora 2024	127	?	-	-	-	-	-	-	-
2025 Cora 2024	128	UNSAT	7.90	25.1	-	-	-	-	-
2025 Cora 2024	129	SAT	6.29	6.89	7.86	12.5	-	-	-
2025 Cora 2024	130	SAT	6.28	6.85	7.91	12.5	-	-	-
2025 Cora 2024	131	UNSAT	7.90	-	-	-	-	-	-
2025 Cora 2024	132	SAT	6.32	6.85	7.90	12.5	-	-	-
2025 Cora 2024	133	SAT	6.34	6.79	7.89	-	-	-	-
2025 Cora 2024	134	SAT	6.31	6.84	7.87	11.5	-	-	-
2025 Cora 2024	135	SAT	6.29	6.93	7.82	11.5	-	-	-
2025 Cora 2024	136	SAT	6.32	6.80	7.87	12.4	-	-	-
2025 Cora 2024	137	SAT	6.31	6.84	7.90	12.5	-	-	-
2025 Cora 2024	138	?	-	-	-	-	-	-	-
2025 Cora 2024	139	?	-	-	-	-	-	-	-
2025 Cora 2024	140	SAT	6.33	6.83	7.88	12.5	-	20.8	-
2025 Cora 2024	141	SAT	6.29	6.82	7.88	-	-	-	-
2025 Cora 2024	142	SAT	6.28	6.88	7.90	12.5	-	-	-
2025 Cora 2024	143	SAT	6.31	6.84	7.85	12.5	-	-	-
2025 Cora 2024	144	SAT	6.27	6.97	7.85	-	-	-	-
2025 Cora 2024	145	?	-	-	-	-	-	-	-
2025 Cora 2024	146	SAT	6.30	6.82	7.88	12.5	-	-	-
2025 Cora 2024	147	SAT	6.28	6.85	7.86	12.5	-	-	-
2025 Cora 2024	148	SAT	6.31	6.88	7.92	12.5	-	-	-
2025 Cora 2024	149	?	-	-	-	-	-	-	-
2025 Cora 2024	150	SAT	6.32	6.83	7.89	12.5	-	-	-
2025 Cora 2024	151	SAT	6.31	6.81	7.93	11.5	-	-	-
2025 Cora 2024	152	SAT	6.30	6.85	7.92	12.5	-	-	-
2025 Cora 2024	153	SAT	6.32	6.84	7.88	12.5	-	-	-
2025 Cora 2024	154	SAT	6.28	6.83	7.88	12.4	-	-	-
2025 Cora 2024	155	SAT	6.30	6.83	7.96	11.5	-	-	-
2025 Cora 2024	156	SAT	6.31	6.83	7.95	12.5	-	-	-
2025 Cora 2024	157	SAT	6.30	6.86	7.88	11.8	17.3	-	-
2025 Cora 2024	158	SAT	6.34	6.89	7.88	12.8	-	-	-
2025 Cora 2024	159	SAT	6.31	6.85	7.88	11.4	-	-	-
2025 Cora 2024	160	SAT	6.30	6.82	-	12.5	-	-	-
2025 Cora 2024	161	SAT	6.28	6.83	7.91	12.5	-	-	-
2025 Cora 2024	162	SAT	6.28	6.93	7.91	11.5	-	-	-
2025 Cora 2024	163	SAT	6.27	6.85	7.90	12.5	-	-	-
2025 Cora 2024	164	SAT	6.33	6.85	7.90	12.6	-	-	-
2025 Cora 2024	165	SAT	6.30	6.87	7.80	12.5	-	-	-
2025 Cora 2024	166	SAT	6.28	6.88	7.87	12.5	-	-	-
2025 Cora 2024	167	SAT	6.29	6.84	7.90	12.5	-	-	-
2025 Cora 2024	168	SAT	6.31	6.86	7.92	12.5	-	-	-
2025 Cora 2024	169	SAT	6.30	6.83	7.90	12.5	-	-	-
2025 Cora 2024	170	SAT	6.27	6.83	7.91	12.5	-	-	-
2025 Cora 2024	171	SAT	6.26	6.49	7.84	12.5	17.3	-	-
2025 Cora 2024	172	?	-	-	-	-	-	-	-
2025 Cora 2024	173	UNSAT	7.14	9.40	9.01	-	-	-	-
2025 Cora 2024	174	SAT	6.33	6.90	7.92	11.5	-	-	-
2025 Cora 2024	175	SAT	6.28	6.28	7.88	12.5	17.5	-	-
2025 Cora 2024	176	?	-	-	-	-	-	-	-
2025 Cora 2024	177	SAT	6.31	6.84	7.89	12.5	-	-	-
2025 Cora 2024	178	SAT	6.31	6.90	7.88	12.5	-	-	-
2025 Cora 2024	179	SAT	6.31	6.80	7.87	12.5	-	27.0	-
2025 Dist Shift 2023	0	UNSAT	8.31	27.0	8.34	15.3	-	-	-
2025 Dist Shift 2023	1	UNSAT	6.44	26.7	7.15	15.0	59.3	-	-
2025 Dist Shift 2023	2	UNSAT	8.29	26.9	7.53	14.4	69.1	-	-
2025 Dist Shift 2023	3	UNSAT	6.47	26.8	7.06	13.7	57.7	-	-
2025 Dist Shift 2023	4	UNSAT	6.40	26.8	7.20	13.4	58.2	-	-
2025 Dist Shift 2023	5	UNSAT	6.47	26.8	7.17	13.9	60.3	-	-
2025 Dist Shift 2023	6	UNSAT	6.75	26.9	7.22	13.9	59.7	-	-
2025 Dist Shift 2023	7	UNSAT	6.41	26.9	7.08	13.4	57.7	-	-
2025 Dist Shift 2023	8	UNSAT	8.25	27.0	13.5	14.4	-	-	-
2025 Dist Shift 2023	9	UNSAT	8.32	26.9	8.97	14.4	-	-	-
2025 Dist Shift 2023	10	UNSAT	6.77	26.9	7.31	14.7	58.3	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Dist Shift 2023	11	UNSAT	6.45	26.8	7.12	13.4	59.4	-	-
2025 Dist Shift 2023	12	UNSAT	8.36	27.0	8.20	14.5	-	-	-
2025 Dist Shift 2023	13	UNSAT	8.29	26.9	7.18	13.9	-	-	-
2025 Dist Shift 2023	14	UNSAT	6.38	26.8	7.31	14.0	59.2	-	-
2025 Dist Shift 2023	15	UNSAT	7.03	6.13	6.12	13.7	17.5	-	-
2025 Dist Shift 2023	16	UNSAT	13.1	27.2	-	16.7	90.2	-	-
2025 Dist Shift 2023	17	UNSAT	6.77	26.9	7.18	13.9	60.8	-	-
2025 Dist Shift 2023	18	UNSAT	6.47	26.9	7.29	14.2	59.5	-	-
2025 Dist Shift 2023	19	UNSAT	6.48	26.9	7.26	14.0	61.5	-	-
2025 Dist Shift 2023	20	UNSAT	6.97	6.68	6.16	14.2	-	-	-
2025 Dist Shift 2023	21	UNSAT	6.97	26.8	7.34	16.0	63.4	-	-
2025 Dist Shift 2023	22	UNSAT	6.44	26.7	7.24	13.8	57.7	-	-
2025 Dist Shift 2023	23	UNSAT	7.01	6.67	6.19	13.7	-	-	-
2025 Dist Shift 2023	24	UNSAT	6.97	6.63	6.15	13.7	16.8	-	-
2025 Dist Shift 2023	25	UNSAT	6.92	26.9	7.37	16.5	61.3	-	-
2025 Dist Shift 2023	26	UNSAT	6.89	26.9	7.26	14.0	-	-	-
2025 Dist Shift 2023	27	UNSAT	6.44	26.8	7.25	13.6	58.6	-	-
2025 Dist Shift 2023	28	UNSAT	6.89	26.9	7.29	14.2	-	-	-
2025 Dist Shift 2023	29	UNSAT	6.95	27.1	7.37	15.5	60.6	-	-
2025 Dist Shift 2023	30	UNSAT	6.42	26.8	7.08	13.7	58.7	-	-
2025 Dist Shift 2023	31	UNSAT	6.44	26.9	7.18	13.4	61.2	-	-
2025 Dist Shift 2023	32	UNSAT	8.64	26.9	18.1	14.5	-	-	-
2025 Dist Shift 2023	33	UNSAT	6.45	26.8	6.96	13.7	57.3	-	-
2025 Dist Shift 2023	34	UNSAT	6.45	26.8	7.37	14.0	60.6	-	-
2025 Dist Shift 2023	35	UNSAT	6.82	26.9	7.27	14.0	-	-	-
2025 Dist Shift 2023	36	UNSAT	6.81	26.8	7.33	14.4	62.1	-	-
2025 Dist Shift 2023	37	UNSAT	6.38	26.9	7.22	14.2	61.9	-	-
2025 Dist Shift 2023	38	UNSAT	6.45	26.8	7.01	13.5	58.2	-	-
2025 Dist Shift 2023	39	UNSAT	8.28	26.9	10.4	14.5	-	-	-
2025 Dist Shift 2023	40	UNSAT	6.45	26.8	7.20	13.7	58.3	-	-
2025 Dist Shift 2023	41	UNSAT	6.83	26.9	7.29	14.2	59.1	-	-
2025 Dist Shift 2023	42	UNSAT	7.03	6.73	6.12	14.5	-	-	-
2025 Dist Shift 2023	43	UNSAT	6.46	26.9	7.31	14.7	61.7	-	-
2025 Dist Shift 2023	44	UNSAT	6.43	26.8	7.29	15.2	75.5	-	-
2025 Dist Shift 2023	45	UNSAT	6.45	26.9	7.24	13.5	60.1	-	-
2025 Dist Shift 2023	46	UNSAT	7.02	6.19	6.11	13.7	16.7	-	-
2025 Dist Shift 2023	47	UNSAT	6.41	26.8	7.16	13.7	60.0	-	-
2025 Dist Shift 2023	48	UNSAT	9.88	27.4	20.3	15.3	-	-	-
2025 Dist Shift 2023	49	UNSAT	6.41	26.8	6.96	13.7	58.0	-	-
2025 Dist Shift 2023	50	UNSAT	6.44	26.8	6.94	14.0	57.9	-	-
2025 Dist Shift 2023	51	UNSAT	10.0	27.3	40.0	16.1	-	-	-
2025 Dist Shift 2023	52	UNSAT	6.86	26.9	7.24	14.0	-	-	-
2025 Dist Shift 2023	53	UNSAT	6.40	26.8	7.15	13.7	58.6	-	-
2025 Dist Shift 2023	54	UNSAT	6.70	26.9	7.33	14.0	61.4	-	-
2025 Dist Shift 2023	55	UNSAT	8.30	26.9	7.43	15.0	62.4	-	-
2025 Dist Shift 2023	56	UNSAT	6.41	26.9	7.28	13.5	59.6	-	-
2025 Dist Shift 2023	57	UNSAT	6.42	26.8	7.20	14.0	62.4	-	-
2025 Dist Shift 2023	58	UNSAT	8.99	26.9	7.35	14.4	-	-	-
2025 Dist Shift 2023	59	UNSAT	6.58	26.9	7.39	14.7	62.8	-	-
2025 Dist Shift 2023	60	UNSAT	6.45	26.8	7.35	13.7	60.2	-	-
2025 Dist Shift 2023	61	UNSAT	6.38	26.8	7.26	14.5	61.0	-	-
2025 Dist Shift 2023	62	UNSAT	6.91	26.9	7.33	14.2	90.3	-	-
2025 Dist Shift 2023	63	UNSAT	6.43	26.8	7.17	13.7	60.3	-	-
2025 Dist Shift 2023	64	UNSAT	6.40	26.7	7.12	13.7	58.4	-	-
2025 Dist Shift 2023	65	UNSAT	6.39	26.9	7.06	13.6	58.7	-	-
2025 Dist Shift 2023	66	UNSAT	6.76	26.9	7.18	13.9	58.5	-	-
2025 Dist Shift 2023	67	UNSAT	6.42	26.7	7.16	13.7	60.7	-	-
2025 Dist Shift 2023	68	UNSAT	6.80	26.8	7.28	14.5	61.3	-	-
2025 Dist Shift 2023	69	UNSAT	7.02	6.11	6.15	13.7	16.9	-	-
2025 Dist Shift 2023	70	UNSAT	6.39	26.8	7.10	13.7	57.0	-	-
2025 Dist Shift 2023	71	UNSAT	8.66	26.9	12.0	14.4	-	-	-
2025 Linearizenn 2024	0	SAT	6.52	7.11	12.4	13.4	16.5	2.07	3.02
2025 Linearizenn 2024	1	UNSAT	6.51	26.6	6.40	12.0	66.8	1.80	2.97
2025 Linearizenn 2024	2	UNSAT	6.52	26.6	6.47	13.2	68.5	1.86	2.99
2025 Linearizenn 2024	3	UNSAT	6.51	26.7	6.78	13.2	68.5	1.96	2.97
2025 Linearizenn 2024	4	UNSAT	6.52	26.7	6.45	13.0	67.8	1.85	2.97
2025 Linearizenn 2024	5	UNSAT	6.54	26.7	6.54	12.0	69.2	1.84	2.99
2025 Linearizenn 2024	6	UNSAT	8.09	26.8	8.66	14.5	-	2.74	3.01

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Linearizenn 2024	7	UNSAT	6.48	26.6	6.43	13.2	68.4	1.99	2.99
2025 Linearizenn 2024	8	UNSAT	6.52	26.6	6.12	11.9	68.9	2.11	2.99
2025 Linearizenn 2024	9	UNSAT	6.52	26.6	6.45	13.2	68.9	2.24	3.11
2025 Linearizenn 2024	10	UNSAT	6.50	26.7	7.10	13.2	69.2	2.28	3.09
2025 Linearizenn 2024	11	UNSAT	7.81	26.6	6.48	13.2	68.9	2.07	3.06
2025 Linearizenn 2024	12	UNSAT	8.40	26.9	12.1	14.5	-	9.57	3.10
2025 Linearizenn 2024	13	UNSAT	8.08	26.9	9.29	14.2	69.0	5.80	3.05
2025 Linearizenn 2024	14	UNSAT	8.04	26.8	9.24	13.0	69.2	5.31	2.99
2025 Linearizenn 2024	15	UNSAT	8.07	26.7	8.68	13.7	-	2.92	2.98
2025 Linearizenn 2024	16	UNSAT	8.03	26.7	8.63	12.7	-	3.87	3.01
2025 Linearizenn 2024	17	UNSAT	7.93	26.7	7.92	12.7	-	3.47	2.98
2025 Linearizenn 2024	18	UNSAT	8.45	26.9	14.8	15.5	68.1	4.67	2.96
2025 Linearizenn 2024	19	UNSAT	8.11	26.7	9.56	14.0	69.1	3.05	2.95
2025 Linearizenn 2024	20	UNSAT	7.91	26.7	8.87	14.0	-	2.82	2.98
2025 Linearizenn 2024	21	UNSAT	8.04	26.7	9.28	14.3	-	3.00	2.98
2025 Linearizenn 2024	22	UNSAT	8.09	26.7	9.28	14.2	-	2.96	2.99
2025 Linearizenn 2024	23	UNSAT	8.17	26.7	9.74	14.2	69.1	3.17	2.96
2025 Linearizenn 2024	24	UNSAT	8.51	27.1	26.4	16.5	-	9.02	2.97
2025 Linearizenn 2024	25	UNSAT	8.38	27.0	16.3	15.8	-	5.55	2.99
2025 Linearizenn 2024	26	UNSAT	8.26	26.9	14.0	15.2	69.3	4.94	2.97
2025 Linearizenn 2024	27	UNSAT	8.36	26.9	14.0	15.3	-	5.28	3.00
2025 Linearizenn 2024	28	UNSAT	8.30	26.9	16.1	14.5	-	5.52	2.99
2025 Linearizenn 2024	29	UNSAT	8.20	26.9	14.7	15.2	-	4.95	2.98
2025 Linearizenn 2024	30	UNSAT	8.58	27.9	31.5	17.5	69.0	19.5	2.96
2025 Linearizenn 2024	31	UNSAT	8.31	27.7	17.7	15.5	-	8.61	2.98
2025 Linearizenn 2024	32	UNSAT	8.28	27.7	15.8	14.2	-	7.30	2.97
2025 Linearizenn 2024	33	UNSAT	8.18	27.8	16.4	14.9	69.0	8.20	3.01
2025 Linearizenn 2024	34	UNSAT	8.16	27.8	14.3	14.0	68.8	5.91	2.98
2025 Linearizenn 2024	35	UNSAT	8.14	27.8	15.4	15.0	68.5	6.54	3.00
2025 Linearizenn 2024	36	UNSAT	8.49	27.1	13.6	15.0	69.4	10.8	2.97
2025 Linearizenn 2024	37	UNSAT	8.13	26.9	8.92	14.1	69.3	4.65	2.98
2025 Linearizenn 2024	38	UNSAT	7.86	26.9	7.69	14.0	69.3	3.19	2.99
2025 Linearizenn 2024	39	UNSAT	8.19	27.0	9.83	13.0	69.5	3.89	2.97
2025 Linearizenn 2024	40	UNSAT	8.08	26.9	9.41	13.0	69.2	4.90	2.99
2025 Linearizenn 2024	41	UNSAT	8.09	27.0	9.48	14.0	68.9	3.83	2.97
2025 Linearizenn 2024	42	UNSAT	8.55	26.9	19.2	16.3	69.5	9.09	2.97
2025 Linearizenn 2024	43	UNSAT	8.14	26.9	9.59	14.2	-	4.42	2.96
2025 Linearizenn 2024	44	UNSAT	8.21	26.9	12.6	13.8	-	5.57	2.99
2025 Linearizenn 2024	45	UNSAT	8.29	26.9	12.4	14.8	-	5.95	2.98
2025 Linearizenn 2024	46	UNSAT	8.19	26.9	11.0	14.5	69.4	4.83	2.98
2025 Linearizenn 2024	47	UNSAT	8.42	26.9	13.2	14.7	-	5.78	2.99
2025 Linearizenn 2024	48	UNSAT	8.35	26.9	11.5	15.1	69.5	6.70	2.99
2025 Linearizenn 2024	49	UNSAT	8.22	26.9	8.60	13.9	69.5	4.01	2.98
2025 Linearizenn 2024	50	UNSAT	8.12	26.8	8.69	13.9	70.5	3.56	2.97
2025 Linearizenn 2024	51	UNSAT	8.14	26.8	9.03	14.0	69.2	3.80	2.97
2025 Linearizenn 2024	52	UNSAT	8.15	26.9	8.52	13.9	69.2	3.78	2.98
2025 Linearizenn 2024	53	UNSAT	8.13	26.8	9.39	12.7	68.5	3.06	2.97
2025 Linearizenn 2024	54	UNSAT	7.99	26.7	7.84	14.0	69.5	2.12	2.98
2025 Linearizenn 2024	55	UNSAT	7.99	26.7	7.22	13.2	69.9	2.00	2.95
2025 Linearizenn 2024	56	UNSAT	7.85	26.6	6.54	11.9	68.9	1.87	2.97
2025 Linearizenn 2024	57	UNSAT	7.87	26.7	6.78	13.2	69.7	2.01	3.00
2025 Linearizenn 2024	58	UNSAT	7.85	26.6	6.91	13.0	69.4	1.88	2.97
2025 Linearizenn 2024	59	UNSAT	7.96	26.6	7.36	13.7	69.5	1.97	2.99
2025 Malbeware	0	UNSAT	6.27	16.4	7.85	11.0	49.1	3.88	-
2025 Malbeware	1	UNSAT	6.24	16.3	7.83	11.9	52.3	3.89	-
2025 Malbeware	2	UNSAT	6.25	16.3	7.85	12.0	51.8	3.86	-
2025 Malbeware	3	UNSAT	6.24	16.3	7.85	10.9	51.7	3.86	-
2025 Malbeware	4	UNSAT	6.25	16.3	7.86	11.9	51.6	3.89	-
2025 Malbeware	5	UNSAT	6.24	16.3	7.85	11.9	52.3	3.89	-
2025 Malbeware	6	UNSAT	6.22	16.3	7.84	12.0	51.5	3.85	-
2025 Malbeware	7	UNSAT	6.23	16.3	7.88	11.9	51.8	3.88	-
2025 Malbeware	8	UNSAT	6.18	16.3	7.89	12.0	51.4	3.88	-
2025 Malbeware	9	UNSAT	6.22	16.4	7.84	11.9	51.7	3.92	-
2025 Malbeware	10	UNSAT	6.21	16.3	7.86	11.9	51.7	3.89	-
2025 Malbeware	11	UNSAT	6.23	16.3	7.85	12.0	51.6	3.90	-
2025 Malbeware	12	UNSAT	6.20	16.3	7.85	12.0	50.5	3.87	-
2025 Malbeware	13	UNSAT	6.23	16.3	7.91	11.9	51.2	3.86	-
2025 Malbeware	14	UNSAT	6.24	16.3	7.88	11.9	51.7	3.91	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Malbeware	15	UNSAT	6.23	16.3	7.84	11.9	52.2	3.87	-
2025 Malbeware	16	UNSAT	6.22	16.3	7.91	11.9	51.9	3.89	-
2025 Malbeware	17	UNSAT	6.22	16.3	7.86	10.9	51.6	3.84	-
2025 Malbeware	18	UNSAT	6.23	16.3	7.87	12.0	51.9	3.90	-
2025 Malbeware	19	UNSAT	6.23	16.3	7.89	11.9	51.9	4.02	-
2025 Malbeware	20	UNSAT	6.24	16.3	7.87	12.0	52.3	3.88	-
2025 Malbeware	21	SAT	6.28	6.59	7.77	11.3	15.3	5.80	-
2025 Malbeware	22	UNSAT	6.22	16.3	7.84	10.9	50.8	3.87	-
2025 Malbeware	23	UNSAT	6.25	16.3	7.87	11.9	50.3	4.11	-
2025 Malbeware	24	UNSAT	6.24	16.3	7.89	10.9	52.1	3.87	-
2025 Malbeware	25	UNSAT	6.27	16.3	7.88	11.9	51.7	3.82	-
2025 Malbeware	26	UNSAT	6.24	16.3	7.88	11.9	52.6	3.90	-
2025 Malbeware	27	UNSAT	6.18	16.4	7.93	12.0	50.7	3.85	-
2025 Malbeware	28	UNSAT	6.24	16.3	7.87	11.9	51.5	3.92	-
2025 Malbeware	29	UNSAT	6.21	16.3	7.90	12.0	51.7	3.89	-
2025 Malbeware	30	UNSAT	6.22	16.3	7.85	11.9	52.3	3.91	-
2025 Malbeware	31	UNSAT	6.20	16.3	7.88	12.0	51.4	3.90	-
2025 Malbeware	32	UNSAT	6.20	16.3	7.89	12.0	51.3	3.92	-
2025 Malbeware	33	UNSAT	6.22	16.3	7.89	11.9	50.9	3.92	-
2025 Malbeware	34	UNSAT	6.21	16.4	7.91	11.9	51.7	3.87	-
2025 Malbeware	35	UNSAT	6.23	16.3	7.91	12.0	53.2	3.92	-
2025 Malbeware	36	UNSAT	6.22	16.4	7.88	11.9	51.1	3.88	-
2025 Malbeware	37	UNSAT	6.25	16.4	7.86	12.0	49.5	3.87	-
2025 Malbeware	38	UNSAT	6.24	16.3	7.88	10.9	50.8	3.89	-
2025 Malbeware	39	UNSAT	6.40	16.3	7.91	12.0	51.9	3.86	-
2025 Malbeware	40	UNSAT	6.21	16.3	7.92	12.0	51.5	3.88	-
2025 Malbeware	41	UNSAT	6.23	16.3	7.88	10.9	51.9	3.86	-
2025 Malbeware	42	UNSAT	6.19	16.3	7.94	11.9	52.2	3.90	-
2025 Malbeware	43	UNSAT	6.21	16.3	7.94	11.9	51.4	3.91	-
2025 Malbeware	44	UNSAT	6.22	16.3	7.90	11.9	51.2	3.95	-
2025 Malbeware	45	UNSAT	6.23	16.3	7.90	11.9	52.5	3.95	-
2025 Malbeware	46	UNSAT	6.23	16.3	7.90	11.9	52.0	3.85	-
2025 Malbeware	47	UNSAT	6.23	16.3	7.93	11.9	51.8	3.87	-
2025 Malbeware	48	UNSAT	6.22	16.3	7.93	12.0	51.9	3.86	-
2025 Malbeware	49	UNSAT	6.23	16.3	7.90	12.0	51.5	3.89	-
2025 Malbeware	50	UNSAT	6.51	16.7	8.87	12.8	-	8.92	-
2025 Malbeware	51	UNSAT	6.55	16.7	8.80	12.8	-	8.47	-
2025 Malbeware	52	UNSAT	16.2	-	-	-	-	-	-
2025 Malbeware	53	UNSAT	6.55	16.7	8.80	12.7	-	8.79	-
2025 Malbeware	54	UNSAT	6.55	16.7	8.80	12.8	-	8.79	-
2025 Malbeware	55	UNSAT	6.50	16.6	8.82	11.8	-	8.50	-
2025 Malbeware	56	SAT	7.26	7.27	8.62	13.3	-	84.5	-
2025 Malbeware	57	UNSAT	6.52	16.7	8.81	12.8	-	9.29	-
2025 Malbeware	58	UNSAT	6.50	16.7	8.78	12.8	-	9.25	-
2025 Malbeware	59	SAT	7.30	7.33	8.62	13.0	-	67.8	-
2025 Malbeware	60	UNSAT	6.52	16.7	8.86	12.9	-	8.65	-
2025 Malbeware	61	UNSAT	6.54	16.7	8.82	12.8	-	8.39	-
2025 Malbeware	62	UNSAT	6.52	16.7	8.81	12.7	-	9.36	-
2025 Malbeware	63	UNSAT	6.54	16.7	8.89	12.7	-	9.37	-
2025 Malbeware	64	UNSAT	6.60	16.7	8.81	12.8	-	8.28	-
2025 Malbeware	65	UNSAT	17.4	-	-	-	-	-	-
2025 Malbeware	66	UNSAT	6.52	16.7	8.76	12.9	-	8.24	-
2025 Malbeware	67	UNSAT	6.52	16.7	8.87	12.7	-	9.75	-
2025 Malbeware	68	UNSAT	6.51	16.7	8.80	12.8	-	8.37	-
2025 Malbeware	69	UNSAT	6.52	16.7	8.80	12.7	-	8.45	-
2025 Malbeware	70	UNSAT	6.53	16.7	8.79	12.6	-	8.07	-
2025 Malbeware	71	SAT	7.24	7.33	8.63	13.3	-	65.1	-
2025 Malbeware	72	UNSAT	6.50	16.7	8.87	12.8	-	10.2	-
2025 Malbeware	73	UNSAT	6.50	16.7	8.73	12.8	-	8.96	-
2025 Malbeware	74	UNSAT	6.52	16.7	8.87	13.0	-	8.75	-
2025 Malbeware	75	UNSAT	6.51	16.7	8.84	12.8	-	8.43	-
2025 Malbeware	76	UNSAT	11.4	25.3	-	-	-	-	-
2025 Malbeware	77	UNSAT	6.48	16.7	8.81	13.1	-	8.77	-
2025 Malbeware	78	UNSAT	6.52	16.7	8.82	12.8	-	8.11	-
2025 Malbeware	79	UNSAT	6.50	16.7	8.87	13.0	-	8.61	-
2025 Malbeware	80	UNSAT	6.49	16.7	8.82	12.8	-	8.30	-
2025 Malbeware	81	UNSAT	6.51	16.7	8.82	12.8	-	8.44	-
2025 Malbeware	82	SAT	7.24	7.28	8.62	13.0	-	57.3	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Malbeware	83	UNSAT	6.53	16.7	8.84	12.7	-	9.48	-
2025 Malbeware	84	UNSAT	6.56	16.7	8.73	12.8	-	8.59	-
2025 Malbeware	85	SAT	7.23	7.29	8.61	12.1	-	82.5	-
2025 Malbeware	86	UNSAT	6.51	16.7	8.81	12.8	-	8.41	-
2025 Malbeware	87	SAT	7.23	7.30	8.63	13.0	-	79.6	-
2025 Malbeware	88	UNSAT	6.51	16.7	8.83	13.1	-	8.87	-
2025 Malbeware	89	SAT	7.20	7.33	8.68	13.0	-	50.4	-
2025 Malbeware	90	UNSAT	6.51	16.7	8.79	12.8	-	8.69	-
2025 Malbeware	91	UNSAT	6.50	16.7	8.83	11.7	-	8.62	-
2025 Malbeware	92	UNSAT	6.48	16.7	8.79	12.8	-	8.41	-
2025 Malbeware	93	UNSAT	6.53	16.7	8.86	12.8	-	9.28	-
2025 Malbeware	94	SAT	7.19	7.35	8.62	13.0	-	54.3	-
2025 Malbeware	95	UNSAT	6.62	16.7	8.86	12.7	-	8.58	-
2025 Malbeware	96	UNSAT	6.52	16.7	8.82	12.7	-	9.21	-
2025 Malbeware	97	UNSAT	6.47	16.7	8.79	12.8	-	8.72	-
2025 Malbeware	98	UNSAT	6.48	16.7	8.85	12.8	-	8.82	-
2025 Malbeware	99	UNSAT	6.48	16.7	8.89	12.8	-	9.42	-
2025 Malbeware	100	UNSAT	6.56	16.7	9.18	-	-	25.1	-
2025 Malbeware	101	UNSAT	6.58	16.7	9.40	-	-	30.5	-
2025 Malbeware	102	SAT	7.30	7.35	-	-	-	-	-
2025 Malbeware	103	UNSAT	6.57	16.7	-	-	-	43.7	-
2025 Malbeware	104	UNSAT	6.54	16.7	9.20	-	-	30.8	-
2025 Malbeware	105	UNSAT	6.57	16.7	9.12	-	-	30.9	-
2025 Malbeware	106	UNSAT	17.0	-	-	-	-	-	-
2025 Malbeware	107	UNSAT	6.50	16.7	9.37	-	-	30.6	-
2025 Malbeware	108	UNSAT	6.57	16.7	-	-	-	38.7	-
2025 Malbeware	109	SAT	7.37	7.33	8.69	-	-	-	-
2025 Malbeware	110	UNSAT	6.58	16.7	9.23	-	-	30.3	-
2025 Malbeware	111	UNSAT	6.55	16.7	9.14	-	-	28.5	-
2025 Malbeware	112	SAT	7.30	7.32	8.68	-	-	-	-
2025 Malbeware	113	UNSAT	6.59	16.7	9.19	-	-	31.5	-
2025 Malbeware	114	UNSAT	6.58	16.7	9.13	-	-	28.7	-
2025 Malbeware	115	SAT	7.29	7.33	8.60	-	-	-	-
2025 Malbeware	116	UNSAT	6.60	16.7	-	-	-	41.8	-
2025 Malbeware	117	UNSAT	6.54	16.7	9.15	-	-	31.3	-
2025 Malbeware	118	UNSAT	6.58	16.7	9.06	-	-	22.0	-
2025 Malbeware	119	UNSAT	6.56	16.7	9.04	-	-	25.7	-
2025 Malbeware	120	UNSAT	6.59	16.7	9.09	-	-	25.0	-
2025 Malbeware	121	SAT	7.27	6.79	8.65	-	16.2	14.6	-
2025 Malbeware	122	UNSAT	6.51	16.7	9.39	-	-	32.7	-
2025 Malbeware	123	UNSAT	6.55	16.7	9.09	-	-	27.6	-
2025 Malbeware	124	UNSAT	6.58	16.7	9.14	-	-	29.7	-
2025 Malbeware	125	UNSAT	6.55	16.7	9.12	-	-	29.7	-
2025 Malbeware	126	SAT	7.32	7.35	8.67	-	-	-	-
2025 Malbeware	127	UNSAT	6.52	16.7	9.10	-	-	28.1	-
2025 Malbeware	128	UNSAT	6.58	16.7	9.02	-	-	25.5	-
2025 Malbeware	129	UNSAT	6.66	16.7	9.38	-	-	34.2	-
2025 Malbeware	130	UNSAT	6.54	16.7	9.06	-	-	25.9	-
2025 Malbeware	131	UNSAT	6.59	16.7	9.13	-	-	28.7	-
2025 Malbeware	132	SAT	7.29	7.36	8.62	-	-	-	-
2025 Malbeware	133	UNSAT	6.57	16.7	9.18	-	-	29.6	-
2025 Malbeware	134	UNSAT	6.57	16.7	9.02	-	-	30.5	-
2025 Malbeware	135	UNSAT	17.5	-	-	-	-	-	-
2025 Malbeware	136	UNSAT	6.55	16.7	9.11	-	-	27.9	-
2025 Malbeware	137	UNSAT	6.76	17.2	-	-	-	-	-
2025 Malbeware	138	UNSAT	6.58	16.7	9.10	-	-	26.8	-
2025 Malbeware	139	SAT	7.24	6.78	8.56	-	15.9	14.9	-
2025 Malbeware	140	UNSAT	6.54	16.7	9.38	-	-	33.0	-
2025 Malbeware	141	UNSAT	6.59	16.7	-	-	-	35.1	-
2025 Malbeware	142	UNSAT	6.56	16.7	9.20	-	-	29.5	-
2025 Malbeware	143	SAT	7.24	6.81	8.60	-	16.0	12.7	-
2025 Malbeware	144	SAT	7.29	7.31	8.63	-	-	-	-
2025 Malbeware	145	UNSAT	6.56	16.7	9.11	-	-	27.1	-
2025 Malbeware	146	UNSAT	6.53	16.7	9.33	-	-	31.4	-
2025 Malbeware	147	UNSAT	6.58	16.7	9.12	-	-	26.2	-
2025 Malbeware	148	UNSAT	6.58	16.7	9.11	-	-	27.7	-
2025 Malbeware	149	UNSAT	6.53	16.7	9.18	-	-	31.1	-
2025 Metaroom 2023	0	UNSAT	6.86	28.5	11.5	13.8	17.4	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Metaroom 2023	1	UNSAT	6.56	27.3	8.70	12.0	16.0	-	-
2025 Metaroom 2023	2	UNSAT	6.82	28.4	11.5	13.8	16.7	-	-
2025 Metaroom 2023	3	UNSAT	6.98	28.1	12.5	13.8	18.8	2.56	-
2025 Metaroom 2023	4	UNSAT	6.56	27.3	8.71	13.3	15.9	-	-
2025 Metaroom 2023	5	UNSAT	6.80	27.8	11.5	13.7	16.7	-	-
2025 Metaroom 2023	6	UNSAT	6.54	27.3	8.72	12.9	15.8	-	-
2025 Metaroom 2023	7	UNSAT	6.59	27.2	8.78	13.0	15.8	-	-
2025 Metaroom 2023	8	UNSAT	6.94	28.1	12.6	13.7	18.4	2.60	-
2025 Metaroom 2023	9	UNSAT	6.88	27.9	13.2	13.7	20.0	3.78	-
2025 Metaroom 2023	10	UNSAT	6.60	27.3	8.81	13.1	17.2	1.94	-
2025 Metaroom 2023	11	UNSAT	6.54	27.3	8.79	13.0	16.1	-	-
2025 Metaroom 2023	12	UNSAT	6.87	28.0	12.3	13.7	18.3	2.64	-
2025 Metaroom 2023	13	UNSAT	6.51	27.3	8.78	13.0	16.0	-	-
2025 Metaroom 2023	14	UNSAT	7.09	8.64	13.1	14.1	-	-	-
2025 Metaroom 2023	15	UNSAT	6.52	27.2	8.87	13.0	17.6	1.84	-
2025 Metaroom 2023	16	UNSAT	6.81	27.6	11.5	13.7	17.0	-	-
2025 Metaroom 2023	17	UNSAT	6.96	27.7	12.8	13.8	18.6	2.55	-
2025 Metaroom 2023	18	UNSAT	6.77	27.8	11.5	13.7	16.6	-	-
2025 Metaroom 2023	19	UNSAT	6.91	28.4	12.6	13.7	18.2	2.52	-
2025 Metaroom 2023	20	UNSAT	6.50	27.2	8.90	12.9	17.3	1.81	-
2025 Metaroom 2023	21	UNSAT	6.54	27.3	8.73	13.0	16.3	-	-
2025 Metaroom 2023	22	UNSAT	8.34	27.5	9.46	-	17.8	3.26	-
2025 Metaroom 2023	23	UNSAT	6.53	27.3	8.82	13.0	17.2	1.82	-
2025 Metaroom 2023	24	UNSAT	6.55	27.3	8.87	13.2	17.4	1.83	-
2025 Metaroom 2023	25	UNSAT	6.51	27.3	8.82	12.0	17.5	1.82	-
2025 Metaroom 2023	26	UNSAT	7.03	8.44	13.1	14.0	-	-	-
2025 Metaroom 2023	27	UNSAT	6.93	28.4	13.2	13.7	20.2	3.77	-
2025 Metaroom 2023	28	UNSAT	6.84	28.0	11.5	13.7	16.5	-	-
2025 Metaroom 2023	29	UNSAT	6.91	28.5	12.7	13.7	19.8	3.08	-
2025 Metaroom 2023	30	UNSAT	6.85	27.7	11.5	13.7	16.7	-	-
2025 Metaroom 2023	31	UNSAT	6.92	27.9	12.8	13.8	18.7	2.57	-
2025 Metaroom 2023	32	UNSAT	6.54	27.3	8.84	13.2	17.2	1.79	-
2025 Metaroom 2023	33	UNSAT	6.83	28.3	11.5	13.8	16.8	-	-
2025 Metaroom 2023	34	UNSAT	6.57	27.3	8.85	12.0	17.2	1.82	-
2025 Metaroom 2023	35	UNSAT	6.79	7.26	8.57	13.5	-	3.45	-
2025 Metaroom 2023	36	UNSAT	6.55	27.3	8.74	13.2	15.9	-	-
2025 Metaroom 2023	37	UNSAT	6.93	27.9	12.2	13.8	18.7	2.65	-
2025 Metaroom 2023	38	UNSAT	6.94	27.8	12.2	13.7	18.2	2.64	-
2025 Metaroom 2023	39	UNSAT	6.84	28.2	11.4	13.8	16.6	-	-
2025 Metaroom 2023	40	UNSAT	6.79	27.8	11.5	13.8	16.6	-	-
2025 Metaroom 2023	41	UNSAT	6.94	27.8	12.6	13.7	18.4	2.63	-
2025 Metaroom 2023	42	UNSAT	6.47	27.3	8.74	13.0	15.9	-	-
2025 Metaroom 2023	43	UNSAT	6.53	27.2	8.87	13.0	17.2	1.85	-
2025 Metaroom 2023	44	UNSAT	6.67	27.3	8.89	13.0	17.4	1.99	-
2025 Metaroom 2023	45	UNSAT	7.03	7.82	9.16	14.1	16.8	-	-
2025 Metaroom 2023	46	UNSAT	6.82	28.0	11.5	13.8	16.7	-	-
2025 Metaroom 2023	47	UNSAT	6.86	27.9	11.6	13.8	16.7	-	-
2025 Metaroom 2023	48	UNSAT	6.85	27.8	11.4	13.8	16.7	-	-
2025 Metaroom 2023	49	UNSAT	6.94	28.6	12.8	13.7	18.4	2.63	-
2025 Metaroom 2023	50	UNSAT	6.88	28.2	12.8	13.7	18.6	2.60	-
2025 Metaroom 2023	51	UNSAT	6.52	27.3	8.88	13.2	17.4	1.84	-
2025 Metaroom 2023	52	UNSAT	6.95	27.9	12.9	13.8	18.7	2.55	-
2025 Metaroom 2023	53	UNSAT	6.94	28.4	12.2	13.8	18.3	2.63	-
2025 Metaroom 2023	54	UNSAT	6.86	27.7	11.5	12.7	16.7	-	-
2025 Metaroom 2023	55	UNSAT	6.66	27.3	8.88	13.0	17.3	1.91	-
2025 Metaroom 2023	56	UNSAT	6.81	27.9	11.5	13.7	16.8	-	-
2025 Metaroom 2023	57	UNSAT	6.64	27.3	8.86	13.0	17.9	1.94	-
2025 Metaroom 2023	58	UNSAT	6.56	27.3	8.72	13.2	16.0	-	-
2025 Metaroom 2023	59	UNSAT	6.83	28.3	11.5	13.7	16.5	-	-
2025 Metaroom 2023	60	UNSAT	6.80	27.6	11.4	13.7	16.7	-	-
2025 Metaroom 2023	61	UNSAT	6.62	27.3	8.79	13.0	17.4	1.81	-
2025 Metaroom 2023	62	UNSAT	6.58	27.3	8.75	13.2	16.1	-	-
2025 Metaroom 2023	63	UNSAT	6.99	28.4	11.6	13.8	18.4	2.65	-
2025 Metaroom 2023	64	UNSAT	6.89	28.1	11.8	13.7	18.2	2.69	-
2025 Metaroom 2023	65	UNSAT	6.96	29.4	12.6	13.7	18.8	2.53	-
2025 Metaroom 2023	66	UNSAT	6.95	27.8	12.9	13.7	19.1	2.70	-
2025 Metaroom 2023	67	UNSAT	6.92	27.6	11.5	13.7	16.9	-	-
2025 Metaroom 2023	68	UNSAT	6.78	29.0	11.6	13.7	16.6	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Metaroom 2023	69	UNSAT	6.57	27.3	8.73	13.0	15.8	-	-
2025 Metaroom 2023	70	UNSAT	7.08	28.0	12.4	13.7	18.5	2.63	-
2025 Metaroom 2023	71	UNSAT	6.65	27.3	8.82	13.0	17.2	1.81	-
2025 Metaroom 2023	72	UNSAT	6.58	27.3	8.78	13.3	15.9	-	-
2025 Metaroom 2023	73	UNSAT	6.66	27.3	8.82	13.1	17.1	1.81	-
2025 Metaroom 2023	74	UNSAT	6.85	27.7	11.4	13.7	16.7	-	-
2025 Metaroom 2023	75	UNSAT	6.92	27.9	13.1	13.7	20.3	3.54	-
2025 Metaroom 2023	76	UNSAT	6.57	27.3	8.76	13.2	15.8	-	-
2025 Metaroom 2023	77	UNSAT	6.59	27.2	8.78	13.0	16.0	-	-
2025 Metaroom 2023	78	UNSAT	10.00	110	10.6	-	-	48.2	-
2025 Metaroom 2023	79	UNSAT	6.93	28.0	12.9	13.7	21.1	3.99	-
2025 Metaroom 2023	80	UNSAT	6.55	27.2	8.74	12.0	16.1	-	-
2025 Metaroom 2023	81	UNSAT	6.52	27.3	8.74	13.0	15.9	-	-
2025 Metaroom 2023	82	UNSAT	6.63	27.2	8.79	13.0	17.2	1.83	-
2025 Metaroom 2023	83	UNSAT	6.97	28.0	12.4	13.7	18.6	2.63	-
2025 Metaroom 2023	84	UNSAT	6.91	27.8	12.6	13.7	18.2	2.60	-
2025 Metaroom 2023	85	UNSAT	6.57	27.3	8.73	13.0	15.7	-	-
2025 Metaroom 2023	86	UNSAT	6.85	27.8	11.3	13.8	17.1	-	-
2025 Metaroom 2023	87	UNSAT	6.97	27.7	12.7	12.7	18.7	2.65	-
2025 Metaroom 2023	88	UNSAT	6.91	27.7	12.9	13.7	19.3	2.69	-
2025 Metaroom 2023	89	UNSAT	6.52	27.3	8.77	13.0	15.9	-	-
2025 Metaroom 2023	90	UNSAT	6.92	27.6	12.9	13.7	19.0	2.72	-
2025 Metaroom 2023	91	UNSAT	6.86	27.7	11.5	13.8	16.6	-	-
2025 Metaroom 2023	92	UNSAT	6.85	28.3	11.5	13.7	16.9	-	-
2025 Metaroom 2023	93	UNSAT	6.91	27.8	12.3	12.7	18.1	2.72	-
2025 Metaroom 2023	94	UNSAT	6.94	27.6	12.9	13.7	18.8	2.75	-
2025 Metaroom 2023	95	UNSAT	7.04	7.28	9.08	14.1	16.8	-	-
2025 Metaroom 2023	96	UNSAT	6.92	27.7	12.7	13.7	19.0	2.64	-
2025 Metaroom 2023	97	UNSAT	-	-	13.2	-	-	-	-
2025 Metaroom 2023	98	UNSAT	6.59	27.3	8.67	12.9	16.0	-	-
2025 Metaroom 2023	99	UNSAT	6.82	27.8	11.5	13.7	16.5	-	-
2025 Nn4sys	0	UNSAT	6.62	9.81	6.07	-	-	-	18.3
2025 Nn4sys	1	UNSAT	7.50	11.8	-	-	-	-	24.1
2025 Nn4sys	2	UNSAT	6.60	9.82	6.09	-	-	-	17.4
2025 Nn4sys	3	UNSAT	6.62	9.79	6.12	-	-	-	17.3
2025 Nn4sys	4	UNSAT	7.11	10.9	-	-	-	-	21.0
2025 Nn4sys	5	UNSAT	6.66	9.91	6.08	-	-	-	17.2
2025 Nn4sys	6	UNSAT	6.78	10.2	6.20	-	-	-	17.5
2025 Nn4sys	7	UNSAT	6.79	10.3	6.17	-	-	-	17.6
2025 Nn4sys	8	UNSAT	7.47	11.6	-	-	-	-	22.0
2025 Nn4sys	9	UNSAT	7.17	10.9	-	-	-	-	21.1
2025 Nn4sys	10	UNSAT	6.83	10.4	6.16	-	-	-	17.5
2025 Nn4sys	11	UNSAT	6.78	10.2	6.12	-	-	-	17.5
2025 Nn4sys	12	UNSAT	6.80	10.3	6.13	-	-	-	17.5
2025 Nn4sys	13	UNSAT	6.65	9.78	6.07	-	-	-	17.3
2025 Nn4sys	14	UNSAT	6.82	10.2	6.17	-	-	-	17.6
2025 Nn4sys	15	UNSAT	6.63	9.80	6.12	-	-	-	17.3
2025 Nn4sys	16	UNSAT	6.59	9.85	6.11	-	-	-	17.4
2025 Nn4sys	17	UNSAT	7.10	10.9	-	-	-	-	21.0
2025 Nn4sys	18	UNSAT	6.65	9.82	6.11	-	-	-	17.3
2025 Nn4sys	19	UNSAT	7.17	10.8	-	-	-	-	21.0
2025 Nn4sys	20	UNSAT	7.12	10.9	-	-	-	-	20.9
2025 Nn4sys	21	UNSAT	6.76	10.2	6.12	-	-	-	17.5
2025 Nn4sys	22	UNSAT	6.78	10.3	6.17	-	-	-	17.6
2025 Nn4sys	23	UNSAT	7.47	11.8	-	-	-	-	22.1
2025 Nn4sys	24	UNSAT	7.47	11.9	-	-	-	-	22.1
2025 Nn4sys	25	UNSAT	6.78	10.3	6.16	-	-	-	17.6
2025 Nn4sys	26	UNSAT	6.85	10.3	6.15	-	-	-	17.5
2025 Nn4sys	27	UNSAT	7.11	10.9	-	-	-	-	21.0
2025 Nn4sys	28	UNSAT	6.62	9.91	6.06	-	-	-	17.3
2025 Nn4sys	29	UNSAT	6.77	10.3	6.16	-	-	-	17.5
2025 Nn4sys	30	UNSAT	7.47	11.6	-	-	-	-	21.9
2025 Nn4sys	31	UNSAT	6.77	10.3	6.14	-	-	-	17.5
2025 Nn4sys	32	UNSAT	7.08	10.9	-	-	-	-	21.0
2025 Nn4sys	33	UNSAT	7.13	10.8	-	-	-	-	21.0
2025 Nn4sys	34	UNSAT	6.60	9.80	6.09	-	-	-	17.4
2025 Nn4sys	35	UNSAT	10.7	-	-	-	-	-	22.2
2025 Nn4sys	36	UNSAT	10.8	-	-	-	-	-	22.1

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Nn4sys	37	UNSAT	10.8	-	-	-	-	-	22.0
2025 Nn4sys	38	UNSAT	10.4	-	-	-	-	-	22.1
2025 Nn4sys	39	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	40	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	41	UNSAT	10.8	-	-	-	-	-	22.2
2025 Nn4sys	42	UNSAT	10.4	-	-	-	-	-	21.9
2025 Nn4sys	43	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	44	UNSAT	10.5	-	-	-	-	-	22.0
2025 Nn4sys	45	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	46	UNSAT	10.4	-	-	-	-	-	22.1
2025 Nn4sys	47	UNSAT	10.5	-	-	-	-	-	22.0
2025 Nn4sys	48	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	49	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	50	UNSAT	10.2	-	-	-	-	-	22.1
2025 Nn4sys	51	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	52	UNSAT	10.00	-	-	-	-	-	22.1
2025 Nn4sys	53	UNSAT	10.4	-	-	-	-	-	22.1
2025 Nn4sys	54	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	55	UNSAT	11.2	-	-	-	-	-	22.0
2025 Nn4sys	56	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	57	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	58	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	59	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	60	UNSAT	10.8	-	-	-	-	-	21.9
2025 Nn4sys	61	UNSAT	10.7	-	-	-	-	-	21.9
2025 Nn4sys	62	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	63	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	64	UNSAT	10.5	-	-	-	-	-	22.0
2025 Nn4sys	65	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	66	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	67	UNSAT	10.4	-	-	-	-	-	21.9
2025 Nn4sys	68	UNSAT	10.8	-	-	-	-	-	22.1
2025 Nn4sys	69	UNSAT	10.7	-	-	-	-	-	22.2
2025 Nn4sys	70	UNSAT	11.1	-	-	-	-	-	21.8
2025 Nn4sys	71	UNSAT	11.0	-	-	-	108	-	22.2
2025 Nn4sys	72	UNSAT	11.0	-	-	-	88.3	-	21.9
2025 Nn4sys	73	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	74	UNSAT	10.8	-	-	-	-	-	22.0
2025 Nn4sys	75	UNSAT	11.3	-	-	-	90.3	-	22.1
2025 Nn4sys	76	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	77	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	78	UNSAT	11.1	-	-	-	-	-	22.0
2025 Nn4sys	79	UNSAT	11.7	-	-	-	87.7	-	22.0
2025 Nn4sys	80	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	81	UNSAT	11.1	-	-	-	88.7	-	22.0
2025 Nn4sys	82	UNSAT	11.0	-	-	-	-	-	22.0
2025 Nn4sys	83	UNSAT	11.7	-	-	-	90.0	-	21.9
2025 Nn4sys	84	UNSAT	11.0	-	-	-	-	-	22.1
2025 Nn4sys	85	UNSAT	10.7	-	-	-	94.5	-	21.9
2025 Nn4sys	86	UNSAT	11.0	-	-	-	88.6	-	21.9
2025 Nn4sys	87	UNSAT	10.9	-	-	-	87.2	-	22.0
2025 Nn4sys	88	UNSAT	11.4	-	-	-	-	-	22.2
2025 Nn4sys	89	UNSAT	11.0	-	-	-	-	-	22.2
2025 Nn4sys	90	UNSAT	11.3	-	-	-	91.8	-	22.0
2025 Nn4sys	91	UNSAT	11.0	-	-	-	-	-	22.1
2025 Nn4sys	92	UNSAT	11.0	-	-	-	90.1	-	22.1
2025 Nn4sys	93	UNSAT	11.0	-	-	-	89.9	-	22.2
2025 Nn4sys	94	UNSAT	10.7	-	-	-	90.7	-	22.1
2025 Nn4sys	95	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	96	UNSAT	11.0	-	-	-	-	-	22.0
2025 Nn4sys	97	UNSAT	10.7	-	-	-	98.5	-	22.1
2025 Nn4sys	98	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	99	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	100	UNSAT	11.0	-	-	-	102	-	22.0
2025 Nn4sys	101	UNSAT	11.3	-	-	-	-	-	22.0
2025 Nn4sys	102	UNSAT	11.3	-	-	-	-	-	22.0
2025 Nn4sys	103	UNSAT	10.9	-	-	-	103	-	22.1
2025 Nn4sys	104	UNSAT	10.7	-	-	-	95.3	-	22.1

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Nn4sys	105	UNSAT	6.27	9.33	6.33	-	-	0.90	2.81
2025 Nn4sys	106	UNSAT	6.37	9.37	6.39	-	-	0.90	2.83
2025 Nn4sys	107	UNSAT	6.31	9.39	17.9	-	-	1.29	-
2025 Nn4sys	108	UNSAT	6.38	9.55	21.4	-	-	1.32	-
2025 Nn4sys	109	UNSAT	6.32	9.87	28.2	-	-	1.82	-
2025 Nn4sys	110	UNSAT	6.37	9.90	35.6	-	-	1.74	-
2025 Nn4sys	111	UNSAT	6.38	10.2	30.6	-	-	2.02	-
2025 Nn4sys	112	UNSAT	6.39	10.3	46.4	-	-	2.14	-
2025 Nn4sys	113	UNSAT	6.32	10.5	45.2	-	-	2.39	-
2025 Nn4sys	114	UNSAT	6.39	10.6	58.2	-	-	2.63	-
2025 Nn4sys	115	UNSAT	6.37	10.8	58.0	-	-	2.84	-
2025 Nn4sys	116	UNSAT	6.43	10.9	61.9	-	-	3.03	-
2025 Nn4sys	117	UNSAT	6.40	14.7	85.8	-	-	6.52	-
2025 Nn4sys	118	UNSAT	6.42	14.7	-	-	-	7.21	-
2025 Nn4sys	119	UNSAT	6.39	19.2	82.2	-	-	10.3	-
2025 Nn4sys	120	UNSAT	6.43	19.4	-	-	-	11.2	-
2025 Nn4sys	121	UNSAT	6.64	24.5	-	-	-	13.9	-
2025 Nn4sys	122	UNSAT	6.67	24.9	-	-	-	15.5	-
2025 Nn4sys	123	UNSAT	6.61	30.4	-	-	-	17.7	-
2025 Nn4sys	124	UNSAT	6.63	30.3	-	-	-	19.5	-
2025 Nn4sys	125	UNSAT	6.64	33.2	-	-	-	19.6	-
2025 Nn4sys	126	UNSAT	6.65	33.3	-	-	-	21.4	-
2025 Nn4sys	127	UNSAT	8.09	-	-	-	-	-	-
2025 Nn4sys	128	UNSAT	8.10	-	-	-	-	-	-
2025 Nn4sys	129	UNSAT	7.33	10.1	6.44	-	-	-	-
2025 Nn4sys	130	UNSAT	7.47	12.4	51.3	-	-	-	-
2025 Nn4sys	131	UNSAT	7.49	15.0	-	-	-	-	-
2025 Nn4sys	132	UNSAT	7.42	16.2	-	-	-	-	-
2025 Nn4sys	133	UNSAT	7.71	26.2	-	-	-	-	-
2025 Nn4sys	134	UNSAT	7.69	31.5	-	-	-	-	-
2025 Nn4sys	135	UNSAT	7.76	29.4	-	-	-	-	-
2025 Nn4sys	136	UNSAT	7.90	32.5	-	-	-	-	-
2025 Nn4sys	137	UNSAT	7.70	10.6	7.37	-	-	-	-
2025 Nn4sys	138	UNSAT	8.36	17.3	-	-	-	-	-
2025 Nn4sys	139	UNSAT	8.39	15.1	-	-	-	-	-
2025 Nn4sys	140	UNSAT	8.73	15.5	-	-	-	-	-
2025 Nn4sys	141	UNSAT	8.70	16.0	-	-	-	-	-
2025 Nn4sys	142	UNSAT	8.74	18.0	-	-	-	-	-
2025 Nn4sys	143	UNSAT	8.77	18.9	-	-	-	-	-
2025 Nn4sys	144	UNSAT	8.86	19.5	-	-	-	-	-
2025 Nn4sys	145	UNSAT	9.27	32.6	-	-	-	-	-
2025 Nn4sys	146	UNSAT	9.62	35.6	-	-	-	-	-
2025 Nn4sys	147	UNSAT	9.94	42.5	-	-	-	-	-
2025 Nn4sys	148	UNSAT	10.1	49.9	-	-	-	-	-
2025 Nn4sys	149	UNSAT	10.1	52.8	-	-	-	-	-
2025 Nn4sys	150	UNSAT	10.3	57.6	-	-	-	-	-
2025 Nn4sys	151	UNSAT	10.5	63.2	-	-	-	-	-
2025 Nn4sys	152	UNSAT	10.9	66.8	-	-	-	-	-
2025 Nn4sys	153	UNSAT	11.1	72.8	-	-	-	-	-
2025 Nn4sys	154	UNSAT	11.4	78.6	-	-	-	-	-
2025 Nn4sys	155	UNSAT	11.7	82.8	-	-	-	-	-
2025 Nn4sys	156	UNSAT	11.9	87.8	-	-	-	-	-
2025 Nn4sys	157	UNSAT	21.7	92.0	-	-	-	-	-
2025 Nn4sys	158	UNSAT	22.9	97.8	-	-	-	-	-
2025 Nn4sys	159	UNSAT	23.4	105	-	-	-	-	-
2025 Nn4sys	160	UNSAT	8.88	13.0	16.1	-	-	-	-
2025 Nn4sys	161	UNSAT	9.50	-	-	-	-	-	-
2025 Nn4sys	162	UNSAT	10.4	20.3	-	-	-	-	-
2025 Nn4sys	163	UNSAT	10.8	22.2	-	-	-	-	-
2025 Nn4sys	164	UNSAT	12.7	28.8	-	-	-	-	-
2025 Nn4sys	165	UNSAT	13.6	33.8	-	-	-	-	-
2025 Nn4sys	166	UNSAT	14.4	38.5	-	-	-	-	-
2025 Nn4sys	167	UNSAT	15.8	45.1	-	-	-	-	-
2025 Nn4sys	168	UNSAT	16.5	49.5	-	-	-	-	-
2025 Nn4sys	169	UNSAT	17.5	53.9	-	-	-	-	-
2025 Nn4sys	170	UNSAT	18.7	60.4	-	-	-	-	-
2025 Nn4sys	171	UNSAT	10.1	20.1	-	-	-	-	-
2025 Nn4sys	172	UNSAT	11.7	30.4	-	-	-	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Nn4sys	173	UNSAT	12.9	35.7	-	-	-	-	-
2025 Nn4sys	174	UNSAT	13.1	37.0	-	-	-	-	-
2025 Nn4sys	175	UNSAT	13.3	38.3	-	-	-	-	-
2025 Nn4sys	176	UNSAT	15.9	48.0	-	-	-	-	-
2025 Nn4sys	177	UNSAT	15.5	48.0	-	-	-	-	-
2025 Nn4sys	178	UNSAT	17.1	50.6	-	-	-	-	-
2025 Nn4sys	179	UNSAT	23.4	60.7	-	-	-	-	-
2025 Nn4sys	180	UNSAT	29.2	70.6	-	-	-	-	-
2025 Nn4sys	181	UNSAT	36.4	97.9	-	-	-	-	-
2025 Nn4sys	182	UNSAT	36.3	99.4	-	-	-	-	-
2025 Nn4sys	183	UNSAT	42.1	112	-	-	-	-	-
2025 Nn4sys	184	UNSAT	48.5	129	-	-	-	-	-
2025 Nn4sys	185	UNSAT	48.7	140	-	-	-	-	-
2025 Nn4sys	186	UNSAT	56.1	159	-	-	-	-	-
2025 Nn4sys	187	UNSAT	57.9	167	-	-	-	-	-
2025 Nn4sys	188	UNSAT	65.4	184	-	-	-	-	-
2025 Nn4sys	189	UNSAT	67.4	-	-	-	-	-	-
2025 Nn4sys	190	UNSAT	70.3	201	-	-	-	-	-
2025 Nn4sys	191	UNSAT	80.1	217	-	-	-	-	-
2025 Nn4sys	192	UNSAT	80.5	236	-	-	-	-	-
2025 Nn4sys	193	UNSAT	78.5	249	-	-	-	-	-
2025 Safenlp 2024	0	UNSAT	6.64	8.99	6.12	12.2	-	1.23	17.9
2025 Safenlp 2024	1	UNSAT	8.26	10.4	-	-	-	-	17.9
2025 Safenlp 2024	2	UNSAT	6.87	8.91	6.17	12.2	-	1.24	17.9
2025 Safenlp 2024	3	UNSAT	6.86	-	6.11	14.3	-	-	18.0
2025 Safenlp 2024	4	UNSAT	6.27	7.94	6.37	11.9	17.0	1.07	19.0
2025 Safenlp 2024	5	UNSAT	6.80	8.21	6.10	12.2	-	1.30	18.4
2025 Safenlp 2024	6	UNSAT	6.77	8.14	6.08	12.2	-	1.25	-
2025 Safenlp 2024	7	UNSAT	7.61	8.55	-	-	-	-	-
2025 Safenlp 2024	8	UNSAT	6.32	7.94	6.34	12.0	16.8	1.07	18.0
2025 Safenlp 2024	9	UNSAT	7.29	8.01	9.81	13.3	-	2.00	17.9
2025 Safenlp 2024	10	UNSAT	7.02	8.02	7.17	12.7	-	2.01	17.8
2025 Safenlp 2024	11	UNSAT	7.33	8.03	6.86	12.9	-	1.60	17.8
2025 Safenlp 2024	12	UNSAT	6.59	8.05	6.13	12.2	-	1.30	18.1
2025 Safenlp 2024	13	SAT	6.71	6.00	6.14	11.2	-	1.29	18.1
2025 Safenlp 2024	14	UNSAT	6.81	8.92	6.12	12.2	-	1.26	18.1
2025 Safenlp 2024	15	SAT	6.79	6.27	6.12	11.2	-	1.24	18.0
2025 Safenlp 2024	16	UNSAT	6.32	7.91	6.40	12.0	16.8	1.13	17.6
2025 Safenlp 2024	17	UNSAT	6.51	7.99	6.12	21.0	-	1.53	17.7
2025 Safenlp 2024	18	UNSAT	7.14	8.01	11.7	13.5	-	2.43	17.9
2025 Safenlp 2024	19	UNSAT	6.63	9.12	6.10	12.2	-	1.24	18.2
2025 Safenlp 2024	20	SAT	6.87	5.90	6.04	12.2	14.9	1.23	17.9
2025 Safenlp 2024	21	UNSAT	8.35	9.00	-	-	-	-	17.9
2025 Safenlp 2024	22	UNSAT	6.32	7.91	6.40	10.9	16.6	1.07	17.8
2025 Safenlp 2024	23	SAT	6.71	5.98	6.07	12.2	15.0	1.23	18.0
2025 Safenlp 2024	24	SAT	6.82	6.01	6.11	12.2	14.9	1.24	18.1
2025 Safenlp 2024	25	UNSAT	7.14	8.29	15.2	13.8	-	3.67	-
2025 Safenlp 2024	26	UNSAT	6.32	7.88	6.38	11.9	16.3	1.13	17.7
2025 Safenlp 2024	27	UNSAT	6.83	8.97	6.11	12.3	-	1.24	-
2025 Safenlp 2024	28	UNSAT	7.18	8.02	14.6	13.6	-	3.33	17.9
2025 Safenlp 2024	29	SAT	6.79	5.97	6.05	11.1	15.2	1.26	18.2
2025 Safenlp 2024	30	SAT	6.51	5.99	6.12	11.2	14.9	1.25	18.1
2025 Safenlp 2024	31	UNSAT	6.72	8.97	6.13	12.2	-	1.26	17.9
2025 Safenlp 2024	32	UNSAT	7.08	8.00	8.61	13.5	-	1.93	17.7
2025 Safenlp 2024	33	UNSAT	6.39	7.99	6.46	11.7	17.0	1.07	18.1
2025 Safenlp 2024	34	UNSAT	6.79	9.03	6.11	12.2	-	1.23	18.1
2025 Safenlp 2024	35	UNSAT	6.62	7.93	6.10	11.2	-	1.24	18.2
2025 Safenlp 2024	36	UNSAT	6.89	8.09	6.10	13.0	-	1.23	17.9
2025 Safenlp 2024	37	UNSAT	6.34	7.89	6.39	12.0	16.5	1.07	17.6
2025 Safenlp 2024	38	UNSAT	7.04	8.00	6.11	12.2	-	1.24	18.1
2025 Safenlp 2024	39	UNSAT	6.57	8.05	6.12	12.7	-	1.47	18.0
2025 Safenlp 2024	40	UNSAT	6.71	8.01	6.12	12.7	-	1.26	17.8
2025 Safenlp 2024	41	UNSAT	6.68	8.06	6.12	11.4	-	1.24	17.9
2025 Safenlp 2024	42	UNSAT	7.05	7.96	6.62	12.7	-	1.27	17.9
2025 Safenlp 2024	43	UNSAT	7.17	8.19	12.4	15.8	-	2.73	17.8
2025 Safenlp 2024	44	UNSAT	8.30	8.86	-	-	-	-	17.9
2025 Safenlp 2024	45	UNSAT	7.19	8.04	8.26	13.2	-	2.22	17.9
2025 Safenlp 2024	46	UNSAT	6.69	8.12	6.11	12.8	-	1.43	18.1

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	47	UNSAT	6.69	8.96	6.10	12.2	-	1.24	-
2025 Safenlp 2024	48	UNSAT	6.33	7.90	6.42	10.9	16.4	1.10	17.5
2025 Safenlp 2024	49	UNSAT	6.74	8.98	6.06	12.7	-	1.23	18.1
2025 Safenlp 2024	50	UNSAT	6.72	8.88	6.10	12.2	-	1.23	17.9
2025 Safenlp 2024	51	SAT	6.78	6.05	6.08	11.2	15.6	1.24	18.1
2025 Safenlp 2024	52	UNSAT	6.76	7.95	6.12	12.2	-	1.24	17.8
2025 Safenlp 2024	53	UNSAT	6.58	8.95	6.10	12.2	-	1.27	17.9
2025 Safenlp 2024	54	UNSAT	7.15	8.19	17.6	-	-	20.8	17.9
2025 Safenlp 2024	55	UNSAT	6.27	7.93	6.38	11.9	16.4	1.07	17.8
2025 Safenlp 2024	56	UNSAT	6.86	8.06	6.11	12.2	-	1.29	18.0
2025 Safenlp 2024	57	UNSAT	6.79	8.90	6.08	13.5	-	1.78	18.2
2025 Safenlp 2024	58	UNSAT	7.41	8.32	-	17.3	-	-	18.0
2025 Safenlp 2024	59	UNSAT	11.7	26.7	-	-	-	-	-
2025 Safenlp 2024	60	UNSAT	7.35	8.01	9.04	13.3	-	2.03	17.7
2025 Safenlp 2024	61	SAT	6.84	5.96	6.07	12.3	15.1	1.24	-
2025 Safenlp 2024	62	UNSAT	7.25	8.24	14.5	15.5	-	2.71	18.0
2025 Safenlp 2024	63	UNSAT	7.20	8.04	6.75	12.8	-	1.47	17.8
2025 Safenlp 2024	64	UNSAT	6.73	8.00	6.10	12.2	-	1.27	18.1
2025 Safenlp 2024	65	UNSAT	6.85	8.99	6.07	11.2	-	1.23	17.9
2025 Safenlp 2024	66	SAT	6.85	6.34	6.10	12.2	-	1.25	✗
2025 Safenlp 2024	67	UNSAT	6.80	8.95	6.09	12.3	-	1.24	18.2
2025 Safenlp 2024	68	UNSAT	6.57	8.00	6.11	12.3	-	1.22	17.7
2025 Safenlp 2024	69	UNSAT	6.72	8.03	6.11	12.3	-	1.25	17.9
2025 Safenlp 2024	70	SAT	6.82	6.11	6.07	12.2	-	1.24	18.1
2025 Safenlp 2024	71	SAT	6.64	5.97	6.06	12.2	15.1	1.22	18.0
2025 Safenlp 2024	72	UNSAT	6.89	7.99	6.13	12.3	-	1.25	18.2
2025 Safenlp 2024	73	UNSAT	6.78	7.91	6.11	12.1	-	1.23	17.9
2025 Safenlp 2024	74	UNSAT	6.32	7.97	6.36	11.9	16.7	1.07	17.6
2025 Safenlp 2024	75	UNSAT	8.80	43.0	-	-	-	-	17.7
2025 Safenlp 2024	76	SAT	6.86	6.47	6.12	12.2	-	1.23	✗
2025 Safenlp 2024	77	SAT	6.82	7.70	6.11	11.2	-	1.25	18.1
2025 Safenlp 2024	78	UNSAT	6.77	7.97	6.07	11.2	-	1.23	17.8
2025 Safenlp 2024	79	UNSAT	6.80	9.00	6.12	12.2	-	1.24	18.2
2025 Safenlp 2024	80	SAT	6.67	5.95	6.06	11.2	14.9	1.26	17.8
2025 Safenlp 2024	81	UNSAT	6.72	8.94	6.13	11.2	-	1.23	18.1
2025 Safenlp 2024	82	UNSAT	6.32	7.97	6.38	12.0	16.7	1.08	17.8
2025 Safenlp 2024	83	UNSAT	6.83	8.93	6.10	13.0	-	1.24	18.0
2025 Safenlp 2024	84	SAT	6.64	5.97	6.10	12.2	15.1	1.29	18.0
2025 Safenlp 2024	85	UNSAT	6.88	7.93	6.12	12.2	-	1.28	18.3
2025 Safenlp 2024	86	UNSAT	6.80	8.94	6.14	13.0	-	1.44	17.9
2025 Safenlp 2024	87	UNSAT	6.35	8.00	6.36	11.9	16.7	1.07	17.8
2025 Safenlp 2024	88	UNSAT	6.40	8.02	6.46	11.5	16.8	1.08	17.7
2025 Safenlp 2024	89	SAT	6.80	5.95	6.06	12.2	14.8	1.28	18.1
2025 Safenlp 2024	90	UNSAT	6.67	7.92	6.12	13.3	-	1.76	-
2025 Safenlp 2024	91	SAT	6.84	5.94	6.06	12.1	15.0	1.26	18.2
2025 Safenlp 2024	92	SAT	6.67	5.97	6.08	12.2	14.9	1.23	17.9
2025 Safenlp 2024	93	UNSAT	7.26	8.95	-	20.0	-	-	18.0
2025 Safenlp 2024	94	UNSAT	6.31	7.93	6.39	10.9	16.3	1.07	17.6
2025 Safenlp 2024	95	UNSAT	8.10	20.6	-	-	-	-	17.8
2025 Safenlp 2024	96	UNSAT	6.70	8.93	6.08	11.2	-	1.23	18.1
2025 Safenlp 2024	97	UNSAT	6.85	9.66	6.09	13.2	-	1.73	18.2
2025 Safenlp 2024	98	UNSAT	6.76	8.00	6.11	12.2	-	1.25	17.9
2025 Safenlp 2024	99	UNSAT	6.32	7.94	6.37	12.0	16.2	1.07	17.8
2025 Safenlp 2024	100	SAT	6.74	5.98	6.05	12.2	14.9	1.07	17.9
2025 Safenlp 2024	101	UNSAT	6.29	7.93	6.36	12.0	16.3	1.09	17.6
2025 Safenlp 2024	102	SAT	6.53	6.01	6.07	12.2	15.1	1.27	17.9
2025 Safenlp 2024	103	SAT	6.55	6.05	6.08	12.2	14.8	1.23	17.8
2025 Safenlp 2024	104	UNSAT	6.76	7.99	6.13	12.3	-	1.22	17.8
2025 Safenlp 2024	105	UNSAT	6.82	8.96	6.13	11.2	-	1.28	18.0
2025 Safenlp 2024	106	UNSAT	6.33	7.94	6.41	11.9	16.3	1.13	17.7
2025 Safenlp 2024	107	UNSAT	7.44	8.12	12.5	14.7	-	2.85	17.8
2025 Safenlp 2024	108	UNSAT	6.85	9.00	6.12	13.0	-	1.24	18.1
2025 Safenlp 2024	109	UNSAT	6.86	7.96	6.09	12.2	-	1.29	18.3
2025 Safenlp 2024	110	UNSAT	6.66	8.92	6.13	12.0	-	1.48	18.2
2025 Safenlp 2024	111	SAT	6.80	5.90	6.07	12.2	14.9	1.24	17.8
2025 Safenlp 2024	112	UNSAT	6.30	7.99	6.38	11.9	16.5	1.07	17.6
2025 Safenlp 2024	113	SAT	6.80	5.93	6.10	12.2	14.9	1.24	18.0
2025 Safenlp 2024	114	UNSAT	6.55	8.95	6.10	12.3	-	1.23	17.8

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	115	SAT	6.81	5.91	6.04	12.3	15.3	1.24	17.9
2025 Safenlp 2024	116	UNSAT	7.26	8.02	8.80	13.1	-	2.25	-
2025 Safenlp 2024	117	UNSAT	6.28	7.92	6.38	11.9	16.6	1.07	17.6
2025 Safenlp 2024	118	SAT	6.82	5.95	6.06	12.2	15.0	1.25	17.8
2025 Safenlp 2024	119	UNSAT	6.33	7.96	6.40	11.9	16.8	1.07	17.8
2025 Safenlp 2024	120	UNSAT	6.80	7.97	6.12	11.2	-	1.25	18.3
2025 Safenlp 2024	121	UNSAT	6.32	7.86	6.37	11.9	16.5	1.12	17.7
2025 Safenlp 2024	122	UNSAT	6.77	9.02	6.11	13.8	-	-	18.2
2025 Safenlp 2024	123	SAT	6.49	5.94	6.10	12.1	14.9	1.09	17.9
2025 Safenlp 2024	124	SAT	6.80	5.97	6.04	12.2	14.8	1.25	18.3
2025 Safenlp 2024	125	UNSAT	7.21	8.25	-	-	-	12.6	17.7
2025 Safenlp 2024	126	UNSAT	7.10	8.04	15.2	14.3	-	5.54	17.9
2025 Safenlp 2024	127	UNSAT	8.84	17.2	-	-	-	-	18.1
2025 Safenlp 2024	128	UNSAT	6.82	9.02	6.10	12.2	-	1.25	17.8
2025 Safenlp 2024	129	SAT	6.61	5.95	6.06	12.2	14.9	1.23	17.9
2025 Safenlp 2024	130	UNSAT	6.86	8.96	6.12	12.2	-	1.23	17.8
2025 Safenlp 2024	131	UNSAT	6.72	8.10	6.14	11.2	-	1.24	18.0
2025 Safenlp 2024	132	SAT	6.86	6.08	6.09	12.2	14.9	1.24	18.2
2025 Safenlp 2024	133	SAT	6.87	6.00	6.05	12.2	14.8	1.06	-
2025 Safenlp 2024	134	UNSAT	6.32	7.92	6.39	12.0	16.1	1.08	-
2025 Safenlp 2024	135	UNSAT	6.78	8.00	6.12	12.3	-	1.28	17.8
2025 Safenlp 2024	136	UNSAT	6.33	7.92	6.37	11.9	16.5	1.07	17.6
2025 Safenlp 2024	137	UNSAT	6.90	8.25	6.10	12.2	-	1.61	18.0
2025 Safenlp 2024	138	UNSAT	6.26	7.87	6.39	11.9	16.6	1.12	17.7
2025 Safenlp 2024	139	SAT	6.83	5.98	6.04	12.2	14.9	1.24	18.0
2025 Safenlp 2024	140	SAT	6.68	6.75	6.08	11.2	15.2	1.25	18.0
2025 Safenlp 2024	141	UNSAT	7.33	8.27	-	15.8	-	14.4	18.1
2025 Safenlp 2024	142	UNSAT	7.40	8.13	10.8	14.3	-	2.12	17.8
2025 Safenlp 2024	143	SAT	6.84	5.96	6.10	12.2	15.0	1.08	17.7
2025 Safenlp 2024	144	UNSAT	6.31	7.87	6.35	11.0	16.4	1.14	17.7
2025 Safenlp 2024	145	SAT	6.77	5.91	6.07	11.2	15.0	1.24	18.3
2025 Safenlp 2024	146	UNSAT	6.29	7.94	6.41	12.0	16.5	1.09	17.7
2025 Safenlp 2024	147	UNSAT	6.78	8.04	6.13	12.2	-	1.23	17.8
2025 Safenlp 2024	148	UNSAT	7.79	8.35	20.8	-	-	-	18.1
2025 Safenlp 2024	149	UNSAT	6.72	7.93	6.09	12.2	-	1.24	17.7
2025 Safenlp 2024	150	UNSAT	6.31	7.96	6.36	12.0	16.5	1.08	17.5
2025 Safenlp 2024	151	UNSAT	8.13	8.61	-	-	-	-	18.0
2025 Safenlp 2024	152	UNSAT	7.24	8.03	13.8	15.5	-	2.79	17.9
2025 Safenlp 2024	153	SAT	6.80	6.07	6.10	11.2	15.0	1.25	17.9
2025 Safenlp 2024	154	UNSAT	6.29	7.94	6.38	11.0	16.6	1.07	17.6
2025 Safenlp 2024	155	UNSAT	7.17	7.99	6.87	12.7	-	1.27	17.9
2025 Safenlp 2024	156	UNSAT	8.26	14.5	-	-	-	-	18.0
2025 Safenlp 2024	157	UNSAT	6.26	7.82	6.45	12.5	16.7	1.08	17.8
2025 Safenlp 2024	158	SAT	6.59	5.93	6.07	12.2	15.1	1.24	18.0
2025 Safenlp 2024	159	UNSAT	7.06	7.96	6.46	11.5	-	1.37	17.5
2025 Safenlp 2024	160	UNSAT	6.75	7.97	6.10	11.2	-	1.33	18.0
2025 Safenlp 2024	161	UNSAT	6.66	8.97	6.11	12.2	-	1.27	18.0
2025 Safenlp 2024	162	UNSAT	7.91	8.66	-	-	-	-	18.1
2025 Safenlp 2024	163	UNSAT	6.70	8.98	6.10	12.2	-	1.24	-
2025 Safenlp 2024	164	UNSAT	6.84	9.01	6.10	12.2	-	1.25	18.3
2025 Safenlp 2024	165	UNSAT	6.26	7.90	6.40	10.9	16.8	1.07	17.8
2025 Safenlp 2024	166	UNSAT	6.70	8.06	6.14	12.2	-	1.25	18.3
2025 Safenlp 2024	167	UNSAT	6.50	8.89	6.14	12.3	-	1.25	18.0
2025 Safenlp 2024	168	UNSAT	6.25	7.95	6.36	12.0	16.4	1.08	17.6
2025 Safenlp 2024	169	UNSAT	6.82	9.01	6.10	12.2	-	1.25	18.0
2025 Safenlp 2024	170	SAT	6.78	6.11	6.06	12.3	15.2	1.25	17.9
2025 Safenlp 2024	171	UNSAT	7.11	8.09	11.3	13.5	-	2.57	17.9
2025 Safenlp 2024	172	SAT	6.81	6.02	6.08	12.3	14.9	1.25	18.1
2025 Safenlp 2024	173	UNSAT	6.33	7.87	6.35	12.0	16.5	1.07	18.8
2025 Safenlp 2024	174	UNSAT	6.27	7.91	6.37	12.0	17.1	1.07	17.8
2025 Safenlp 2024	175	UNSAT	7.25	8.30	23.2	16.7	-	7.74	18.0
2025 Safenlp 2024	176	UNSAT	6.31	7.94	6.36	11.9	16.6	1.07	17.6
2025 Safenlp 2024	177	UNSAT	6.31	7.90	6.43	12.0	16.3	1.07	17.7
2025 Safenlp 2024	178	UNSAT	6.85	8.11	6.09	12.7	-	1.41	18.0
2025 Safenlp 2024	179	UNSAT	7.33	8.02	6.62	11.7	-	1.61	17.9
2025 Safenlp 2024	180	UNSAT	7.18	8.21	15.8	25.3	-	14.9	18.1
2025 Safenlp 2024	181	UNSAT	6.69	8.02	6.12	12.2	-	1.24	18.0
2025 Safenlp 2024	182	UNSAT	6.32	7.94	6.38	12.0	16.6	1.07	17.7

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	183	UNSAT	6.55	7.97	6.15	12.2	-	1.21	18.0
2025 Safenlp 2024	184	SAT	6.77	7.10	6.09	12.2	-	1.26	✗
2025 Safenlp 2024	185	UNSAT	7.04	8.09	19.6	14.3	-	4.95	17.8
2025 Safenlp 2024	186	UNSAT	6.28	7.86	6.35	12.0	16.7	1.07	17.9
2025 Safenlp 2024	187	SAT	6.75	7.56	6.12	12.2	15.0	1.24	18.1
2025 Safenlp 2024	188	UNSAT	6.39	7.94	6.48	12.5	16.5	1.07	19.0
2025 Safenlp 2024	189	UNSAT	6.80	7.98	6.09	12.2	-	1.24	18.1
2025 Safenlp 2024	190	UNSAT	7.58	9.89	-	-	-	-	17.9
2025 Safenlp 2024	191	UNSAT	6.25	7.87	6.35	12.0	17.1	1.07	17.8
2025 Safenlp 2024	192	UNSAT	6.83	8.07	6.13	12.5	-	1.43	18.2
2025 Safenlp 2024	193	UNSAT	6.80	8.09	6.12	11.2	-	1.26	18.0
2025 Safenlp 2024	194	UNSAT	6.23	7.88	6.45	12.5	16.8	1.07	17.6
2025 Safenlp 2024	195	SAT	6.77	5.97	6.12	12.2	15.0	1.24	18.2
2025 Safenlp 2024	196	UNSAT	7.01	8.01	7.12	13.3	-	1.44	17.9
2025 Safenlp 2024	197	UNSAT	6.82	8.97	6.13	12.2	-	1.27	18.3
2025 Safenlp 2024	198	UNSAT	7.32	8.52	-	14.3	-	16.4	17.9
2025 Safenlp 2024	199	UNSAT	6.54	7.97	6.09	12.2	-	1.24	17.9
2025 Safenlp 2024	200	UNSAT	6.82	7.97	6.12	12.2	-	1.24	17.8
2025 Safenlp 2024	201	UNSAT	6.78	8.92	6.10	12.2	-	1.26	18.4
2025 Safenlp 2024	202	UNSAT	6.67	8.94	6.12	12.2	-	1.25	18.0
2025 Safenlp 2024	203	SAT	6.72	5.95	6.07	12.2	14.9	1.26	18.1
2025 Safenlp 2024	204	UNSAT	7.17	8.03	8.99	13.5	-	2.27	17.7
2025 Safenlp 2024	205	UNSAT	6.30	7.86	6.41	11.9	16.6	1.08	18.2
2025 Safenlp 2024	206	SAT	6.65	5.98	6.05	11.2	15.2	1.22	17.7
2025 Safenlp 2024	207	UNSAT	6.54	7.94	6.16	12.2	-	1.25	18.3
2025 Safenlp 2024	208	UNSAT	6.26	7.93	6.40	12.0	16.7	1.07	17.9
2025 Safenlp 2024	209	SAT	6.76	7.32	6.14	12.2	14.9	1.30	18.3
2025 Safenlp 2024	210	UNSAT	6.60	9.01	6.11	11.2	-	1.23	17.9
2025 Safenlp 2024	211	UNSAT	6.66	8.01	6.12	12.2	-	1.26	18.1
2025 Safenlp 2024	212	UNSAT	6.83	8.99	6.13	12.2	-	1.27	17.9
2025 Safenlp 2024	213	UNSAT	7.24	8.12	10.9	15.3	-	3.21	18.0
2025 Safenlp 2024	214	UNSAT	6.79	8.93	6.09	12.2	-	1.26	18.1
2025 Safenlp 2024	215	UNSAT	6.62	7.92	6.13	11.2	-	1.27	17.7
2025 Safenlp 2024	216	UNSAT	6.29	7.97	6.39	11.9	16.6	1.09	17.4
2025 Safenlp 2024	217	SAT	6.53	5.93	6.06	12.2	15.0	1.22	17.9
2025 Safenlp 2024	218	UNSAT	7.25	8.01	6.92	12.4	-	1.46	17.9
2025 Safenlp 2024	219	UNSAT	6.87	8.02	6.13	11.7	-	1.61	-
2025 Safenlp 2024	220	UNSAT	6.58	7.98	6.14	12.2	-	1.25	17.7
2025 Safenlp 2024	221	SAT	6.82	6.27	6.13	12.2	-	1.23	18.1
2025 Safenlp 2024	222	UNSAT	6.80	9.07	6.13	12.2	-	1.28	17.9
2025 Safenlp 2024	223	SAT	6.53	5.98	6.04	12.2	15.2	1.22	17.7
2025 Safenlp 2024	224	UNSAT	6.32	7.88	6.36	11.9	16.7	1.08	18.1
2025 Safenlp 2024	225	UNSAT	6.79	8.94	6.10	12.8	-	1.24	18.2
2025 Safenlp 2024	226	UNSAT	6.62	7.93	6.13	11.2	-	1.23	18.0
2025 Safenlp 2024	227	UNSAT	6.29	7.96	6.39	11.9	16.5	1.07	17.7
2025 Safenlp 2024	228	SAT	6.78	5.93	6.06	12.3	14.9	1.24	18.2
2025 Safenlp 2024	229	UNSAT	6.33	7.98	6.43	11.9	16.5	1.08	17.8
2025 Safenlp 2024	230	UNSAT	6.82	7.99	6.14	12.3	-	1.26	18.0
2025 Safenlp 2024	231	SAT	6.48	5.97	6.06	12.2	14.8	1.12	17.9
2025 Safenlp 2024	232	UNSAT	7.44	8.24	14.5	14.3	-	3.21	17.7
2025 Safenlp 2024	233	UNSAT	6.68	8.12	6.10	12.2	-	1.47	17.9
2025 Safenlp 2024	234	UNSAT	8.86	15.9	-	-	-	-	17.9
2025 Safenlp 2024	235	UNSAT	6.79	8.07	6.15	12.2	-	1.24	18.2
2025 Safenlp 2024	236	UNSAT	8.43	9.40	-	-	-	-	18.3
2025 Safenlp 2024	237	UNSAT	6.26	7.96	6.40	12.1	17.2	1.10	17.8
2025 Safenlp 2024	238	UNSAT	6.59	9.27	6.14	12.5	-	1.44	18.1
2025 Safenlp 2024	239	UNSAT	6.27	7.86	6.46	12.4	16.9	1.07	17.9
2025 Safenlp 2024	240	UNSAT	6.37	7.97	6.43	12.8	16.5	1.07	17.9
2025 Safenlp 2024	241	UNSAT	6.29	7.98	6.38	11.9	16.4	1.07	17.9
2025 Safenlp 2024	242	UNSAT	6.29	7.89	6.37	11.9	16.9	1.07	17.6
2025 Safenlp 2024	243	UNSAT	6.82	7.95	6.14	12.2	-	1.25	18.0
2025 Safenlp 2024	244	UNSAT	7.23	8.25	-	13.2	-	6.24	17.7
2025 Safenlp 2024	245	UNSAT	6.27	7.91	6.42	11.9	16.4	1.13	18.0
2025 Safenlp 2024	246	UNSAT	6.80	8.02	6.12	12.7	-	1.25	18.3
2025 Safenlp 2024	247	UNSAT	6.57	7.98	6.12	12.2	-	1.21	17.7
2025 Safenlp 2024	248	SAT	6.75	6.06	6.07	12.2	15.8	1.24	18.0
2025 Safenlp 2024	249	UNSAT	6.67	8.02	6.12	12.2	-	1.25	17.9
2025 Safenlp 2024	250	UNSAT	6.78	7.96	6.10	11.2	-	1.22	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	251	UNSAT	8.80	11.9	-	-	-	-	18.2
2025 Safenlp 2024	252	UNSAT	6.81	8.08	6.13	12.2	-	1.23	18.0
2025 Safenlp 2024	253	SAT	6.46	5.97	6.08	12.3	14.8	1.25	18.0
2025 Safenlp 2024	254	SAT	6.75	5.96	6.13	11.2	-	1.23	17.8
2025 Safenlp 2024	255	UNSAT	6.78	8.09	6.10	12.3	-	1.40	17.9
2025 Safenlp 2024	256	SAT	6.59	6.10	6.14	12.2	-	1.24	17.8
2025 Safenlp 2024	257	UNSAT	6.30	7.93	6.42	11.9	16.6	1.08	17.9
2025 Safenlp 2024	258	SAT	6.80	6.00	6.07	12.3	14.8	1.24	18.4
2025 Safenlp 2024	259	UNSAT	8.39	12.7	-	-	-	-	18.1
2025 Safenlp 2024	260	UNSAT	7.25	8.02	9.39	13.3	-	2.07	17.6
2025 Safenlp 2024	261	UNSAT	6.84	8.98	6.13	13.3	-	1.25	18.4
2025 Safenlp 2024	262	UNSAT	7.48	8.23	18.0	29.6	-	7.31	18.1
2025 Safenlp 2024	263	SAT	6.81	8.95	6.11	11.2	-	1.23	18.3
2025 Safenlp 2024	264	UNSAT	6.86	8.04	6.10	11.2	-	1.26	18.3
2025 Safenlp 2024	265	UNSAT	7.81	9.14	-	-	-	-	17.8
2025 Safenlp 2024	266	UNSAT	7.68	-	-	-	-	-	18.1
2025 Safenlp 2024	267	UNSAT	6.57	9.22	6.12	12.2	-	1.27	18.1
2025 Safenlp 2024	268	SAT	6.66	5.98	6.04	12.3	15.0	1.24	17.9
2025 Safenlp 2024	269	UNSAT	6.84	8.05	6.10	11.3	-	1.25	17.9
2025 Safenlp 2024	270	UNSAT	7.40	8.24	11.8	14.8	-	2.92	18.0
2025 Safenlp 2024	271	UNSAT	10.3	24.3	-	-	-	-	18.2
2025 Safenlp 2024	272	UNSAT	9.68	40.8	-	-	-	-	18.2
2025 Safenlp 2024	273	UNSAT	6.31	7.89	6.42	11.9	16.5	1.09	17.6
2025 Safenlp 2024	274	UNSAT	7.25	7.92	6.84	13.0	-	1.26	17.8
2025 Safenlp 2024	275	UNSAT	6.35	7.99	6.42	11.9	17.0	1.08	17.8
2025 Safenlp 2024	276	SAT	6.71	5.98	6.09	12.2	15.0	1.13	17.7
2025 Safenlp 2024	277	UNSAT	7.11	8.02	9.40	13.0	-	2.44	18.2
2025 Safenlp 2024	278	UNSAT	7.35	8.19	14.1	-	-	3.62	17.7
2025 Safenlp 2024	279	SAT	6.85	5.97	6.09	12.3	15.0	1.25	17.8
2025 Safenlp 2024	280	UNSAT	8.87	28.6	-	-	-	-	18.0
2025 Safenlp 2024	281	UNSAT	6.78	7.98	6.11	13.0	-	1.25	18.0
2025 Safenlp 2024	282	UNSAT	6.67	7.93	6.14	12.2	-	1.24	17.9
2025 Safenlp 2024	283	UNSAT	6.65	8.11	6.11	12.2	-	1.30	18.3
2025 Safenlp 2024	284	UNSAT	6.52	8.04	6.14	12.2	-	1.41	17.9
2025 Safenlp 2024	285	UNSAT	6.26	7.93	6.37	11.9	16.5	1.09	17.8
2025 Safenlp 2024	286	UNSAT	7.38	8.01	6.88	12.4	-	1.27	-
2025 Safenlp 2024	287	UNSAT	6.86	8.12	6.12	13.0	-	1.28	18.0
2025 Safenlp 2024	288	UNSAT	8.06	8.78	-	-	-	-	18.2
2025 Safenlp 2024	289	UNSAT	7.24	8.28	-	14.3	-	16.5	18.1
2025 Safenlp 2024	290	UNSAT	14.0	-	-	-	-	-	17.9
2025 Safenlp 2024	291	UNSAT	7.15	8.33	15.4	16.0	-	3.87	17.8
2025 Safenlp 2024	292	SAT	6.69	5.98	6.07	12.2	15.3	1.25	18.1
2025 Safenlp 2024	293	UNSAT	8.46	12.6	-	-	-	-	18.1
2025 Safenlp 2024	294	UNSAT	7.76	8.30	22.4	-	-	-	17.9
2025 Safenlp 2024	295	SAT	6.48	5.96	6.09	12.2	15.0	1.07	17.6
2025 Safenlp 2024	296	SAT	6.58	5.95	6.07	12.2	14.9	1.24	18.2
2025 Safenlp 2024	297	UNSAT	7.18	8.33	17.5	14.0	-	8.03	18.0
2025 Safenlp 2024	298	UNSAT	7.56	8.38	21.7	24.8	-	19.5	17.9
2025 Safenlp 2024	299	UNSAT	6.28	7.92	6.41	12.0	16.5	1.07	17.7
2025 Safenlp 2024	300	UNSAT	7.48	8.26	17.9	26.3	-	5.16	18.1
2025 Safenlp 2024	301	SAT	6.58	5.98	6.06	12.2	15.0	1.24	17.8
2025 Safenlp 2024	302	UNSAT	7.13	7.97	10.5	13.3	-	2.08	17.6
2025 Safenlp 2024	303	SAT	6.75	5.95	6.06	11.2	15.0	1.26	17.7
2025 Safenlp 2024	304	UNSAT	7.48	8.28	25.7	15.0	-	15.3	17.6
2025 Safenlp 2024	305	UNSAT	6.84	7.98	6.14	11.2	-	1.23	17.9
2025 Safenlp 2024	306	SAT	6.79	5.97	6.05	12.2	14.9	1.24	18.3
2025 Safenlp 2024	307	SAT	6.73	5.94	6.04	12.2	15.0	1.26	-
2025 Safenlp 2024	308	UNSAT	6.84	9.16	6.08	13.8	-	1.62	17.8
2025 Safenlp 2024	309	SAT	6.64	7.15	6.11	12.2	-	1.29	✗
2025 Safenlp 2024	310	SAT	6.86	7.90	6.11	12.1	14.9	1.25	18.4
2025 Safenlp 2024	311	UNSAT	6.30	7.96	6.39	12.0	16.6	1.07	17.7
2025 Safenlp 2024	312	UNSAT	6.81	9.02	6.16	13.5	-	1.42	18.0
2025 Safenlp 2024	313	UNSAT	6.26	7.93	6.36	12.0	16.3	1.08	17.9
2025 Safenlp 2024	314	UNSAT	7.09	8.00	8.48	13.3	-	2.26	17.9
2025 Safenlp 2024	315	UNSAT	6.33	7.94	6.36	10.9	16.8	1.07	17.9
2025 Safenlp 2024	316	UNSAT	6.35	7.95	6.39	11.9	16.6	1.07	17.8
2025 Safenlp 2024	317	SAT	6.56	6.64	6.11	12.2	-	1.24	17.8
2025 Safenlp 2024	318	UNSAT	7.13	8.24	11.8	14.2	-	2.55	17.7

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	319	UNSAT	7.72	8.25	-	-	-	-	18.2
2025 Safenlp 2024	320	UNSAT	7.22	8.24	19.5	14.0	-	4.86	18.1
2025 Safenlp 2024	321	UNSAT	7.28	8.03	10.3	16.3	-	2.82	-
2025 Safenlp 2024	322	UNSAT	6.79	7.96	6.10	12.2	-	1.24	17.9
2025 Safenlp 2024	323	UNSAT	6.77	8.95	6.11	11.3	-	1.25	19.2
2025 Safenlp 2024	324	SAT	6.85	6.52	6.11	12.2	-	1.26	18.3
2025 Safenlp 2024	325	SAT	6.76	5.97	6.06	12.3	14.9	1.28	18.1
2025 Safenlp 2024	326	UNSAT	6.72	7.95	6.12	11.2	-	1.29	18.1
2025 Safenlp 2024	327	UNSAT	6.60	9.01	6.09	12.2	-	1.25	18.1
2025 Safenlp 2024	328	UNSAT	6.31	7.94	6.36	12.0	16.6	1.07	17.6
2025 Safenlp 2024	329	SAT	6.79	6.08	6.12	12.3	15.1	1.23	17.9
2025 Safenlp 2024	330	UNSAT	8.36	11.4	-	-	-	-	17.9
2025 Safenlp 2024	331	SAT	6.57	7.99	6.11	12.2	15.0	1.25	17.8
2025 Safenlp 2024	332	SAT	6.54	6.14	6.07	11.3	-	1.24	18.8
2025 Safenlp 2024	333	UNSAT	6.28	7.95	6.41	11.9	16.5	1.08	-
2025 Safenlp 2024	334	SAT	6.81	5.97	6.09	11.3	14.8	1.25	18.1
2025 Safenlp 2024	335	UNSAT	6.81	8.99	6.11	13.1	-	1.48	18.2
2025 Safenlp 2024	336	UNSAT	6.23	7.94	6.39	11.9	16.5	1.07	19.1
2025 Safenlp 2024	337	UNSAT	9.27	32.5	-	-	-	-	18.1
2025 Safenlp 2024	338	UNSAT	7.15	8.37	15.9	18.2	-	4.56	18.0
2025 Safenlp 2024	339	UNSAT	6.28	7.92	6.37	11.0	16.6	1.07	17.6
2025 Safenlp 2024	340	UNSAT	7.40	8.12	11.2	14.5	-	2.33	18.0
2025 Safenlp 2024	341	UNSAT	7.41	8.06	7.57	12.9	-	2.10	17.8
2025 Safenlp 2024	342	UNSAT	7.08	8.04	10.5	13.6	-	2.98	-
2025 Safenlp 2024	343	UNSAT	6.78	9.01	6.12	12.2	-	1.24	18.3
2025 Safenlp 2024	344	UNSAT	6.30	7.92	6.37	11.0	16.3	1.08	17.8
2025 Safenlp 2024	345	UNSAT	7.47	8.21	18.0	15.8	-	3.71	17.7
2025 Safenlp 2024	346	UNSAT	6.78	8.10	6.12	12.0	-	1.64	17.8
2025 Safenlp 2024	347	SAT	6.83	6.30	6.08	12.2	-	1.26	18.4
2025 Safenlp 2024	348	UNSAT	6.29	7.92	6.39	12.0	16.5	1.09	17.7
2025 Safenlp 2024	349	SAT	6.81	6.22	6.09	12.2	14.8	1.25	18.2
2025 Safenlp 2024	350	UNSAT	6.65	7.98	6.11	11.3	-	1.22	17.8
2025 Safenlp 2024	351	UNSAT	6.65	8.03	6.09	12.2	-	1.23	17.8
2025 Safenlp 2024	352	UNSAT	7.37	8.02	9.80	13.8	-	1.76	17.8
2025 Safenlp 2024	353	UNSAT	12.6	-	-	-	-	-	18.2
2025 Safenlp 2024	354	UNSAT	6.30	8.05	6.38	12.0	16.3	1.13	17.6
2025 Safenlp 2024	355	UNSAT	7.55	8.41	-	-	-	-	18.0
2025 Safenlp 2024	356	UNSAT	7.40	8.16	12.3	21.5	-	3.87	18.1
2025 Safenlp 2024	357	UNSAT	6.61	7.99	6.06	12.2	-	1.24	17.9
2025 Safenlp 2024	358	UNSAT	6.71	8.95	6.08	11.2	-	1.24	17.7
2025 Safenlp 2024	359	UNSAT	6.47	7.91	6.36	12.0	16.5	1.08	17.6
2025 Safenlp 2024	360	UNSAT	6.81	8.04	6.10	12.3	-	1.24	18.1
2025 Safenlp 2024	361	UNSAT	6.55	8.52	6.09	26.6	-	-	17.8
2025 Safenlp 2024	362	UNSAT	6.83	8.98	6.07	12.2	-	1.25	18.2
2025 Safenlp 2024	363	UNSAT	6.30	7.97	6.40	11.9	16.6	1.08	17.6
2025 Safenlp 2024	364	UNSAT	6.76	8.96	6.08	12.2	-	1.24	18.1
2025 Safenlp 2024	365	SAT	6.47	5.98	6.05	12.3	15.1	1.25	18.0
2025 Safenlp 2024	366	UNSAT	7.21	7.99	7.39	12.8	-	1.98	17.8
2025 Safenlp 2024	367	UNSAT	7.28	8.05	6.60	12.7	-	1.26	17.8
2025 Safenlp 2024	368	UNSAT	6.84	8.14	6.12	13.0	-	1.45	18.1
2025 Safenlp 2024	369	UNSAT	6.84	8.94	6.12	11.2	-	1.25	18.2
2025 Safenlp 2024	370	UNSAT	6.83	8.04	6.09	13.0	-	2.40	18.3
2025 Safenlp 2024	371	UNSAT	7.23	7.97	7.00	13.2	-	1.53	17.8
2025 Safenlp 2024	372	UNSAT	6.32	8.00	6.44	12.5	16.8	1.07	17.8
2025 Safenlp 2024	373	UNSAT	6.29	7.97	6.40	11.9	16.4	1.07	17.7
2025 Safenlp 2024	374	SAT	6.56	6.50	6.13	11.3	-	1.22	17.9
2025 Safenlp 2024	375	UNSAT	13.0	73.0	-	-	-	-	17.8
2025 Safenlp 2024	376	UNSAT	7.02	7.96	6.58	12.7	-	1.27	18.1
2025 Safenlp 2024	377	SAT	6.57	7.16	6.12	12.3	14.9	1.24	17.8
2025 Safenlp 2024	378	UNSAT	6.58	7.93	6.11	12.3	-	1.24	18.1
2025 Safenlp 2024	379	SAT	6.77	5.98	6.05	12.2	15.1	1.26	18.1
2025 Safenlp 2024	380	UNSAT	6.32	7.94	6.38	11.0	16.5	1.06	18.0
2025 Safenlp 2024	381	UNSAT	6.82	8.18	6.14	12.2	-	1.25	18.4
2025 Safenlp 2024	382	UNSAT	6.82	8.96	6.09	12.2	-	1.25	18.2
2025 Safenlp 2024	383	SAT	6.77	5.99	6.03	12.2	14.8	1.24	18.0
2025 Safenlp 2024	384	UNSAT	6.34	7.90	6.40	11.9	16.4	1.13	17.8
2025 Safenlp 2024	385	UNSAT	6.62	9.33	6.11	12.2	-	1.29	17.9
2025 Safenlp 2024	386	SAT	6.82	6.05	6.11	11.2	-	1.25	✗

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	387	UNSAT	6.31	7.96	6.39	11.9	16.6	1.08	17.8
2025 Safenlp 2024	388	SAT	6.71	6.06	6.08	12.2	14.8	1.26	18.1
2025 Safenlp 2024	389	SAT	6.83	5.98	6.07	12.2	14.9	1.25	17.7
2025 Safenlp 2024	390	UNSAT	6.43	7.92	6.37	10.9	16.5	1.08	17.7
2025 Safenlp 2024	391	UNSAT	6.29	7.94	6.39	11.9	16.4	1.09	17.9
2025 Safenlp 2024	392	UNSAT	6.85	7.97	6.06	12.2	-	1.23	17.9
2025 Safenlp 2024	393	UNSAT	6.52	8.96	6.11	12.3	-	1.24	17.7
2025 Safenlp 2024	394	UNSAT	6.83	9.01	6.10	11.2	-	1.26	17.9
2025 Safenlp 2024	395	UNSAT	6.29	7.92	6.38	11.9	16.5	1.09	17.8
2025 Safenlp 2024	396	UNSAT	6.84	7.96	6.09	12.3	-	1.25	18.2
2025 Safenlp 2024	397	SAT	6.68	6.02	6.01	12.2	14.8	1.27	18.3
2025 Safenlp 2024	398	SAT	6.82	6.05	6.11	12.2	-	1.25	18.0
2025 Safenlp 2024	399	UNSAT	6.29	7.92	6.39	12.0	17.0	1.12	17.9
2025 Safenlp 2024	400	UNSAT	6.82	9.11	6.12	12.2	-	1.92	18.5
2025 Safenlp 2024	401	UNSAT	6.49	8.02	6.11	11.2	-	1.22	17.6
2025 Safenlp 2024	402	SAT	6.80	6.71	6.10	12.3	-	1.23	✗
2025 Safenlp 2024	403	UNSAT	7.44	8.29	-	16.2	-	-	18.0
2025 Safenlp 2024	404	UNSAT	9.59	56.3	-	-	-	-	18.2
2025 Safenlp 2024	405	UNSAT	6.55	9.00	6.09	12.3	-	1.26	18.1
2025 Safenlp 2024	406	SAT	6.80	5.95	6.04	12.2	15.0	1.23	18.1
2025 Safenlp 2024	407	UNSAT	7.12	7.99	10.9	15.0	-	2.61	17.9
2025 Safenlp 2024	408	UNSAT	7.69	8.25	25.2	23.8	-	8.82	17.7
2025 Safenlp 2024	409	UNSAT	6.70	9.01	6.12	12.7	-	1.57	17.9
2025 Safenlp 2024	410	UNSAT	6.26	7.94	6.38	11.0	16.3	1.07	17.8
2025 Safenlp 2024	411	UNSAT	6.29	7.96	6.39	11.0	16.7	1.09	-
2025 Safenlp 2024	412	UNSAT	7.49	8.28	17.2	16.0	-	5.22	18.1
2025 Safenlp 2024	413	UNSAT	6.83	9.02	6.10	12.2	-	1.25	18.4
2025 Safenlp 2024	414	UNSAT	6.32	8.00	6.36	11.0	16.7	1.08	17.7
2025 Safenlp 2024	415	UNSAT	6.40	7.95	6.39	11.4	16.5	1.07	17.7
2025 Safenlp 2024	416	SAT	6.80	5.96	6.05	12.2	14.8	1.25	17.8
2025 Safenlp 2024	417	UNSAT	6.31	7.95	6.39	10.9	16.5	1.08	17.9
2025 Safenlp 2024	418	UNSAT	6.43	7.91	6.37	12.1	16.4	1.07	17.8
2025 Safenlp 2024	419	SAT	6.72	6.00	6.06	12.3	14.7	1.25	17.9
2025 Safenlp 2024	420	UNSAT	6.29	7.97	6.37	12.0	16.4	1.07	17.7
2025 Safenlp 2024	421	SAT	6.81	6.04	6.10	12.2	-	1.24	18.3
2025 Safenlp 2024	422	UNSAT	6.29	7.92	6.33	11.0	16.6	1.07	17.8
2025 Safenlp 2024	423	SAT	6.60	5.98	6.06	12.2	15.1	1.09	17.8
2025 Safenlp 2024	424	SAT	6.81	7.93	6.11	12.2	14.8	1.25	18.0
2025 Safenlp 2024	425	UNSAT	7.13	7.98	8.32	12.2	-	2.25	17.7
2025 Safenlp 2024	426	UNSAT	6.75	8.05	6.09	12.2	-	1.23	18.3
2025 Safenlp 2024	427	UNSAT	6.24	7.91	6.39	11.0	16.6	1.08	17.8
2025 Safenlp 2024	428	UNSAT	6.87	7.99	6.12	12.2	-	1.23	18.1
2025 Safenlp 2024	429	UNSAT	7.87	9.23	-	-	-	-	17.9
2025 Safenlp 2024	430	UNSAT	6.75	8.01	6.08	12.2	-	1.23	18.1
2025 Safenlp 2024	431	UNSAT	6.27	7.94	6.49	12.5	16.6	1.07	-
2025 Safenlp 2024	432	SAT	6.86	6.13	6.10	12.2	-	1.26	18.0
2025 Safenlp 2024	433	UNSAT	6.81	8.83	6.13	12.2	-	1.25	17.8
2025 Safenlp 2024	434	UNSAT	6.55	7.99	6.11	12.3	-	1.25	18.0
2025 Safenlp 2024	435	UNSAT	7.30	8.08	17.3	13.8	-	8.56	18.2
2025 Safenlp 2024	436	SAT	6.81	6.61	6.13	11.2	-	1.24	18.0
2025 Safenlp 2024	437	UNSAT	6.25	7.96	6.39	11.0	16.6	1.07	17.7
2025 Safenlp 2024	438	UNSAT	6.86	8.00	6.09	11.2	-	1.25	17.8
2025 Safenlp 2024	439	UNSAT	6.56	8.01	6.07	14.7	-	-	18.1
2025 Safenlp 2024	440	SAT	6.70	5.95	6.05	12.3	15.1	1.28	18.0
2025 Safenlp 2024	441	SAT	6.73	6.40	6.12	11.2	-	1.24	✗
2025 Safenlp 2024	442	UNSAT	6.35	7.94	6.37	12.0	16.7	1.07	18.0
2025 Safenlp 2024	443	UNSAT	6.83	7.96	6.12	12.2	-	1.24	18.0
2025 Safenlp 2024	444	UNSAT	6.31	7.91	6.40	12.0	16.5	1.08	-
2025 Safenlp 2024	445	UNSAT	7.07	7.93	7.23	13.5	-	1.46	18.0
2025 Safenlp 2024	446	UNSAT	6.56	8.96	6.11	12.2	-	1.29	18.2
2025 Safenlp 2024	447	UNSAT	6.86	8.99	6.12	12.3	-	1.43	18.0
2025 Safenlp 2024	448	SAT	6.85	5.98	6.13	12.2	14.9	1.23	18.0
2025 Safenlp 2024	449	UNSAT	6.76	8.94	6.10	12.3	-	1.28	17.9
2025 Safenlp 2024	450	UNSAT	12.0	42.3	-	-	-	-	18.0
2025 Safenlp 2024	451	SAT	6.63	5.97	6.05	12.2	14.9	1.25	18.0
2025 Safenlp 2024	452	UNSAT	7.64	8.86	-	-	-	14.0	18.1
2025 Safenlp 2024	453	UNSAT	6.73	8.01	6.08	12.3	-	1.25	18.1
2025 Safenlp 2024	454	UNSAT	15.7	25.7	-	-	-	-	18.0

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	455	UNSAT	6.84	8.00	6.10	12.2	-	1.29	18.4
2025 Safenlp 2024	456	UNSAT	7.47	8.12	11.5	13.8	-	2.22	17.9
2025 Safenlp 2024	457	UNSAT	6.80	8.02	6.13	12.2	-	1.26	18.1
2025 Safenlp 2024	458	SAT	6.82	5.95	6.02	11.3	15.1	1.23	18.2
2025 Safenlp 2024	459	UNSAT	7.17	8.53	-	26.2	-	-	17.7
2025 Safenlp 2024	460	SAT	6.77	5.95	6.09	12.2	15.3	1.25	17.9
2025 Safenlp 2024	461	UNSAT	6.93	8.04	6.11	11.2	-	1.26	18.0
2025 Safenlp 2024	462	SAT	6.80	5.95	6.05	12.2	15.0	1.23	18.0
2025 Safenlp 2024	463	UNSAT	6.84	8.89	6.10	12.2	-	1.22	17.7
2025 Safenlp 2024	464	UNSAT	6.81	7.97	6.09	12.7	-	1.27	18.1
2025 Safenlp 2024	465	SAT	6.70	6.69	6.10	12.2	14.8	1.22	18.0
2025 Safenlp 2024	466	UNSAT	6.83	8.02	6.10	12.2	-	1.23	18.0
2025 Safenlp 2024	467	UNSAT	6.79	8.10	6.09	12.7	-	1.42	18.0
2025 Safenlp 2024	468	UNSAT	6.59	8.90	6.11	12.2	-	1.28	18.2
2025 Safenlp 2024	469	SAT	6.72	5.98	6.06	12.2	15.1	1.23	-
2025 Safenlp 2024	470	UNSAT	7.31	8.00	9.09	13.8	-	2.24	17.9
2025 Safenlp 2024	471	SAT	6.79	6.45	6.09	11.2	-	1.28	18.5
2025 Safenlp 2024	472	UNSAT	6.87	7.98	6.08	12.2	-	1.24	18.4
2025 Safenlp 2024	473	SAT	6.75	6.29	6.13	12.3	14.7	1.24	18.0
2025 Safenlp 2024	474	UNSAT	6.65	7.97	6.10	12.2	-	1.24	18.1
2025 Safenlp 2024	475	UNSAT	7.37	8.20	13.0	14.3	-	2.42	18.0
2025 Safenlp 2024	476	SAT	6.78	8.97	6.10	11.2	-	1.29	18.2
2025 Safenlp 2024	477	UNSAT	6.32	7.88	6.38	11.9	16.6	1.07	17.7
2025 Safenlp 2024	478	SAT	6.85	7.17	6.09	11.2	-	1.25	✗
2025 Safenlp 2024	479	UNSAT	6.28	7.94	6.39	12.0	16.6	1.07	17.8
2025 Safenlp 2024	480	SAT	6.51	5.97	6.06	12.2	15.0	1.24	18.0
2025 Safenlp 2024	481	UNSAT	6.83	8.78	6.08	13.3	-	1.76	18.0
2025 Safenlp 2024	482	UNSAT	6.60	7.99	6.11	12.2	-	1.26	18.2
2025 Safenlp 2024	483	UNSAT	6.50	7.94	6.11	12.2	-	1.25	17.8
2025 Safenlp 2024	484	SAT	6.49	5.96	6.04	12.2	15.0	1.09	17.9
2025 Safenlp 2024	485	UNSAT	7.24	8.10	9.13	13.3	-	2.10	17.9
2025 Safenlp 2024	486	UNSAT	6.84	7.94	6.07	12.2	-	1.27	18.1
2025 Safenlp 2024	487	UNSAT	6.64	7.99	6.09	11.2	-	1.24	18.2
2025 Safenlp 2024	488	SAT	6.71	5.95	6.07	12.2	14.9	1.24	18.1
2025 Safenlp 2024	489	SAT	6.88	7.20	6.11	12.2	-	1.25	✗
2025 Safenlp 2024	490	SAT	6.59	8.93	6.07	12.2	-	1.24	18.0
2025 Safenlp 2024	491	UNSAT	6.88	8.00	6.10	12.2	-	1.22	18.0
2025 Safenlp 2024	492	UNSAT	6.83	9.27	6.09	12.7	-	1.27	18.3
2025 Safenlp 2024	493	UNSAT	7.25	8.10	10.9	14.3	-	3.99	17.9
2025 Safenlp 2024	494	UNSAT	6.60	9.01	6.12	13.0	-	1.62	18.0
2025 Safenlp 2024	495	UNSAT	6.83	9.00	6.07	11.2	-	1.24	18.2
2025 Safenlp 2024	496	UNSAT	6.79	8.93	6.09	12.2	-	1.25	18.0
2025 Safenlp 2024	497	UNSAT	7.34	7.97	6.86	11.5	-	1.42	17.9
2025 Safenlp 2024	498	UNSAT	6.86	8.01	6.09	11.7	-	1.45	18.3
2025 Safenlp 2024	499	UNSAT	6.27	7.93	6.41	12.0	16.3	1.07	17.8
2025 Safenlp 2024	500	UNSAT	6.80	9.01	6.09	11.2	-	1.27	18.4
2025 Safenlp 2024	501	UNSAT	6.51	7.95	6.13	11.2	-	1.24	18.1
2025 Safenlp 2024	502	SAT	6.79	6.00	6.06	12.2	15.2	1.30	18.5
2025 Safenlp 2024	503	UNSAT	7.66	8.31	21.0	-	-	-	18.0
2025 Safenlp 2024	504	SAT	6.52	5.93	6.03	11.2	14.9	1.29	17.9
2025 Safenlp 2024	505	UNSAT	6.30	7.87	6.47	12.4	16.8	1.07	17.9
2025 Safenlp 2024	506	UNSAT	6.33	7.84	6.34	11.0	16.4	1.07	18.0
2025 Safenlp 2024	507	UNSAT	7.37	8.18	17.9	21.3	-	4.55	17.8
2025 Safenlp 2024	508	SAT	6.72	7.94	6.09	12.3	14.9	1.24	18.4
2025 Safenlp 2024	509	UNSAT	6.84	8.96	6.07	11.2	-	1.24	18.2
2025 Safenlp 2024	510	UNSAT	6.26	7.99	6.38	11.9	16.4	1.06	17.9
2025 Safenlp 2024	511	UNSAT	6.28	7.91	6.35	11.9	16.6	1.07	17.8
2025 Safenlp 2024	512	UNSAT	7.73	8.34	18.7	18.1	-	3.90	18.2
2025 Safenlp 2024	513	UNSAT	6.83	8.04	6.11	12.2	-	1.23	17.9
2025 Safenlp 2024	514	UNSAT	6.83	8.01	6.11	11.7	-	1.23	17.9
2025 Safenlp 2024	515	UNSAT	7.53	8.31	22.4	19.1	-	-	18.0
2025 Safenlp 2024	516	SAT	6.76	6.35	6.04	12.1	-	1.24	18.2
2025 Safenlp 2024	517	UNSAT	6.58	9.13	6.08	12.2	-	1.24	18.3
2025 Safenlp 2024	518	SAT	6.81	6.02	6.07	11.2	-	1.25	17.7
2025 Safenlp 2024	519	UNSAT	6.71	9.00	6.06	11.2	-	1.23	18.1
2025 Safenlp 2024	520	UNSAT	6.29	7.92	6.37	12.0	16.3	1.07	17.7
2025 Safenlp 2024	521	SAT	6.71	6.03	6.04	12.2	14.9	1.25	18.1
2025 Safenlp 2024	522	UNSAT	7.65	8.44	24.7	22.1	-	17.5	18.1

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	523	UNSAT	8.04	9.33	-	-	-	-	17.9
2025 Safenlp 2024	524	UNSAT	6.33	7.91	6.33	12.0	16.7	1.07	17.7
2025 Safenlp 2024	525	UNSAT	6.80	8.01	6.09	12.2	15.2	1.24	-
2025 Safenlp 2024	526	SAT	6.54	6.01	6.01	12.2	14.9	1.24	18.1
2025 Safenlp 2024	527	UNSAT	6.73	8.01	6.11	12.2	-	1.25	18.2
2025 Safenlp 2024	528	SAT	6.59	6.05	6.11	12.2	-	1.27	17.9
2025 Safenlp 2024	529	UNSAT	6.73	8.98	6.10	12.2	-	1.24	18.0
2025 Safenlp 2024	530	UNSAT	7.16	8.32	11.6	13.3	-	2.30	17.9
2025 Safenlp 2024	531	SAT	6.76	5.95	6.02	12.1	15.0	1.25	18.1
2025 Safenlp 2024	532	SAT	6.56	6.00	6.08	12.2	14.8	1.26	18.1
2025 Safenlp 2024	533	UNSAT	8.37	9.48	-	-	-	-	18.1
2025 Safenlp 2024	534	UNSAT	8.81	18.5	-	-	-	-	18.0
2025 Safenlp 2024	535	UNSAT	7.00	7.99	7.83	14.0	-	2.07	18.0
2025 Safenlp 2024	536	UNSAT	6.51	7.98	6.11	12.7	-	1.57	18.0
2025 Safenlp 2024	537	UNSAT	7.88	11.1	-	-	-	-	18.3
2025 Safenlp 2024	538	SAT	6.58	6.03	6.09	12.2	15.0	1.25	18.5
2025 Safenlp 2024	539	UNSAT	11.9	26.1	-	-	-	-	18.1
2025 Safenlp 2024	540	SAT	6.77	5.98	6.05	12.2	14.9	1.27	18.2
2025 Safenlp 2024	541	SAT	6.77	5.93	6.05	11.2	14.7	1.24	18.2
2025 Safenlp 2024	542	UNSAT	6.28	7.93	6.37	11.9	16.7	1.09	17.9
2025 Safenlp 2024	543	UNSAT	7.43	8.31	-	16.0	-	15.2	17.7
2025 Safenlp 2024	544	UNSAT	6.66	8.03	6.12	12.3	-	1.28	18.1
2025 Safenlp 2024	545	UNSAT	7.18	8.10	15.2	14.8	-	3.85	18.0
2025 Safenlp 2024	546	UNSAT	6.86	8.94	6.08	12.2	-	1.25	18.3
2025 Safenlp 2024	547	SAT	6.77	5.98	6.04	12.3	14.8	1.07	18.0
2025 Safenlp 2024	548	UNSAT	6.78	8.97	6.11	12.3	-	1.23	17.8
2025 Safenlp 2024	549	SAT	6.82	6.46	6.06	11.2	15.4	1.23	18.2
2025 Safenlp 2024	550	UNSAT	6.74	8.00	6.07	11.8	-	1.26	18.0
2025 Safenlp 2024	551	UNSAT	6.76	8.00	6.09	12.1	-	1.24	18.1
2025 Safenlp 2024	552	SAT	6.74	5.93	6.01	12.2	14.9	1.22	18.4
2025 Safenlp 2024	553	UNSAT	6.81	7.97	6.09	12.2	-	1.24	18.1
2025 Safenlp 2024	554	SAT	6.63	6.48	6.10	11.3	-	1.24	18.2
2025 Safenlp 2024	555	UNSAT	6.84	8.16	6.07	12.3	-	1.25	18.2
2025 Safenlp 2024	556	UNSAT	8.26	9.00	-	-	-	-	18.1
2025 Safenlp 2024	557	UNSAT	7.25	8.04	8.59	13.1	-	1.95	18.0
2025 Safenlp 2024	558	UNSAT	6.29	7.94	6.34	11.0	16.5	1.08	17.8
2025 Safenlp 2024	559	UNSAT	6.81	9.14	6.11	12.2	-	1.48	18.2
2025 Safenlp 2024	560	UNSAT	6.67	8.01	6.12	12.2	-	1.24	18.2
2025 Safenlp 2024	561	SAT	6.77	5.97	6.07	12.3	15.1	1.24	18.0
2025 Safenlp 2024	562	UNSAT	6.28	7.94	6.48	12.5	16.7	1.08	17.8
2025 Safenlp 2024	563	UNSAT	6.29	7.99	6.34	11.9	16.5	1.07	17.9
2025 Safenlp 2024	564	UNSAT	6.55	8.04	6.10	11.7	-	1.48	18.1
2025 Safenlp 2024	565	UNSAT	8.02	8.69	-	-	-	-	18.2
2025 Safenlp 2024	566	UNSAT	6.26	7.93	6.38	12.0	16.3	1.07	17.7
2025 Safenlp 2024	567	UNSAT	7.36	8.33	22.7	-	-	16.7	18.3
2025 Safenlp 2024	568	UNSAT	6.29	7.99	6.38	12.0	16.7	1.07	17.8
2025 Safenlp 2024	569	UNSAT	6.31	7.93	6.33	12.0	16.6	1.07	17.8
2025 Safenlp 2024	570	UNSAT	6.58	7.98	6.09	11.5	-	1.26	17.8
2025 Safenlp 2024	571	UNSAT	6.80	8.96	6.11	12.2	-	1.24	18.0
2025 Safenlp 2024	572	UNSAT	6.82	7.99	6.09	12.2	-	1.25	18.3
2025 Safenlp 2024	573	SAT	6.85	7.08	6.10	12.2	-	1.25	✗
2025 Safenlp 2024	574	UNSAT	8.14	8.71	-	-	-	-	18.3
2025 Safenlp 2024	575	SAT	6.62	5.96	6.07	12.3	15.0	1.25	18.2
2025 Safenlp 2024	576	UNSAT	6.66	8.03	6.09	12.2	-	1.23	17.9
2025 Safenlp 2024	577	UNSAT	6.62	8.91	6.10	11.2	-	1.26	18.0
2025 Safenlp 2024	578	UNSAT	8.43	9.20	-	-	-	-	17.9
2025 Safenlp 2024	579	UNSAT	6.86	9.03	6.08	13.0	-	1.43	18.1
2025 Safenlp 2024	580	SAT	6.79	6.01	6.08	12.2	-	1.25	-
2025 Safenlp 2024	581	UNSAT	6.29	7.97	6.37	12.0	16.9	1.10	17.8
2025 Safenlp 2024	582	UNSAT	7.14	8.01	10.1	13.3	-	2.37	17.7
2025 Safenlp 2024	583	UNSAT	7.23	8.29	16.7	16.5	-	3.52	17.9
2025 Safenlp 2024	584	UNSAT	7.54	8.60	-	17.3	-	-	17.7
2025 Safenlp 2024	585	UNSAT	6.72	7.97	6.07	12.3	-	1.23	18.2
2025 Safenlp 2024	586	UNSAT	7.17	8.04	7.66	13.8	-	2.05	17.8
2025 Safenlp 2024	587	UNSAT	6.79	8.03	6.10	12.3	-	1.24	18.2
2025 Safenlp 2024	588	UNSAT	9.05	29.0	-	-	-	-	18.2
2025 Safenlp 2024	589	UNSAT	7.65	8.31	-	-	-	-	17.9
2025 Safenlp 2024	590	UNSAT	6.83	7.99	6.06	13.0	-	1.25	18.2

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	591	UNSAT	8.42	8.82	-	-	-	-	18.3
2025 Safenlp 2024	592	SAT	6.47	5.98	6.08	12.2	14.7	1.07	17.8
2025 Safenlp 2024	593	UNSAT	6.27	8.00	6.38	12.0	16.3	1.08	17.6
2025 Safenlp 2024	594	UNSAT	6.78	8.98	6.12	11.7	-	1.43	18.3
2025 Safenlp 2024	595	UNSAT	6.70	8.94	6.11	12.2	-	1.25	17.8
2025 Safenlp 2024	596	UNSAT	6.79	7.91	6.11	12.2	-	1.23	18.1
2025 Safenlp 2024	597	UNSAT	6.55	7.99	6.06	11.2	-	1.23	18.0
2025 Safenlp 2024	598	UNSAT	7.55	8.68	25.3	-	-	19.5	18.2
2025 Safenlp 2024	599	UNSAT	7.23	8.07	13.0	16.0	-	3.40	18.1
2025 Safenlp 2024	600	UNSAT	6.54	8.99	6.06	12.2	-	1.24	17.9
2025 Safenlp 2024	601	UNSAT	7.18	7.91	7.11	13.0	-	1.64	17.9
2025 Safenlp 2024	602	UNSAT	6.80	8.88	6.11	12.3	-	1.24	18.3
2025 Safenlp 2024	603	UNSAT	7.25	8.02	12.1	13.8	-	3.08	-
2025 Safenlp 2024	604	UNSAT	12.4	-	-	-	-	-	17.9
2025 Safenlp 2024	605	UNSAT	7.39	9.64	-	-	-	18.0	17.8
2025 Safenlp 2024	606	UNSAT	6.28	7.98	6.39	12.0	16.5	1.08	17.9
2025 Safenlp 2024	607	UNSAT	7.01	7.95	6.93	13.0	-	1.55	17.6
2025 Safenlp 2024	608	SAT	6.76	5.99	6.05	12.2	15.0	1.28	19.3
2025 Safenlp 2024	609	UNSAT	6.72	8.99	6.10	13.0	-	1.44	18.2
2025 Safenlp 2024	610	UNSAT	6.78	9.40	6.12	15.5	-	2.32	17.9
2025 Safenlp 2024	611	UNSAT	6.64	9.01	6.10	13.0	-	2.15	18.2
2025 Safenlp 2024	612	UNSAT	7.24	8.14	18.5	18.5	-	4.58	17.8
2025 Safenlp 2024	613	SAT	6.81	7.97	6.08	12.1	14.9	1.27	18.2
2025 Safenlp 2024	614	SAT	6.70	5.97	6.09	11.2	15.3	1.25	18.2
2025 Safenlp 2024	615	UNSAT	6.81	8.01	6.11	12.2	-	1.27	17.7
2025 Safenlp 2024	616	UNSAT	6.85	8.98	6.10	12.9	-	1.76	17.9
2025 Safenlp 2024	617	SAT	6.77	6.25	6.11	12.2	-	1.23	-
2025 Safenlp 2024	618	SAT	6.55	6.01	6.05	11.2	15.3	1.25	18.1
2025 Safenlp 2024	619	UNSAT	6.81	8.98	6.13	12.3	-	1.24	17.8
2025 Safenlp 2024	620	UNSAT	6.83	7.95	6.08	12.1	-	1.24	18.1
2025 Safenlp 2024	621	UNSAT	6.84	8.86	6.10	11.3	-	1.25	18.1
2025 Safenlp 2024	622	UNSAT	7.27	8.00	7.13	12.7	-	1.81	17.7
2025 Safenlp 2024	623	UNSAT	6.83	8.93	6.09	12.2	-	1.28	17.8
2025 Safenlp 2024	624	UNSAT	7.14	7.99	6.69	11.7	-	1.27	17.8
2025 Safenlp 2024	625	UNSAT	6.79	8.14	6.12	11.7	-	1.25	18.2
2025 Safenlp 2024	626	UNSAT	6.59	9.01	6.08	12.2	-	1.24	17.9
2025 Safenlp 2024	627	SAT	6.56	5.96	6.07	11.2	15.5	1.25	18.1
2025 Safenlp 2024	628	UNSAT	6.68	8.97	6.10	12.2	-	1.23	-
2025 Safenlp 2024	629	SAT	6.69	5.92	6.04	12.2	15.1	1.26	17.9
2025 Safenlp 2024	630	UNSAT	6.80	9.25	6.11	13.0	-	1.30	17.8
2025 Safenlp 2024	631	UNSAT	6.87	8.03	6.09	12.2	-	1.22	18.3
2025 Safenlp 2024	632	UNSAT	8.77	9.48	-	-	-	-	18.2
2025 Safenlp 2024	633	UNSAT	6.56	9.00	6.09	12.2	-	1.23	17.9
2025 Safenlp 2024	634	UNSAT	6.77	7.97	6.10	12.2	-	1.25	18.1
2025 Safenlp 2024	635	UNSAT	6.29	7.91	6.39	11.9	16.3	1.09	-
2025 Safenlp 2024	636	UNSAT	6.85	8.06	6.10	11.7	-	1.24	17.9
2025 Safenlp 2024	637	UNSAT	6.81	8.91	6.10	11.1	-	1.24	18.3
2025 Safenlp 2024	638	UNSAT	6.69	8.02	6.08	12.7	-	1.24	17.8
2025 Safenlp 2024	639	UNSAT	6.30	7.87	6.43	11.9	16.2	1.07	17.6
2025 Safenlp 2024	640	UNSAT	7.32	8.04	9.66	14.7	-	2.43	17.6
2025 Safenlp 2024	641	UNSAT	8.90	10.9	-	-	-	-	17.7
2025 Safenlp 2024	642	SAT	6.81	5.95	6.04	12.2	14.9	1.23	17.9
2025 Safenlp 2024	643	UNSAT	6.29	7.86	6.45	12.5	16.5	1.07	17.8
2025 Safenlp 2024	644	UNSAT	6.76	9.00	6.11	11.3	-	1.23	18.0
2025 Safenlp 2024	645	UNSAT	7.22	8.07	12.2	14.5	-	2.76	17.9
2025 Safenlp 2024	646	UNSAT	6.83	8.02	6.09	12.2	-	1.23	18.0
2025 Safenlp 2024	647	UNSAT	6.84	8.02	6.12	12.2	-	1.23	17.9
2025 Safenlp 2024	648	UNSAT	6.85	9.75	6.11	✗	-	1.24	17.9
2025 Safenlp 2024	649	UNSAT	6.80	8.93	6.10	12.3	-	1.22	18.0
2025 Safenlp 2024	650	UNSAT	6.79	8.96	6.10	12.2	-	1.23	18.0
2025 Safenlp 2024	651	UNSAT	6.79	8.99	6.09	12.2	-	1.28	18.1
2025 Safenlp 2024	652	SAT	6.83	6.41	6.10	12.2	-	1.28	✗
2025 Safenlp 2024	653	UNSAT	6.31	7.93	6.38	11.9	16.5	1.06	17.8
2025 Safenlp 2024	654	SAT	6.84	6.15	6.04	12.2	-	1.28	18.3
2025 Safenlp 2024	655	UNSAT	6.83	7.94	6.10	11.2	-	1.27	17.9
2025 Safenlp 2024	656	SAT	6.54	7.97	6.08	12.3	-	1.27	17.8
2025 Safenlp 2024	657	UNSAT	6.64	8.00	6.05	11.2	-	1.27	18.0
2025 Safenlp 2024	658	SAT	6.78	5.97	6.09	11.2	14.8	1.25	18.1

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	659	UNSAT	6.29	7.99	6.39	12.0	16.6	1.07	-
2025 Safenlp 2024	660	UNSAT	6.76	8.99	6.10	12.2	-	1.27	18.1
2025 Safenlp 2024	661	UNSAT	6.77	8.96	6.11	11.2	-	1.23	18.1
2025 Safenlp 2024	662	UNSAT	7.13	8.00	8.92	12.0	-	2.06	17.9
2025 Safenlp 2024	663	UNSAT	6.29	7.93	6.37	12.0	16.6	1.08	17.9
2025 Safenlp 2024	664	UNSAT	7.35	8.05	8.94	12.6	-	2.10	18.1
2025 Safenlp 2024	665	UNSAT	6.80	7.97	6.09	12.2	-	1.29	18.2
2025 Safenlp 2024	666	SAT	6.65	5.96	6.07	12.2	15.1	1.10	17.9
2025 Safenlp 2024	667	UNSAT	6.26	7.92	6.40	12.0	16.7	1.12	17.7
2025 Safenlp 2024	668	UNSAT	7.22	8.08	8.67	12.5	-	2.10	17.9
2025 Safenlp 2024	669	UNSAT	6.29	7.95	6.35	11.9	16.5	1.08	17.8
2025 Safenlp 2024	670	UNSAT	7.10	8.28	18.0	14.2	-	10.1	18.0
2025 Safenlp 2024	671	UNSAT	7.10	8.08	12.3	12.3	-	2.46	17.8
2025 Safenlp 2024	672	UNSAT	6.71	7.96	6.11	12.2	-	1.24	18.0
2025 Safenlp 2024	673	SAT	6.65	6.30	6.14	12.3	-	1.24	18.2
2025 Safenlp 2024	674	UNSAT	7.14	8.18	16.0	13.8	-	3.73	17.6
2025 Safenlp 2024	675	UNSAT	8.98	32.1	-	-	-	-	18.0
2025 Safenlp 2024	676	UNSAT	7.20	8.00	6.64	11.7	-	1.70	18.0
2025 Safenlp 2024	677	SAT	6.78	6.18	6.06	11.2	-	1.24	✗
2025 Safenlp 2024	678	UNSAT	6.80	8.05	6.12	12.2	-	1.24	17.9
2025 Safenlp 2024	679	SAT	6.79	6.32	6.10	12.2	-	1.24	17.9
2025 Safenlp 2024	680	SAT	6.37	5.97	6.00	12.2	15.2	1.07	17.8
2025 Safenlp 2024	681	SAT	6.83	6.57	6.06	12.2	-	1.26	18.0
2025 Safenlp 2024	682	UNSAT	6.86	8.03	6.12	12.2	-	1.24	18.1
2025 Safenlp 2024	683	UNSAT	6.61	8.01	6.08	12.2	-	1.25	17.9
2025 Safenlp 2024	684	SAT	6.84	5.96	6.07	12.2	14.9	1.23	18.0
2025 Safenlp 2024	685	UNSAT	6.79	8.01	6.09	12.3	-	1.24	18.0
2025 Safenlp 2024	686	UNSAT	6.84	8.58	6.09	29.3	-	-	18.0
2025 Safenlp 2024	687	UNSAT	6.31	7.99	6.34	12.0	16.5	1.13	17.9
2025 Safenlp 2024	688	SAT	6.72	6.02	6.07	12.2	15.0	1.26	18.1
2025 Safenlp 2024	689	UNSAT	6.59	8.98	6.12	11.2	-	1.23	18.0
2025 Safenlp 2024	690	UNSAT	8.00	51.4	-	-	-	-	17.8
2025 Safenlp 2024	691	UNSAT	7.44	8.13	13.6	20.0	-	7.89	17.8
2025 Safenlp 2024	692	UNSAT	6.84	8.98	6.09	12.2	-	1.25	18.3
2025 Safenlp 2024	693	UNSAT	6.77	9.01	6.11	12.2	-	1.24	18.3
2025 Safenlp 2024	694	UNSAT	7.18	8.06	8.17	14.8	-	2.43	17.7
2025 Safenlp 2024	695	UNSAT	6.77	8.01	6.09	12.2	-	1.24	17.9
2025 Safenlp 2024	696	SAT	6.80	5.93	6.07	11.2	15.2	1.28	18.0
2025 Safenlp 2024	697	SAT	6.77	5.95	6.08	12.2	14.8	1.24	17.8
2025 Safenlp 2024	698	UNSAT	6.50	8.27	6.08	12.7	-	1.44	18.3
2025 Safenlp 2024	699	UNSAT	6.73	8.04	6.11	12.3	-	1.23	-
2025 Safenlp 2024	700	UNSAT	6.77	8.55	6.10	14.3	-	1.98	17.9
2025 Safenlp 2024	701	UNSAT	7.25	8.06	9.06	13.2	-	2.33	17.8
2025 Safenlp 2024	702	UNSAT	7.22	7.96	6.82	11.8	-	1.52	17.7
2025 Safenlp 2024	703	SAT	6.81	5.95	6.08	11.3	14.8	1.12	17.8
2025 Safenlp 2024	704	UNSAT	6.84	9.02	6.12	-	-	-	17.8
2025 Safenlp 2024	705	UNSAT	7.30	8.13	19.9	15.0	-	3.44	17.7
2025 Safenlp 2024	706	UNSAT	6.85	9.05	6.10	12.2	-	1.28	18.3
2025 Safenlp 2024	707	UNSAT	6.58	8.08	6.12	12.2	-	1.30	18.3
2025 Safenlp 2024	708	UNSAT	6.59	7.98	6.12	12.2	-	1.24	17.8
2025 Safenlp 2024	709	UNSAT	8.36	8.92	-	-	-	-	17.9
2025 Safenlp 2024	710	UNSAT	6.77	7.97	6.13	12.2	-	1.24	18.2
2025 Safenlp 2024	711	UNSAT	7.10	8.29	20.1	14.2	-	5.75	17.9
2025 Safenlp 2024	712	UNSAT	8.09	42.1	-	-	-	-	17.8
2025 Safenlp 2024	713	UNSAT	6.80	8.04	6.10	12.0	-	1.23	18.2
2025 Safenlp 2024	714	UNSAT	6.75	8.02	6.09	12.2	-	1.30	18.3
2025 Safenlp 2024	715	UNSAT	7.24	8.09	9.76	14.5	-	2.10	17.7
2025 Safenlp 2024	716	UNSAT	6.79	8.97	6.10	12.3	-	1.29	18.2
2025 Safenlp 2024	717	UNSAT	6.82	8.10	6.07	12.2	-	1.28	18.2
2025 Safenlp 2024	718	UNSAT	6.27	7.99	6.39	12.0	16.8	1.07	17.9
2025 Safenlp 2024	719	SAT	6.78	7.87	6.12	11.2	14.8	1.24	18.2
2025 Safenlp 2024	720	UNSAT	6.75	9.31	6.11	12.8	-	1.61	18.1
2025 Safenlp 2024	721	UNSAT	6.63	8.90	6.09	12.2	-	1.26	17.7
2025 Safenlp 2024	722	UNSAT	6.77	9.02	6.12	12.2	-	1.31	17.9
2025 Safenlp 2024	723	UNSAT	9.17	25.7	-	-	-	-	18.1
2025 Safenlp 2024	724	UNSAT	6.66	8.94	6.12	11.2	-	1.25	17.9
2025 Safenlp 2024	725	SAT	6.69	5.98	6.08	12.2	14.9	1.24	18.3
2025 Safenlp 2024	726	SAT	6.78	5.94	6.04	12.2	14.8	1.24	17.8

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	727	UNSAT	7.53	11.3	-	-	-	-	17.7
2025 Safenlp 2024	728	SAT	6.81	5.97	6.10	12.2	15.3	1.24	18.3
2025 Safenlp 2024	729	UNSAT	6.61	8.98	6.09	12.2	-	1.25	18.3
2025 Safenlp 2024	730	SAT	6.56	6.00	6.05	11.2	14.9	1.24	18.2
2025 Safenlp 2024	731	SAT	6.56	6.01	6.08	12.2	14.8	1.26	17.9
2025 Safenlp 2024	732	UNSAT	7.30	8.16	12.3	14.8	-	2.41	17.7
2025 Safenlp 2024	733	UNSAT	7.26	8.05	11.5	15.0	-	2.78	17.9
2025 Safenlp 2024	734	UNSAT	7.15	7.92	6.85	12.7	-	1.34	18.0
2025 Safenlp 2024	735	UNSAT	6.82	8.00	6.12	12.3	-	1.21	17.6
2025 Safenlp 2024	736	UNSAT	6.83	8.05	6.16	12.2	-	1.27	17.9
2025 Safenlp 2024	737	UNSAT	6.81	8.98	6.10	11.7	-	1.42	17.9
2025 Safenlp 2024	738	UNSAT	6.32	7.94	6.38	12.0	16.6	1.07	18.0
2025 Safenlp 2024	739	UNSAT	6.64	8.02	6.09	12.3	-	1.23	18.1
2025 Safenlp 2024	740	UNSAT	6.70	9.02	6.10	12.2	-	1.26	17.9
2025 Safenlp 2024	741	UNSAT	6.83	8.98	6.13	12.2	-	1.23	17.9
2025 Safenlp 2024	742	UNSAT	7.67	8.40	23.8	21.8	-	-	18.0
2025 Safenlp 2024	743	SAT	6.72	5.95	6.06	11.3	15.1	1.25	17.9
2025 Safenlp 2024	744	UNSAT	6.64	8.01	6.09	12.2	-	1.25	18.0
2025 Safenlp 2024	745	SAT	6.77	6.02	6.09	12.2	-	1.22	17.9
2025 Safenlp 2024	746	UNSAT	13.7	24.4	-	-	-	-	18.2
2025 Safenlp 2024	747	SAT	6.81	5.96	6.04	12.2	15.4	1.26	17.9
2025 Safenlp 2024	748	UNSAT	6.60	8.98	6.09	11.2	-	1.23	17.9
2025 Safenlp 2024	749	SAT	6.50	6.07	6.14	11.2	15.0	1.22	17.8
2025 Safenlp 2024	750	SAT	6.54	5.98	6.07	12.2	14.9	1.25	18.3
2025 Safenlp 2024	751	SAT	6.79	6.04	6.05	11.3	15.0	1.23	17.9
2025 Safenlp 2024	752	UNSAT	6.88	7.98	6.10	11.2	-	1.23	-
2025 Safenlp 2024	753	UNSAT	7.04	8.02	10.4	13.1	-	2.18	17.8
2025 Safenlp 2024	754	UNSAT	6.71	8.96	6.11	12.2	-	1.24	18.1
2025 Safenlp 2024	755	UNSAT	6.76	7.96	6.10	12.2	-	1.25	17.8
2025 Safenlp 2024	756	SAT	6.83	7.12	6.09	11.2	-	1.25	✗
2025 Safenlp 2024	757	UNSAT	6.29	7.97	6.39	11.9	16.5	1.13	17.7
2025 Safenlp 2024	758	UNSAT	6.31	7.94	6.35	12.0	16.5	1.07	-
2025 Safenlp 2024	759	SAT	6.80	6.50	6.09	11.2	-	1.23	✗
2025 Safenlp 2024	760	UNSAT	6.85	7.98	6.10	11.3	-	1.24	18.0
2025 Safenlp 2024	761	UNSAT	6.31	7.94	6.38	12.5	16.4	1.08	17.7
2025 Safenlp 2024	762	UNSAT	7.45	8.27	-	18.5	-	18.2	17.8
2025 Safenlp 2024	763	UNSAT	7.02	7.96	6.63	12.4	-	1.33	17.9
2025 Safenlp 2024	764	UNSAT	7.34	8.18	-	14.8	-	5.04	17.9
2025 Safenlp 2024	765	UNSAT	7.12	8.00	10.3	13.5	-	3.55	17.9
2025 Safenlp 2024	766	UNSAT	6.28	7.96	6.44	11.4	16.7	1.09	17.9
2025 Safenlp 2024	767	UNSAT	7.03	7.99	6.54	12.5	-	1.30	17.8
2025 Safenlp 2024	768	SAT	6.83	6.79	6.09	12.2	-	1.24	✗
2025 Safenlp 2024	769	UNSAT	6.82	8.15	6.09	13.6	-	1.45	18.0
2025 Safenlp 2024	770	SAT	6.74	7.99	6.10	12.2	14.8	1.25	18.4
2025 Safenlp 2024	771	SAT	6.62	5.98	6.12	12.2	-	1.24	17.9
2025 Safenlp 2024	772	UNSAT	7.35	8.02	7.95	12.7	-	2.01	17.6
2025 Safenlp 2024	773	UNSAT	6.66	7.96	6.08	12.2	-	1.23	17.8
2025 Safenlp 2024	774	UNSAT	8.75	13.9	-	-	-	-	17.7
2025 Safenlp 2024	775	UNSAT	7.03	8.02	7.04	12.7	-	1.28	17.8
2025 Safenlp 2024	776	UNSAT	6.28	7.90	6.37	12.0	16.5	1.07	18.5
2025 Safenlp 2024	777	UNSAT	6.79	7.96	6.10	12.2	-	1.25	18.0
2025 Safenlp 2024	778	UNSAT	6.52	8.00	6.08	12.2	-	1.28	17.6
2025 Safenlp 2024	779	UNSAT	6.54	8.11	6.09	12.2	-	1.23	17.6
2025 Safenlp 2024	780	SAT	6.87	6.54	6.08	12.2	-	1.27	✗
2025 Safenlp 2024	781	UNSAT	7.79	8.37	-	-	-	15.9	17.8
2025 Safenlp 2024	782	UNSAT	7.07	8.03	13.0	12.8	-	3.15	17.5
2025 Safenlp 2024	783	UNSAT	6.28	7.96	6.38	11.9	16.6	1.07	19.1
2025 Safenlp 2024	784	UNSAT	6.33	7.93	6.33	11.9	16.7	1.08	-
2025 Safenlp 2024	785	UNSAT	6.85	8.99	6.12	11.7	-	1.27	17.6
2025 Safenlp 2024	786	UNSAT	6.83	8.96	6.08	12.2	-	1.24	18.0
2025 Safenlp 2024	787	UNSAT	6.29	7.86	6.36	11.0	16.4	1.08	17.3
2025 Safenlp 2024	788	SAT	6.79	6.03	6.10	12.2	14.8	1.24	18.1
2025 Safenlp 2024	789	UNSAT	6.27	7.91	6.49	12.5	16.7	1.07	17.5
2025 Safenlp 2024	790	UNSAT	7.70	19.7	-	-	-	-	19.4
2025 Safenlp 2024	791	UNSAT	7.10	8.13	15.9	19.8	-	3.56	17.3
2025 Safenlp 2024	792	UNSAT	6.85	8.93	6.08	12.2	-	1.25	17.6
2025 Safenlp 2024	793	UNSAT	6.25	7.97	6.37	12.0	16.6	1.07	17.6
2025 Safenlp 2024	794	UNSAT	6.30	7.95	6.37	12.0	16.4	1.07	17.6

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	795	UNSAT	6.25	7.95	6.39	12.0	16.6	1.08	17.8
2025 Safenlp 2024	796	SAT	6.60	6.02	6.12	11.2	14.8	1.24	17.7
2025 Safenlp 2024	797	SAT	6.82	5.99	6.05	12.2	14.9	1.24	19.5
2025 Safenlp 2024	798	UNSAT	7.24	8.16	17.1	14.8	-	4.22	17.8
2025 Safenlp 2024	799	SAT	6.78	6.31	6.10	12.2	15.1	1.29	17.8
2025 Safenlp 2024	800	UNSAT	6.24	7.99	6.41	12.5	16.8	1.07	17.5
2025 Safenlp 2024	801	SAT	6.69	5.95	6.04	12.2	15.0	1.24	17.8
2025 Safenlp 2024	802	UNSAT	6.84	7.96	6.08	11.3	-	1.24	17.8
2025 Safenlp 2024	803	UNSAT	7.26	7.94	6.63	12.7	-	1.30	17.7
2025 Safenlp 2024	804	UNSAT	7.20	7.93	9.90	13.8	-	2.17	17.8
2025 Safenlp 2024	805	UNSAT	6.81	7.99	6.09	11.2	-	1.23	17.5
2025 Safenlp 2024	806	UNSAT	6.85	8.01	6.08	12.2	-	1.25	17.8
2025 Safenlp 2024	807	UNSAT	6.86	8.01	6.10	12.2	-	1.26	17.8
2025 Safenlp 2024	808	SAT	6.83	5.99	6.06	12.3	15.0	1.07	17.6
2025 Safenlp 2024	809	UNSAT	6.31	7.96	6.36	11.0	16.4	1.07	-
2025 Safenlp 2024	810	UNSAT	7.04	8.06	9.54	13.3	-	2.06	17.5
2025 Safenlp 2024	811	UNSAT	7.96	-	-	-	-	-	17.7
2025 Safenlp 2024	812	SAT	6.81	6.02	6.05	11.2	14.9	1.24	-
2025 Safenlp 2024	813	UNSAT	6.69	7.95	6.10	12.2	-	1.23	17.8
2025 Safenlp 2024	814	SAT	6.78	5.98	6.01	11.3	15.0	1.07	17.6
2025 Safenlp 2024	815	SAT	6.80	5.95	6.11	12.2	15.1	1.24	17.8
2025 Safenlp 2024	816	SAT	6.50	5.95	6.03	12.2	14.9	1.10	17.7
2025 Safenlp 2024	817	UNSAT	6.60	9.09	6.09	15.3	-	-	17.6
2025 Safenlp 2024	818	UNSAT	8.07	12.3	-	-	-	-	17.9
2025 Safenlp 2024	819	SAT	6.78	5.95	6.09	12.2	14.8	1.25	18.2
2025 Safenlp 2024	820	UNSAT	15.4	-	-	-	-	-	17.8
2025 Safenlp 2024	821	UNSAT	8.80	-	-	-	-	-	17.8
2025 Safenlp 2024	822	SAT	6.96	6.96	6.10	12.2	-	1.25	18.2
2025 Safenlp 2024	823	UNSAT	8.33	8.57	-	-	-	-	18.2
2025 Safenlp 2024	824	UNSAT	7.26	8.36	-	14.2	-	11.1	17.8
2025 Safenlp 2024	825	UNSAT	6.78	8.01	6.14	12.2	-	1.25	17.8
2025 Safenlp 2024	826	SAT	6.77	6.00	6.08	12.2	15.1	1.25	-
2025 Safenlp 2024	827	UNSAT	6.79	8.99	6.11	12.9	-	-	18.3
2025 Safenlp 2024	828	UNSAT	7.13	8.19	19.5	15.0	-	7.11	18.3
2025 Safenlp 2024	829	UNSAT	6.79	8.06	6.08	12.2	-	1.24	17.7
2025 Safenlp 2024	830	SAT	6.66	5.94	6.04	12.3	14.9	1.29	17.9
2025 Safenlp 2024	831	UNSAT	7.85	8.47	-	-	-	-	17.9
2025 Safenlp 2024	832	SAT	6.62	6.08	6.07	12.2	-	1.27	-
2025 Safenlp 2024	833	UNSAT	6.28	7.90	6.37	12.0	16.6	1.10	17.6
2025 Safenlp 2024	834	UNSAT	6.82	7.97	6.12	11.2	-	1.23	17.7
2025 Safenlp 2024	835	UNSAT	6.80	7.99	6.08	12.2	-	1.26	18.0
2025 Safenlp 2024	836	UNSAT	6.24	7.92	6.35	11.0	16.6	1.08	17.8
2025 Safenlp 2024	837	UNSAT	6.71	9.22	6.12	-	-	-	17.6
2025 Safenlp 2024	838	UNSAT	6.68	8.97	6.10	12.2	-	1.23	17.7
2025 Safenlp 2024	839	UNSAT	7.26	8.11	-	15.8	-	-	17.6
2025 Safenlp 2024	840	UNSAT	6.84	7.90	6.10	11.2	-	1.27	18.1
2025 Safenlp 2024	841	UNSAT	6.80	8.02	6.09	11.2	-	1.23	17.8
2025 Safenlp 2024	842	SAT	6.75	5.99	6.09	12.3	14.7	1.25	18.0
2025 Safenlp 2024	843	SAT	6.69	5.97	6.05	12.2	14.9	1.25	17.8
2025 Safenlp 2024	844	UNSAT	13.3	38.1	-	-	-	-	18.0
2025 Safenlp 2024	845	UNSAT	7.28	8.00	7.39	13.6	-	2.09	17.5
2025 Safenlp 2024	846	UNSAT	6.88	9.21	6.07	14.5	-	2.11	17.8
2025 Safenlp 2024	847	SAT	6.57	5.97	6.10	11.2	15.3	1.22	17.7
2025 Safenlp 2024	848	UNSAT	6.71	7.97	6.10	12.2	-	1.23	17.8
2025 Safenlp 2024	849	UNSAT	7.70	8.44	21.8	-	-	-	17.8
2025 Safenlp 2024	850	UNSAT	6.85	8.87	6.09	12.2	-	1.25	17.9
2025 Safenlp 2024	851	UNSAT	6.60	7.96	6.09	12.2	-	1.23	17.8
2025 Safenlp 2024	852	UNSAT	7.40	8.12	11.5	14.0	-	2.76	17.5
2025 Safenlp 2024	853	SAT	6.89	6.57	6.09	12.2	-	1.22	17.9
2025 Safenlp 2024	854	UNSAT	6.67	8.01	6.08	12.2	-	1.22	17.6
2025 Safenlp 2024	855	UNSAT	6.22	7.95	6.37	11.0	16.5	1.08	17.5
2025 Safenlp 2024	856	SAT	6.90	7.54	6.12	12.2	-	1.26	✗
2025 Safenlp 2024	857	UNSAT	7.21	7.98	7.01	12.8	-	1.75	17.7
2025 Safenlp 2024	858	UNSAT	11.9	34.8	-	-	-	-	17.8
2025 Safenlp 2024	859	UNSAT	6.80	9.27	6.12	13.2	-	1.60	17.9
2025 Safenlp 2024	860	UNSAT	6.61	7.98	6.11	11.1	-	1.24	17.9
2025 Safenlp 2024	861	UNSAT	7.55	8.65	-	-	-	20.3	17.7
2025 Safenlp 2024	862	UNSAT	7.18	8.17	22.8	26.5	-	4.09	17.7

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	863	SAT	6.82	7.78	6.11	11.2	14.9	1.26	18.2
2025 Safenlp 2024	864	UNSAT	7.39	8.07	9.97	13.7	-	2.18	-
2025 Safenlp 2024	865	SAT	6.68	5.97	6.07	12.2	-	1.23	-
2025 Safenlp 2024	866	UNSAT	6.65	8.03	6.10	12.2	-	1.23	17.7
2025 Safenlp 2024	867	UNSAT	6.32	7.92	6.37	12.0	16.4	1.12	17.5
2025 Safenlp 2024	868	UNSAT	6.38	7.97	6.44	12.7	16.7	1.08	17.6
2025 Safenlp 2024	869	UNSAT	7.28	8.23	24.2	-	-	3.06	17.8
2025 Safenlp 2024	870	UNSAT	6.74	8.00	6.11	11.2	-	1.25	17.6
2025 Safenlp 2024	871	UNSAT	7.28	8.02	9.36	13.4	-	3.68	19.3
2025 Safenlp 2024	872	UNSAT	7.65	8.48	-	-	-	15.7	17.8
2025 Safenlp 2024	873	UNSAT	6.26	7.95	6.37	12.0	16.5	1.13	17.8
2025 Safenlp 2024	874	SAT	6.78	5.95	6.05	11.2	14.9	1.23	17.8
2025 Safenlp 2024	875	UNSAT	6.53	8.97	6.11	11.7	-	1.71	17.9
2025 Safenlp 2024	876	UNSAT	6.27	7.96	6.34	10.9	16.7	1.08	17.6
2025 Safenlp 2024	877	UNSAT	6.76	7.88	6.14	12.2	-	1.25	18.2
2025 Safenlp 2024	878	UNSAT	6.80	7.99	6.08	12.2	-	1.25	17.7
2025 Safenlp 2024	879	SAT	6.83	5.94	6.07	12.2	14.8	1.22	17.7
2025 Safenlp 2024	880	UNSAT	6.27	7.89	6.35	12.0	16.3	1.09	17.5
2025 Safenlp 2024	881	SAT	6.61	5.99	6.04	12.2	14.9	1.25	17.9
2025 Safenlp 2024	882	UNSAT	6.85	8.00	6.11	12.2	-	1.24	18.3
2025 Safenlp 2024	883	UNSAT	8.66	9.20	-	-	-	-	18.0
2025 Safenlp 2024	884	UNSAT	6.30	7.92	6.35	11.0	16.5	1.08	19.2
2025 Safenlp 2024	885	UNSAT	6.82	9.21	6.08	14.0	-	2.00	17.8
2025 Safenlp 2024	886	UNSAT	6.87	8.00	6.14	11.8	-	1.24	17.8
2025 Safenlp 2024	887	UNSAT	6.82	8.93	6.06	12.2	-	1.24	18.1
2025 Safenlp 2024	888	UNSAT	6.84	8.00	6.08	12.3	-	1.32	18.0
2025 Safenlp 2024	889	SAT	6.71	5.96	6.06	12.2	15.3	1.28	17.9
2025 Safenlp 2024	890	UNSAT	7.75	8.42	-	24.3	-	-	19.3
2025 Safenlp 2024	891	UNSAT	6.65	7.98	6.12	12.3	-	1.23	-
2025 Safenlp 2024	892	SAT	6.64	5.99	6.11	12.3	14.8	1.24	17.8
2025 Safenlp 2024	893	UNSAT	6.40	7.94	6.36	12.0	16.3	1.07	18.0
2025 Safenlp 2024	894	SAT	6.76	6.03	6.10	11.2	14.9	1.24	-
2025 Safenlp 2024	895	SAT	6.81	5.99	6.09	12.2	-	1.23	✗
2025 Safenlp 2024	896	SAT	6.95	6.00	6.07	11.3	-	1.27	18.1
2025 Safenlp 2024	897	UNSAT	7.26	8.25	18.1	-	-	-	17.8
2025 Safenlp 2024	898	UNSAT	7.10	8.03	6.62	11.5	-	1.27	17.6
2025 Safenlp 2024	899	SAT	6.47	5.92	6.05	11.2	15.0	1.12	19.2
2025 Safenlp 2024	900	SAT	6.77	5.93	6.03	12.2	14.8	1.24	17.9
2025 Safenlp 2024	901	UNSAT	6.83	8.02	6.07	13.5	-	1.25	19.1
2025 Safenlp 2024	902	UNSAT	6.80	8.00	6.10	12.2	-	1.25	17.8
2025 Safenlp 2024	903	SAT	6.79	5.96	6.12	11.2	15.1	1.25	18.1
2025 Safenlp 2024	904	UNSAT	13.1	-	-	-	-	-	17.5
2025 Safenlp 2024	905	UNSAT	6.28	8.05	6.39	11.9	16.4	1.07	17.4
2025 Safenlp 2024	906	SAT	6.57	6.10	6.09	12.2	-	1.30	17.8
2025 Safenlp 2024	907	SAT	6.79	5.96	6.04	12.1	14.9	1.09	17.7
2025 Safenlp 2024	908	UNSAT	6.44	7.89	6.50	11.8	16.6	1.07	17.5
2025 Safenlp 2024	909	UNSAT	8.29	9.31	-	-	-	-	17.7
2025 Safenlp 2024	910	UNSAT	7.26	8.07	15.5	13.6	-	3.77	17.6
2025 Safenlp 2024	911	UNSAT	6.64	8.98	6.09	11.2	-	1.23	17.7
2025 Safenlp 2024	912	UNSAT	6.30	7.93	6.40	12.0	17.1	1.08	17.8
2025 Safenlp 2024	913	UNSAT	7.06	7.97	7.79	13.2	-	1.83	17.5
2025 Safenlp 2024	914	UNSAT	6.29	7.96	6.36	12.0	16.5	1.07	17.6
2025 Safenlp 2024	915	UNSAT	6.83	7.88	6.08	12.2	-	1.24	19.2
2025 Safenlp 2024	916	SAT	6.71	5.98	6.03	12.2	14.8	1.23	19.2
2025 Safenlp 2024	917	UNSAT	6.84	8.01	6.11	12.2	-	1.24	-
2025 Safenlp 2024	918	UNSAT	6.77	8.95	6.09	11.2	-	1.26	19.3
2025 Safenlp 2024	919	UNSAT	6.30	7.94	6.37	12.0	16.6	1.07	17.5
2025 Safenlp 2024	920	UNSAT	6.74	7.88	6.12	11.2	-	1.23	17.8
2025 Safenlp 2024	921	UNSAT	6.26	7.93	6.38	11.9	16.7	1.07	19.2
2025 Safenlp 2024	922	UNSAT	6.67	8.96	6.08	11.2	-	1.25	18.0
2025 Safenlp 2024	923	SAT	6.50	5.96	6.03	11.2	-	1.23	17.6
2025 Safenlp 2024	924	UNSAT	6.60	7.98	6.12	12.2	-	1.39	17.7
2025 Safenlp 2024	925	UNSAT	7.90	11.7	-	-	-	-	17.8
2025 Safenlp 2024	926	UNSAT	6.58	8.01	6.09	11.2	-	1.26	17.9
2025 Safenlp 2024	927	UNSAT	7.71	9.64	6.10	13.0	-	-	19.3
2025 Safenlp 2024	928	SAT	6.71	5.98	6.05	12.3	14.9	1.25	17.9
2025 Safenlp 2024	929	UNSAT	6.73	8.89	6.09	12.2	-	1.22	18.2
2025 Safenlp 2024	930	UNSAT	7.73	8.37	-	-	-	-	19.1

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	931	UNSAT	11.4	19.3	-	-	-	-	18.1
2025 Safenlp 2024	932	SAT	6.81	6.01	6.06	12.2	15.0	1.26	18.0
2025 Safenlp 2024	933	UNSAT	7.28	8.00	6.56	12.4	-	1.47	17.5
2025 Safenlp 2024	934	SAT	6.81	6.19	6.09	12.2	-	1.26	✗
2025 Safenlp 2024	935	SAT	6.80	5.99	6.05	12.2	14.9	1.27	18.0
2025 Safenlp 2024	936	UNSAT	8.38	9.47	-	-	-	-	17.7
2025 Safenlp 2024	937	SAT	6.87	6.34	6.09	12.2	-	1.23	17.8
2025 Safenlp 2024	938	UNSAT	6.30	7.89	6.36	12.0	16.6	1.08	17.4
2025 Safenlp 2024	939	SAT	6.76	6.01	6.06	11.2	15.0	1.31	17.9
2025 Safenlp 2024	940	UNSAT	6.25	7.96	6.37	11.0	16.8	1.07	17.4
2025 Safenlp 2024	941	UNSAT	9.49	27.0	-	-	-	-	17.8
2025 Safenlp 2024	942	UNSAT	6.81	8.02	6.09	12.7	-	1.25	18.0
2025 Safenlp 2024	943	UNSAT	6.61	8.21	6.12	12.8	-	2.44	17.5
2025 Safenlp 2024	944	UNSAT	7.49	8.91	-	-	-	-	17.8
2025 Safenlp 2024	945	UNSAT	6.81	-	6.09	12.2	-	1.30	18.5
2025 Safenlp 2024	946	SAT	6.71	5.95	6.05	12.2	14.9	1.23	17.8
2025 Safenlp 2024	947	SAT	6.50	5.92	6.06	12.2	14.8	1.24	17.7
2025 Safenlp 2024	948	SAT	6.52	5.97	6.03	12.2	14.9	1.26	18.0
2025 Safenlp 2024	949	UNSAT	6.87	7.96	6.09	12.2	-	1.84	17.9
2025 Safenlp 2024	950	UNSAT	6.83	9.03	6.12	12.5	-	1.24	18.1
2025 Safenlp 2024	951	UNSAT	6.70	9.01	6.10	13.1	-	1.80	17.9
2025 Safenlp 2024	952	UNSAT	6.68	8.17	6.08	13.5	-	2.23	18.1
2025 Safenlp 2024	953	UNSAT	6.85	9.20	6.11	12.5	-	1.47	18.0
2025 Safenlp 2024	954	UNSAT	7.37	8.08	10.5	13.3	-	2.09	17.5
2025 Safenlp 2024	955	UNSAT	7.19	8.01	7.08	12.0	-	1.93	17.5
2025 Safenlp 2024	956	UNSAT	6.24	7.99	6.35	11.9	16.3	1.07	19.0
2025 Safenlp 2024	957	UNSAT	6.84	7.97	6.14	12.2	-	1.26	18.3
2025 Safenlp 2024	958	UNSAT	6.35	7.97	6.37	12.0	16.9	1.07	18.1
2025 Safenlp 2024	959	UNSAT	6.56	7.96	6.10	12.2	-	1.26	17.6
2025 Safenlp 2024	960	SAT	6.61	6.36	6.13	12.2	-	1.23	-
2025 Safenlp 2024	961	UNSAT	6.32	7.94	6.40	12.0	16.5	1.07	17.7
2025 Safenlp 2024	962	UNSAT	6.23	7.93	6.39	11.0	16.5	1.07	17.6
2025 Safenlp 2024	963	UNSAT	6.81	8.20	6.12	12.7	-	1.24	18.6
2025 Safenlp 2024	964	UNSAT	6.83	8.97	6.12	16.5	-	-	17.8
2025 Safenlp 2024	965	UNSAT	6.31	7.96	6.38	12.0	16.7	1.08	17.6
2025 Safenlp 2024	966	UNSAT	6.53	7.99	6.09	12.2	-	1.27	17.9
2025 Safenlp 2024	967	UNSAT	6.86	8.12	6.09	12.2	-	1.24	17.8
2025 Safenlp 2024	968	UNSAT	7.62	8.33	-	-	-	-	17.8
2025 Safenlp 2024	969	UNSAT	7.09	8.05	7.11	13.5	-	1.77	17.7
2025 Safenlp 2024	970	UNSAT	6.81	8.03	6.10	12.2	-	1.25	17.7
2025 Safenlp 2024	971	UNSAT	6.90	8.07	6.08	12.2	-	1.25	-
2025 Safenlp 2024	972	UNSAT	6.88	7.93	6.11	11.5	-	1.25	18.0
2025 Safenlp 2024	973	SAT	6.80	7.21	6.09	12.2	-	1.25	17.6
2025 Safenlp 2024	974	SAT	6.63	7.89	6.13	11.2	14.7	1.26	18.1
2025 Safenlp 2024	975	UNSAT	6.81	8.97	6.11	12.3	-	1.28	18.0
2025 Safenlp 2024	976	UNSAT	7.30	8.02	10.1	13.5	-	2.24	18.2
2025 Safenlp 2024	977	UNSAT	7.41	8.11	14.6	16.5	-	3.01	17.7
2025 Safenlp 2024	978	UNSAT	6.82	8.94	6.11	12.1	-	1.24	19.6
2025 Safenlp 2024	979	UNSAT	6.87	8.00	6.08	11.2	-	1.24	18.2
2025 Safenlp 2024	980	UNSAT	6.71	7.99	6.12	12.8	-	1.59	19.3
2025 Safenlp 2024	981	UNSAT	6.75	9.09	6.10	11.2	-	1.43	18.2
2025 Safenlp 2024	982	SAT	6.74	7.80	6.09	12.2	-	1.23	✗
2025 Safenlp 2024	983	UNSAT	6.32	7.91	6.35	12.0	16.7	1.08	17.6
2025 Safenlp 2024	984	UNSAT	6.31	7.95	6.39	12.0	16.3	1.10	17.5
2025 Safenlp 2024	985	UNSAT	6.74	8.98	6.09	12.2	-	1.31	17.9
2025 Safenlp 2024	986	UNSAT	6.62	8.00	6.11	11.7	-	1.24	17.6
2025 Safenlp 2024	987	UNSAT	6.52	8.98	6.09	12.2	-	1.28	-
2025 Safenlp 2024	988	UNSAT	6.56	8.00	6.11	12.2	-	1.25	17.8
2025 Safenlp 2024	989	UNSAT	7.26	7.98	7.80	13.3	-	2.27	17.7
2025 Safenlp 2024	990	UNSAT	7.03	8.99	6.08	12.3	-	1.23	17.6
2025 Safenlp 2024	991	UNSAT	6.81	9.02	6.10	12.2	-	1.25	18.2
2025 Safenlp 2024	992	UNSAT	7.27	8.03	9.21	14.3	-	1.78	-
2025 Safenlp 2024	993	SAT	6.50	5.96	6.06	12.2	15.0	1.23	17.6
2025 Safenlp 2024	994	UNSAT	6.31	7.90	6.37	12.0	16.7	1.08	17.6
2025 Safenlp 2024	995	UNSAT	6.83	8.00	6.11	12.7	-	1.43	17.9
2025 Safenlp 2024	996	UNSAT	6.28	7.98	6.39	11.9	16.4	1.09	17.6
2025 Safenlp 2024	997	UNSAT	6.59	9.07	6.11	12.4	-	1.76	17.6
2025 Safenlp 2024	998	UNSAT	6.81	8.09	6.11	12.2	-	1.24	18.1

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	999	UNSAT	6.65	8.00	6.14	12.7	-	1.29	17.7
2025 Safenlp 2024	1000	SAT	6.47	5.96	6.08	12.2	14.9	1.27	19.2
2025 Safenlp 2024	1001	UNSAT	6.27	7.93	6.36	11.0	16.7	1.13	17.7
2025 Safenlp 2024	1002	UNSAT	6.65	8.94	6.11	11.6	-	1.26	17.8
2025 Safenlp 2024	1003	UNSAT	6.68	8.04	6.11	12.2	-	1.27	17.7
2025 Safenlp 2024	1004	UNSAT	6.34	7.95	6.39	12.0	16.6	1.08	17.5
2025 Safenlp 2024	1005	UNSAT	6.62	8.95	6.11	12.4	-	1.23	17.7
2025 Safenlp 2024	1006	UNSAT	6.68	8.11	6.09	12.9	-	1.98	17.9
2025 Safenlp 2024	1007	UNSAT	6.82	8.92	6.10	12.2	-	1.31	17.9
2025 Safenlp 2024	1008	UNSAT	6.74	8.03	6.11	12.7	-	1.24	-
2025 Safenlp 2024	1009	SAT	6.84	8.90	6.09	11.2	-	1.27	17.8
2025 Safenlp 2024	1010	UNSAT	6.36	7.89	6.39	11.9	16.5	1.07	17.6
2025 Safenlp 2024	1011	UNSAT	7.19	8.27	-	16.5	-	19.3	17.8
2025 Safenlp 2024	1012	UNSAT	6.80	8.96	6.11	12.2	-	1.22	17.8
2025 Safenlp 2024	1013	UNSAT	6.80	7.99	6.10	12.2	-	1.26	17.8
2025 Safenlp 2024	1014	UNSAT	6.82	7.95	6.09	12.2	-	1.24	17.7
2025 Safenlp 2024	1015	UNSAT	7.36	8.04	17.4	14.3	-	13.8	17.8
2025 Safenlp 2024	1016	UNSAT	6.64	7.96	6.09	12.2	-	1.25	17.5
2025 Safenlp 2024	1017	SAT	6.71	7.30	6.06	11.2	-	1.23	✗
2025 Safenlp 2024	1018	SAT	6.80	6.27	6.08	12.3	-	1.27	18.0
2025 Safenlp 2024	1019	UNSAT	6.84	7.97	6.06	12.2	-	1.24	17.7
2025 Safenlp 2024	1020	UNSAT	7.39	8.02	7.73	13.8	-	2.16	17.6
2025 Safenlp 2024	1021	UNSAT	6.57	9.03	6.09	12.2	-	1.25	17.5
2025 Safenlp 2024	1022	UNSAT	6.68	8.01	6.09	13.0	-	1.26	19.3
2025 Safenlp 2024	1023	UNSAT	7.25	8.04	6.66	12.7	-	1.28	17.7
2025 Safenlp 2024	1024	SAT	6.55	5.95	6.06	12.2	15.1	1.23	17.8
2025 Safenlp 2024	1025	UNSAT	7.09	8.00	6.60	12.7	-	1.28	19.5
2025 Safenlp 2024	1026	UNSAT	7.20	8.27	13.1	14.2	-	2.94	17.8
2025 Safenlp 2024	1027	UNSAT	6.76	7.98	6.09	11.3	-	1.25	17.6
2025 Safenlp 2024	1028	UNSAT	6.78	7.94	6.11	11.2	-	1.25	17.7
2025 Safenlp 2024	1029	SAT	6.77	6.02	6.16	11.1	15.1	1.28	17.9
2025 Safenlp 2024	1030	UNSAT	7.12	7.97	6.65	12.5	-	1.29	17.6
2025 Safenlp 2024	1031	UNSAT	7.02	7.99	7.19	13.0	-	1.89	17.4
2025 Safenlp 2024	1032	UNSAT	6.68	8.96	6.10	12.2	-	1.23	17.9
2025 Safenlp 2024	1033	UNSAT	6.59	8.99	6.12	12.2	-	1.24	-
2025 Safenlp 2024	1034	UNSAT	6.27	7.88	6.36	11.9	16.9	1.08	19.5
2025 Safenlp 2024	1035	UNSAT	7.45	8.57	-	29.1	-	14.3	17.7
2025 Safenlp 2024	1036	UNSAT	6.30	7.90	6.38	10.9	16.6	1.08	17.8
2025 Safenlp 2024	1037	UNSAT	6.24	7.92	6.38	12.0	16.4	1.07	17.5
2025 Safenlp 2024	1038	UNSAT	7.62	9.76	-	-	-	-	19.2
2025 Safenlp 2024	1039	UNSAT	6.65	8.02	6.09	11.2	-	1.27	18.1
2025 Safenlp 2024	1040	UNSAT	6.65	8.96	6.07	12.5	-	1.37	17.6
2025 Safenlp 2024	1041	SAT	6.78	8.97	6.08	12.2	14.8	1.24	17.8
2025 Safenlp 2024	1042	SAT	6.70	5.95	6.04	12.2	14.8	1.25	17.9
2025 Safenlp 2024	1043	UNSAT	6.84	9.01	6.14	12.2	-	1.22	19.3
2025 Safenlp 2024	1044	UNSAT	7.05	7.99	8.54	12.8	-	1.96	17.5
2025 Safenlp 2024	1045	UNSAT	6.78	8.90	6.06	12.3	-	1.24	17.6
2025 Safenlp 2024	1046	UNSAT	7.32	8.02	6.87	12.9	-	1.74	17.6
2025 Safenlp 2024	1047	SAT	6.75	6.50	6.10	12.3	-	1.24	19.3
2025 Safenlp 2024	1048	UNSAT	7.74	8.96	-	-	-	-	17.6
2025 Safenlp 2024	1049	SAT	6.75	5.96	6.08	12.2	-	1.24	17.8
2025 Safenlp 2024	1050	UNSAT	6.82	7.98	6.10	11.2	-	1.23	18.4
2025 Safenlp 2024	1051	SAT	6.81	7.14	6.11	11.3	-	1.25	17.9
2025 Safenlp 2024	1052	SAT	6.78	6.10	6.12	12.3	-	1.25	18.0
2025 Safenlp 2024	1053	UNSAT	6.27	7.93	6.37	11.0	16.4	1.07	17.6
2025 Safenlp 2024	1054	SAT	6.76	7.97	6.09	12.2	14.8	1.26	18.2
2025 Safenlp 2024	1055	SAT	6.62	6.06	6.08	12.2	14.9	1.26	17.9
2025 Safenlp 2024	1056	SAT	6.61	6.06	6.11	11.3	-	1.24	17.8
2025 Safenlp 2024	1057	UNSAT	6.78	8.93	6.10	13.5	-	1.42	17.6
2025 Safenlp 2024	1058	UNSAT	7.19	8.28	20.3	21.0	-	19.4	18.4
2025 Safenlp 2024	1059	UNSAT	6.71	7.99	6.10	12.2	-	1.28	17.7
2025 Safenlp 2024	1060	UNSAT	6.58	9.00	6.10	12.3	-	1.23	17.8
2025 Safenlp 2024	1061	UNSAT	6.74	9.20	6.07	12.5	-	1.70	18.0
2025 Safenlp 2024	1062	UNSAT	6.83	7.98	6.10	12.3	-	1.24	19.7
2025 Safenlp 2024	1063	UNSAT	6.29	7.99	6.37	10.9	16.7	1.07	17.5
2025 Safenlp 2024	1064	UNSAT	6.79	7.93	6.06	12.2	-	1.25	17.6
2025 Safenlp 2024	1065	UNSAT	7.30	7.98	7.15	12.7	-	1.51	17.6
2025 Safenlp 2024	1066	UNSAT	6.67	8.92	6.12	12.2	-	1.24	17.7

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Safenlp 2024	1067	SAT	6.48	6.24	6.08	12.2	-	1.23	17.7
2025 Safenlp 2024	1068	UNSAT	6.27	7.93	6.36	10.9	16.5	1.07	17.8
2025 Safenlp 2024	1069	UNSAT	6.82	8.01	6.09	11.2	-	1.22	17.7
2025 Safenlp 2024	1070	SAT	6.67	6.11	6.02	12.2	15.0	1.26	17.8
2025 Safenlp 2024	1071	UNSAT	7.74	8.53	-	-	-	-	17.9
2025 Safenlp 2024	1072	SAT	6.77	5.95	6.05	12.2	15.2	1.25	17.8
2025 Safenlp 2024	1073	UNSAT	6.79	8.13	6.11	12.2	-	1.25	17.8
2025 Safenlp 2024	1074	SAT	6.78	5.93	6.02	12.2	15.0	1.26	18.3
2025 Safenlp 2024	1075	UNSAT	6.79	8.99	6.07	11.2	-	1.25	17.6
2025 Safenlp 2024	1076	UNSAT	6.60	8.95	6.09	12.2	-	1.25	19.7
2025 Safenlp 2024	1077	SAT	6.65	6.03	6.10	12.2	-	1.24	18.3
2025 Safenlp 2024	1078	UNSAT	6.95	7.88	6.76	12.7	-	1.38	17.6
2025 Safenlp 2024	1079	UNSAT	6.77	8.84	6.10	12.1	-	1.23	18.0
2025 Sat Relu	0	SAT	6.09	8.74	6.13	12.2	-	1.12	-
2025 Sat Relu	1	UNSAT	6.76	16.3	-	12.0	-	-	-
2025 Sat Relu	2	SAT	6.07	8.62	6.18	12.1	14.6	2.50	✗
2025 Sat Relu	3	UNSAT	6.60	16.4	-	13.5	-	-	-
2025 Sat Relu	4	SAT	6.10	8.68	6.22	12.2	-	-	✗
2025 Sat Relu	5	UNSAT	6.69	16.4	-	13.5	-	-	-
2025 Sat Relu	6	SAT	5.99	8.57	6.14	12.7	14.6	1.10	17.5
2025 Sat Relu	7	UNSAT	6.53	16.2	23.2	13.2	-	1.74	-
2025 Sat Relu	8	SAT	6.09	8.84	6.29	11.2	-	-	✗
2025 Sat Relu	9	UNSAT	6.64	16.5	-	12.5	-	-	-
2025 Sat Relu	10	SAT	6.04	8.65	6.14	12.7	-	1.07	✗
2025 Sat Relu	11	UNSAT	6.46	16.2	7.61	12.7	96.9	1.11	-
2025 Sat Relu	12	SAT	6.08	8.69	6.15	12.7	-	1.08	✗
2025 Sat Relu	13	UNSAT	6.71	16.2	7.52	12.8	97.4	1.11	-
2025 Sat Relu	14	SAT	6.09	8.64	6.35	12.2	-	-	✗
2025 Sat Relu	15	UNSAT	6.80	16.5	-	13.0	-	-	-
2025 Sat Relu	16	SAT	6.07	8.71	6.18	11.2	-	2.32	✗
2025 Sat Relu	17	UNSAT	6.58	16.4	-	13.5	-	-	-
2025 Sat Relu	18	SAT	5.99	8.56	6.16	11.7	14.6	1.10	19.3
2025 Sat Relu	19	UNSAT	6.59	16.3	-	13.0	-	-	-
2025 Sat Relu	20	SAT	6.05	8.69	6.20	12.2	14.4	4.21	23.3
2025 Sat Relu	21	UNSAT	6.62	16.4	-	13.0	-	-	-
2025 Sat Relu	22	SAT	6.07	8.64	6.23	12.3	-	2.94	✗
2025 Sat Relu	23	UNSAT	6.63	16.4	-	13.5	-	-	-
2025 Sat Relu	24	SAT	6.10	8.69	6.12	12.7	-	1.09	✗
2025 Sat Relu	25	UNSAT	6.78	16.4	-	12.1	-	11.0	-
2025 Sat Relu	26	SAT	6.08	8.57	6.19	12.2	-	-	✗
2025 Sat Relu	27	UNSAT	6.68	16.5	-	13.3	-	-	-
2025 Sat Relu	28	SAT	6.06	12.4	6.30	12.2	-	-	✗
2025 Sat Relu	29	UNSAT	6.72	16.5	-	13.7	-	-	-
2025 Sat Relu	30	SAT	6.03	8.70	6.10	12.2	14.7	1.09	21.2
2025 Sat Relu	31	UNSAT	6.52	16.4	-	13.0	-	-	-
2025 Sat Relu	32	SAT	6.10	8.70	6.20	12.2	-	-	-
2025 Sat Relu	33	UNSAT	6.64	16.5	-	12.6	-	-	-
2025 Sat Relu	34	SAT	6.11	8.74	6.16	12.2	-	1.90	✗
2025 Sat Relu	35	UNSAT	6.65	16.5	-	13.2	-	-	-
2025 Sat Relu	36	SAT	6.04	12.3	6.18	12.7	15.2	1.57	✗
2025 Sat Relu	37	UNSAT	6.91	16.5	-	13.3	-	-	-
2025 Sat Relu	38	SAT	6.00	8.70	6.15	12.2	14.7	1.14	21.7
2025 Sat Relu	39	UNSAT	6.70	16.7	-	13.0	-	-	-
2025 Sat Relu	40	SAT	6.06	8.84	6.15	12.2	-	2.03	✗
2025 Sat Relu	41	UNSAT	6.60	16.4	-	13.2	-	-	-
2025 Sat Relu	42	SAT	6.07	8.88	6.21	11.7	-	4.12	✗
2025 Sat Relu	43	UNSAT	6.61	16.5	-	13.5	-	-	-
2025 Sat Relu	44	SAT	6.06	8.67	6.14	12.7	-	1.07	✗
2025 Sat Relu	45	UNSAT	6.46	16.2	8.25	13.0	-	1.36	-
2025 Sat Relu	46	SAT	6.06	8.72	6.18	12.3	-	-	-
2025 Sat Relu	47	UNSAT	6.65	16.4	-	13.6	-	-	-
2025 Sat Relu	48	SAT	6.02	8.86	6.20	11.7	14.3	-	26.5
2025 Sat Relu	49	UNSAT	6.92	16.4	-	13.4	-	-	-
2025 Sat Relu	50	SAT	6.05	8.73	6.17	12.2	14.9	1.80	✗
2025 Sat Relu	51	UNSAT	6.63	16.5	-	13.3	-	-	-
2025 Sat Relu	52	SAT	6.09	8.67	6.11	12.3	-	1.08	✗
2025 Sat Relu	53	UNSAT	6.45	16.2	6.81	12.7	-	1.25	-
2025 Sat Relu	54	SAT	6.07	8.58	6.14	12.2	-	1.11	✗

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Sat Relu	55	UNSAT	6.47	16.2	7.31	12.7	-	1.20	-
2025 Sat Relu	56	SAT	6.03	8.70	6.25	12.2	14.7	4.49	22.2
2025 Sat Relu	57	UNSAT	6.63	16.4	-	12.3	-	-	-
2025 Sat Relu	58	SAT	6.06	8.73	6.26	12.3	-	-	✗
2025 Sat Relu	59	UNSAT	6.68	16.5	-	13.5	-	-	-
2025 Sat Relu	60	SAT	6.08	8.56	6.16	12.3	-	1.22	✗
2025 Sat Relu	61	UNSAT	6.84	16.5	-	12.3	-	-	-
2025 Sat Relu	62	SAT	6.07	8.73	6.36	12.2	-	-	✗
2025 Sat Relu	63	UNSAT	6.78	16.6	-	13.8	-	-	-
2025 Sat Relu	64	SAT	6.11	8.61	6.36	12.2	-	-	✗
2025 Sat Relu	65	UNSAT	6.74	16.5	-	12.8	-	-	-
2025 Sat Relu	66	SAT	6.08	8.62	6.23	11.2	-	-	✗
2025 Sat Relu	67	UNSAT	6.61	16.4	-	13.6	-	-	-
2025 Sat Relu	68	SAT	6.03	8.71	6.13	12.2	14.2	1.08	✗
2025 Sat Relu	69	UNSAT	6.48	16.2	19.5	13.0	-	-	-
2025 Sat Relu	70	SAT	6.05	8.70	6.15	11.2	-	1.30	✗
2025 Sat Relu	71	UNSAT	6.70	16.4	-	13.3	-	-	-
2025 Sat Relu	72	SAT	6.07	8.70	6.19	12.2	-	-	✗
2025 Sat Relu	73	UNSAT	6.90	16.4	-	13.3	-	-	-
2025 Sat Relu	74	SAT	6.06	8.64	6.15	12.2	-	1.09	-
2025 Sat Relu	75	UNSAT	6.52	16.2	56.9	13.3	-	2.22	-
2025 Sat Relu	76	SAT	6.06	8.57	6.18	12.2	14.7	1.14	-
2025 Sat Relu	77	UNSAT	6.59	16.5	-	13.0	-	-	-
2025 Sat Relu	78	SAT	6.01	8.70	6.24	11.2	-	4.96	✗
2025 Sat Relu	79	UNSAT	6.62	16.4	-	13.8	-	-	-
2025 Sat Relu	80	SAT	6.12	8.68	6.17	12.2	-	1.75	✗
2025 Sat Relu	81	UNSAT	6.63	16.4	-	13.3	-	-	-
2025 Sat Relu	82	SAT	6.12	8.66	6.19	12.2	-	1.39	✗
2025 Sat Relu	83	UNSAT	6.60	16.6	-	13.3	-	-	-
2025 Sat Relu	84	SAT	6.08	12.5	6.31	11.2	-	-	✗
2025 Sat Relu	85	UNSAT	6.99	16.6	-	13.8	-	-	-
2025 Sat Relu	86	SAT	6.09	8.79	6.18	12.2	14.7	2.95	✗
2025 Sat Relu	87	UNSAT	6.61	16.4	-	12.4	-	-	-
2025 Sat Relu	88	SAT	6.05	8.68	6.18	12.2	14.9	10.6	30.1
2025 Sat Relu	89	UNSAT	6.70	16.5	-	13.3	-	-	-
2025 Sat Relu	90	SAT	6.09	8.66	6.23	11.3	-	3.43	✗
2025 Sat Relu	91	UNSAT	6.60	16.5	-	12.5	-	-	-
2025 Sat Relu	92	SAT	6.05	8.72	6.15	12.2	-	1.40	-
2025 Sat Relu	93	UNSAT	6.63	16.4	-	13.3	-	-	-
2025 Sat Relu	94	SAT	6.07	8.68	6.15	11.2	-	1.07	-
2025 Sat Relu	95	UNSAT	6.45	16.2	32.6	13.0	-	4.31	-
2025 Sat Relu	96	SAT	6.03	8.73	6.20	12.3	14.5	-	24.6
2025 Sat Relu	97	UNSAT	6.88	16.4	-	13.6	-	-	-
2025 Sat Relu	98	SAT	6.03	8.73	6.19	11.3	15.0	1.30	27.9
2025 Sat Relu	99	UNSAT	6.74	17.2	-	13.3	-	-	-
2025 Soundnessbench	0	UNSAT	106	83.8	-	-	-	-	-
2025 Soundnessbench	1	UNSAT	99.1	9.69	-	-	-	-	-
2025 Soundnessbench	2	UNSAT	50.4	9.46	-	-	-	-	-
2025 Soundnessbench	3	UNSAT	50.4	9.25	-	-	-	-	-
2025 Soundnessbench	4	UNSAT	66.7	16.2	-	-	-	-	-
2025 Soundnessbench	5	UNSAT	105	83.7	-	-	-	-	-
2025 Soundnessbench	6	UNSAT	106	85.3	-	-	-	-	-
2025 Soundnessbench	7	UNSAT	37.8	9.82	-	-	-	-	-
2025 Soundnessbench	8	UNSAT	116	84.0	-	15.2	-	-	-
2025 Soundnessbench	9	UNSAT	104	10.1	-	-	-	-	-
2025 Soundnessbench	10	UNSAT	118	10.1	-	-	-	-	-
2025 Soundnessbench	11	UNSAT	49.0	9.34	-	-	-	-	-
2025 Soundnessbench	12	UNSAT	109	-	-	12.3	-	-	-
2025 Soundnessbench	13	UNSAT	121	84.0	-	-	-	-	-
2025 Soundnessbench	14	UNSAT	98.1	-	-	15.0	-	-	-
2025 Soundnessbench	15	UNSAT	96.3	84.0	-	-	-	-	-
2025 Soundnessbench	16	UNSAT	59.8	9.78	-	27.0	-	-	-
2025 Soundnessbench	17	UNSAT	101	83.9	-	-	-	-	-
2025 Soundnessbench	18	UNSAT	30.1	9.50	-	-	-	-	-
2025 Soundnessbench	19	UNSAT	34.3	-	-	-	-	-	-
2025 Soundnessbench	20	UNSAT	60.4	84.0	-	-	-	-	-
2025 Soundnessbench	21	UNSAT	68.6	9.30	-	-	-	-	-
2025 Soundnessbench	22	UNSAT	125	9.30	-	-	-	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Soundnessbench	23	UNSAT	37.7	9.16	-	-	-	-	-
2025 Soundnessbench	24	UNSAT	108	9.64	-	-	-	-	-
2025 Soundnessbench	25	UNSAT	32.0	9.25	-	-	-	-	-
2025 Soundnessbench	26	UNSAT	107	11.1	-	16.3	-	-	-
2025 Soundnessbench	27	UNSAT	77.3	11.0	-	62.9	-	-	-
2025 Soundnessbench	28	UNSAT	53.9	9.19	-	-	-	-	-
2025 Soundnessbench	29	UNSAT	80.8	-	-	15.5	-	-	-
2025 Soundnessbench	30	UNSAT	118	11.1	-	15.5	-	-	-
2025 Soundnessbench	31	UNSAT	52.5	83.7	-	13.2	-	-	-
2025 Soundnessbench	32	UNSAT	29.7	9.42	-	-	-	-	-
2025 Soundnessbench	33	UNSAT	31.0	9.35	-	15.0	-	-	-
2025 Soundnessbench	34	UNSAT	42.7	9.66	-	-	-	-	-
2025 Soundnessbench	35	UNSAT	82.3	9.52	-	-	-	-	-
2025 Soundnessbench	36	UNSAT	44.8	9.53	-	-	-	-	-
2025 Soundnessbench	37	UNSAT	96.8	-	-	16.3	-	-	-
2025 Soundnessbench	38	UNSAT	118	83.7	-	-	-	-	-
2025 Soundnessbench	39	UNSAT	70.3	11.2	-	14.1	-	-	-
2025 Soundnessbench	40	UNSAT	72.9	9.37	-	15.0	-	-	-
2025 Soundnessbench	41	UNSAT	38.3	9.36	-	-	-	-	-
2025 Soundnessbench	42	UNSAT	118	83.6	-	-	-	-	-
2025 Soundnessbench	43	UNSAT	55.3	10.3	-	-	-	-	-
2025 Soundnessbench	44	UNSAT	121	83.7	-	14.8	-	-	-
2025 Soundnessbench	45	UNSAT	98.7	10.1	-	89.5	-	-	-
2025 Soundnessbench	46	UNSAT	95.5	-	-	16.4	-	-	-
2025 Soundnessbench	47	UNSAT	48.8	9.62	-	-	-	-	-
2025 Soundnessbench	48	UNSAT	82.8	-	-	15.0	-	-	-
2025 Soundnessbench	49	UNSAT	101	-	-	14.7	-	-	-
2025 Tinyimagenet 2024	0	UNSAT	14.8	54.9	70.5	-	-	-	-
2025 Tinyimagenet 2024	1	UNSAT	7.78	15.9	8.87	-	-	-	-
2025 Tinyimagenet 2024	2	UNSAT	25.5	-	-	-	-	-	-
2025 Tinyimagenet 2024	3	UNSAT	7.77	15.8	9.01	-	-	-	-
2025 Tinyimagenet 2024	4	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	5	UNSAT	15.3	39.5	18.9	-	-	-	-
2025 Tinyimagenet 2024	6	UNSAT	7.67	14.7	8.83	14.8	23.4	-	-
2025 Tinyimagenet 2024	7	UNSAT	7.85	16.1	9.07	-	-	-	-
2025 Tinyimagenet 2024	8	UNSAT	19.5	70.8	-	-	-	-	-
2025 Tinyimagenet 2024	9	UNSAT	9.87	31.5	14.0	-	-	-	-
2025 Tinyimagenet 2024	10	UNSAT	7.74	15.8	8.87	-	-	-	-
2025 Tinyimagenet 2024	11	UNSAT	15.8	45.0	102	-	-	-	-
2025 Tinyimagenet 2024	12	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	13	UNSAT	9.78	27.2	13.8	-	-	-	-
2025 Tinyimagenet 2024	14	UNSAT	10.2	28.4	14.6	-	-	-	-
2025 Tinyimagenet 2024	15	UNSAT	16.3	79.1	-	-	-	-	-
2025 Tinyimagenet 2024	16	UNSAT	17.9	-	-	-	-	-	-
2025 Tinyimagenet 2024	17	UNSAT	15.3	41.6	19.1	-	-	-	-
2025 Tinyimagenet 2024	18	UNSAT	14.3	65.3	18.1	-	-	-	-
2025 Tinyimagenet 2024	19	UNSAT	17.6	88.2	-	-	-	-	-
2025 Tinyimagenet 2024	20	UNSAT	21.7	-	-	-	-	-	-
2025 Tinyimagenet 2024	21	UNSAT	31.8	-	-	-	-	-	-
2025 Tinyimagenet 2024	22	UNSAT	36.7	-	-	-	-	-	-
2025 Tinyimagenet 2024	23	UNSAT	7.85	15.6	8.91	14.8	-	-	-
2025 Tinyimagenet 2024	24	UNSAT	17.8	70.2	-	-	-	-	-
2025 Tinyimagenet 2024	25	UNSAT	21.1	56.2	-	-	-	-	-
2025 Tinyimagenet 2024	26	UNSAT	34.4	-	-	-	-	-	-
2025 Tinyimagenet 2024	27	UNSAT	10.4	29.0	14.7	-	-	-	-
2025 Tinyimagenet 2024	28	UNSAT	20.6	61.6	-	-	-	-	-
2025 Tinyimagenet 2024	29	UNSAT	7.83	16.0	8.97	-	-	-	-
2025 Tinyimagenet 2024	30	UNSAT	14.7	52.4	45.0	-	-	-	-
2025 Tinyimagenet 2024	31	UNSAT	18.5	59.9	-	-	-	-	-
2025 Tinyimagenet 2024	32	UNSAT	7.77	15.8	9.07	-	-	-	-
2025 Tinyimagenet 2024	33	UNSAT	10.2	28.1	16.3	-	-	-	-
2025 Tinyimagenet 2024	34	UNSAT	58.5	-	-	-	-	-	-
2025 Tinyimagenet 2024	35	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	36	UNSAT	10.6	28.9	14.9	-	-	-	-
2025 Tinyimagenet 2024	37	UNSAT	21.2	78.4	-	-	-	-	-
2025 Tinyimagenet 2024	38	UNSAT	7.73	15.7	8.89	14.8	-	-	-
2025 Tinyimagenet 2024	39	UNSAT	19.7	59.4	-	-	-	-	-
2025 Tinyimagenet 2024	40	UNSAT	9.88	28.1	15.1	-	-	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Tinyimagenet 2024	41	UNSAT	23.0	71.4	-	-	-	-	-
2025 Tinyimagenet 2024	42	UNSAT	15.5	46.5	82.8	-	-	-	-
2025 Tinyimagenet 2024	43	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	44	UNSAT	9.74	27.1	13.0	-	-	-	-
2025 Tinyimagenet 2024	45	UNSAT	24.7	63.4	-	-	-	-	-
2025 Tinyimagenet 2024	46	UNSAT	7.76	16.0	9.06	-	-	-	-
2025 Tinyimagenet 2024	47	UNSAT	16.0	58.1	32.9	-	-	-	-
2025 Tinyimagenet 2024	48	UNSAT	17.4	48.5	-	-	-	-	-
2025 Tinyimagenet 2024	49	UNSAT	9.75	29.2	16.4	-	-	-	-
2025 Tinyimagenet 2024	50	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	51	UNSAT	16.8	101	-	-	-	-	-
2025 Tinyimagenet 2024	52	UNSAT	11.0	30.2	15.4	-	-	-	-
2025 Tinyimagenet 2024	53	UNSAT	7.72	15.6	8.96	-	-	-	-
2025 Tinyimagenet 2024	54	UNSAT	7.73	16.0	9.06	-	-	-	-
2025 Tinyimagenet 2024	55	UNSAT	17.8	48.7	75.5	-	-	-	-
2025 Tinyimagenet 2024	56	UNSAT	102	-	-	-	-	-	-
2025 Tinyimagenet 2024	57	UNSAT	14.5	43.0	30.0	-	-	-	-
2025 Tinyimagenet 2024	58	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	59	UNSAT	15.5	41.7	52.1	-	-	-	-
2025 Tinyimagenet 2024	60	UNSAT	7.81	15.6	8.97	-	-	-	-
2025 Tinyimagenet 2024	61	UNSAT	11.1	31.4	23.0	-	-	-	-
2025 Tinyimagenet 2024	62	UNSAT	7.70	15.7	8.92	14.8	-	-	-
2025 Tinyimagenet 2024	63	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	64	UNSAT	15.7	46.0	47.9	-	-	-	-
2025 Tinyimagenet 2024	65	UNSAT	7.72	15.9	8.99	-	-	-	-
2025 Tinyimagenet 2024	66	UNSAT	16.0	62.6	-	-	-	-	-
2025 Tinyimagenet 2024	67	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	68	UNSAT	7.53	24.4	13.7	-	-	-	-
2025 Tinyimagenet 2024	69	UNSAT	7.75	15.9	9.06	-	-	-	-
2025 Tinyimagenet 2024	70	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	71	UNSAT	10.4	29.2	15.6	-	-	-	-
2025 Tinyimagenet 2024	72	UNSAT	25.6	85.1	-	-	-	-	-
2025 Tinyimagenet 2024	73	UNSAT	7.76	16.2	8.92	-	-	-	-
2025 Tinyimagenet 2024	74	UNSAT	10.8	29.7	16.7	-	-	-	-
2025 Tinyimagenet 2024	75	UNSAT	16.3	40.6	21.2	-	-	-	-
2025 Tinyimagenet 2024	76	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	77	UNSAT	7.76	15.7	9.02	-	-	-	-
2025 Tinyimagenet 2024	78	UNSAT	17.6	55.6	-	-	-	-	-
2025 Tinyimagenet 2024	79	UNSAT	9.96	27.5	15.1	-	-	-	-
2025 Tinyimagenet 2024	80	UNSAT	22.5	92.5	-	-	-	-	-
2025 Tinyimagenet 2024	81	UNSAT	10.5	32.1	14.1	-	-	-	-
2025 Tinyimagenet 2024	82	UNSAT	16.1	45.3	21.9	-	-	-	-
2025 Tinyimagenet 2024	83	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	84	UNSAT	9.85	28.0	16.8	-	-	-	-
2025 Tinyimagenet 2024	85	UNSAT	7.77	15.8	8.96	-	-	-	-
2025 Tinyimagenet 2024	86	UNSAT	16.1	43.8	27.0	-	-	-	-
2025 Tinyimagenet 2024	87	UNSAT	7.76	15.7	8.95	-	-	-	-
2025 Tinyimagenet 2024	88	UNSAT	16.9	52.3	-	-	-	-	-
2025 Tinyimagenet 2024	89	UNSAT	17.7	51.7	-	-	-	-	-
2025 Tinyimagenet 2024	90	UNSAT	7.83	15.5	9.07	-	-	-	-
2025 Tinyimagenet 2024	91	UNSAT	16.6	95.6	-	-	-	-	-
2025 Tinyimagenet 2024	92	UNSAT	60.8	-	-	-	-	-	-
2025 Tinyimagenet 2024	93	UNSAT	7.69	28.9	-	-	-	-	-
2025 Tinyimagenet 2024	94	UNSAT	21.2	-	-	-	-	-	-
2025 Tinyimagenet 2024	95	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	96	UNSAT	15.3	46.9	30.2	-	-	-	-
2025 Tinyimagenet 2024	97	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	98	UNSAT	23.3	-	-	-	-	-	-
2025 Tinyimagenet 2024	99	UNSAT	9.97	28.0	13.4	-	-	-	-
2025 Tinyimagenet 2024	100	UNSAT	18.1	71.2	-	-	-	-	-
2025 Tinyimagenet 2024	101	UNSAT	21.4	69.1	-	-	-	-	-
2025 Tinyimagenet 2024	102	UNSAT	15.7	55.0	-	-	-	-	-
2025 Tinyimagenet 2024	103	UNSAT	7.88	15.9	8.93	14.9	-	-	-
2025 Tinyimagenet 2024	104	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	105	UNSAT	21.9	-	-	-	-	-	-
2025 Tinyimagenet 2024	106	UNSAT	15.0	42.8	38.0	-	-	-	-
2025 Tinyimagenet 2024	107	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	108	UNSAT	7.76	16.2	9.06	-	-	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Tinyimagenet 2024	109	UNSAT	18.7	53.1	-	-	-	-	-
2025 Tinyimagenet 2024	110	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	111	UNSAT	10.5	29.5	16.0	-	-	-	-
2025 Tinyimagenet 2024	112	UNSAT	16.8	46.2	-	-	-	-	-
2025 Tinyimagenet 2024	113	UNSAT	15.7	43.2	39.5	-	-	-	-
2025 Tinyimagenet 2024	114	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	115	UNSAT	16.5	49.9	21.0	-	-	-	-
2025 Tinyimagenet 2024	116	UNSAT	7.75	15.7	8.89	-	-	-	-
2025 Tinyimagenet 2024	117	UNSAT	16.2	40.9	75.5	-	-	-	-
2025 Tinyimagenet 2024	118	UNSAT	15.6	65.3	46.1	-	-	-	-
2025 Tinyimagenet 2024	119	UNSAT	16.4	52.9	-	-	-	-	-
2025 Tinyimagenet 2024	120	UNSAT	7.76	16.1	-	-	-	-	-
2025 Tinyimagenet 2024	121	UNSAT	11.2	31.3	22.4	-	-	-	-
2025 Tinyimagenet 2024	122	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	123	UNSAT	16.3	78.5	32.2	-	-	-	-
2025 Tinyimagenet 2024	124	UNSAT	10.1	27.8	15.1	-	-	-	-
2025 Tinyimagenet 2024	125	UNSAT	7.82	15.8	8.95	-	-	-	-
2025 Tinyimagenet 2024	126	UNSAT	14.4	35.5	26.8	-	-	-	-
2025 Tinyimagenet 2024	127	UNSAT	18.2	54.0	-	-	-	-	-
2025 Tinyimagenet 2024	128	UNSAT	19.1	76.2	-	-	-	-	-
2025 Tinyimagenet 2024	129	UNSAT	16.1	43.5	108	-	-	-	-
2025 Tinyimagenet 2024	130	UNSAT	17.1	70.9	-	-	-	-	-
2025 Tinyimagenet 2024	131	UNSAT	84.6	-	-	-	-	-	-
2025 Tinyimagenet 2024	132	UNSAT	16.9	51.6	55.2	-	-	-	-
2025 Tinyimagenet 2024	133	UNSAT	22.2	86.4	-	-	-	-	-
2025 Tinyimagenet 2024	134	UNSAT	20.9	65.1	-	-	-	-	-
2025 Tinyimagenet 2024	135	UNSAT	15.6	67.1	-	-	-	-	-
2025 Tinyimagenet 2024	136	UNSAT	15.5	40.7	21.7	-	-	-	-
2025 Tinyimagenet 2024	137	UNSAT	14.8	51.6	37.5	-	-	-	-
2025 Tinyimagenet 2024	138	UNSAT	17.2	69.8	-	-	-	-	-
2025 Tinyimagenet 2024	139	UNSAT	19.6	-	-	-	-	-	-
2025 Tinyimagenet 2024	140	UNSAT	16.5	59.8	28.2	-	-	-	-
2025 Tinyimagenet 2024	141	UNSAT	17.5	103	-	-	-	-	-
2025 Tinyimagenet 2024	142	UNSAT	19.1	-	-	-	-	-	-
2025 Tinyimagenet 2024	143	UNSAT	7.82	✗	-	-	-	-	-
2025 Tinyimagenet 2024	144	UNSAT	16.9	58.1	-	-	-	-	-
2025 Tinyimagenet 2024	145	UNSAT	28.8	89.7	-	-	-	-	-
2025 Tinyimagenet 2024	146	UNSAT	7.76	15.9	8.99	-	-	-	-
2025 Tinyimagenet 2024	147	UNSAT	25.1	-	-	-	-	-	-
2025 Tinyimagenet 2024	148	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	149	UNSAT	18.6	56.0	-	-	-	-	-
2025 Tinyimagenet 2024	150	UNSAT	7.76	17.5	9.14	-	-	-	-
2025 Tinyimagenet 2024	151	UNSAT	15.3	65.8	41.2	-	-	-	-
2025 Tinyimagenet 2024	152	UNSAT	31.0	-	-	-	-	-	-
2025 Tinyimagenet 2024	153	UNSAT	7.81	16.0	9.33	-	-	-	-
2025 Tinyimagenet 2024	154	UNSAT	16.9	70.7	-	-	-	-	-
2025 Tinyimagenet 2024	155	UNSAT	7.78	15.5	8.92	-	-	-	-
2025 Tinyimagenet 2024	156	UNSAT	19.9	95.7	-	-	-	-	-
2025 Tinyimagenet 2024	157	UNSAT	14.6	45.1	19.7	-	-	-	-
2025 Tinyimagenet 2024	158	UNSAT	17.5	59.3	-	-	-	-	-
2025 Tinyimagenet 2024	159	UNSAT	7.65	24.5	14.9	-	-	-	-
2025 Tinyimagenet 2024	160	UNSAT	9.95	27.5	14.4	-	-	-	-
2025 Tinyimagenet 2024	161	UNSAT	7.78	15.6	8.91	-	-	-	-
2025 Tinyimagenet 2024	162	UNSAT	16.3	46.6	41.9	-	-	-	-
2025 Tinyimagenet 2024	163	UNSAT	10.7	34.3	15.8	-	-	-	-
2025 Tinyimagenet 2024	164	UNSAT	7.81	16.1	8.95	-	-	-	-
2025 Tinyimagenet 2024	165	UNSAT	16.3	70.4	43.9	-	-	-	-
2025 Tinyimagenet 2024	166	UNSAT	16.1	58.5	41.6	-	-	-	-
2025 Tinyimagenet 2024	167	UNSAT	29.5	-	-	-	-	-	-
2025 Tinyimagenet 2024	168	UNSAT	15.0	42.6	39.9	-	-	-	-
2025 Tinyimagenet 2024	169	UNSAT	16.8	46.2	-	-	-	-	-
2025 Tinyimagenet 2024	170	UNSAT	10.8	29.9	15.2	-	-	-	-
2025 Tinyimagenet 2024	171	UNSAT	21.2	54.5	-	-	-	-	-
2025 Tinyimagenet 2024	172	UNSAT	10.0	30.5	13.7	-	-	-	-
2025 Tinyimagenet 2024	173	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	174	UNSAT	17.3	49.7	-	-	-	-	-
2025 Tinyimagenet 2024	175	UNSAT	22.1	64.8	-	-	-	-	-
2025 Tinyimagenet 2024	176	UNSAT	17.2	79.2	-	-	-	-	-

Table 70: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNV	NNen	SB
2025 Tinyimagenet 2024	177	UNSAT	10.0	28.1	13.4	-	-	-	-
2025 Tinyimagenet 2024	178	UNSAT	17.6	75.0	-	-	-	-	-
2025 Tinyimagenet 2024	179	UNSAT	18.3	97.6	-	-	-	-	-
2025 Tinyimagenet 2024	180	UNSAT	18.7	-	-	-	-	-	-
2025 Tinyimagenet 2024	181	UNSAT	7.69	15.7	8.91	-	-	-	-
2025 Tinyimagenet 2024	182	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	183	UNSAT	38.5	-	-	-	-	-	-
2025 Tinyimagenet 2024	184	UNSAT	20.3	-	-	-	-	-	-
2025 Tinyimagenet 2024	185	UNSAT	7.59	24.4	13.9	-	-	-	-
2025 Tinyimagenet 2024	186	UNSAT	15.6	65.0	46.8	-	-	-	-
2025 Tinyimagenet 2024	187	UNSAT	24.1	63.3	-	-	-	-	-
2025 Tinyimagenet 2024	188	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	189	UNSAT	7.79	15.7	9.05	-	-	-	-
2025 Tinyimagenet 2024	190	UNSAT	9.92	27.5	14.9	-	-	-	-
2025 Tinyimagenet 2024	191	UNSAT	16.7	48.5	77.4	-	-	-	-
2025 Tinyimagenet 2024	192	UNSAT	7.80	15.9	8.92	-	-	-	-
2025 Tinyimagenet 2024	193	UNSAT	7.75	16.4	9.12	-	-	-	-
2025 Tinyimagenet 2024	194	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	195	UNSAT	16.7	71.6	57.5	-	-	-	-
2025 Tinyimagenet 2024	196	UNSAT	14.6	38.8	30.5	-	-	-	-
2025 Tinyimagenet 2024	197	UNSAT	7.62	24.6	14.3	-	-	-	-
2025 Tinyimagenet 2024	198	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	199	?	-	-	-	-	-	-	-
2025 Tllverifybench 2023	0	UNSAT	7.20	26.7	8.40	14.3	-	-	2.83
2025 Tllverifybench 2023	1	UNSAT	7.23	26.8	8.04	13.8	-	-	2.81
2025 Tllverifybench 2023	2	UNSAT	7.19	26.6	6.33	13.6	-	1.88	2.82
2025 Tllverifybench 2023	3	SAT	6.26	5.97	6.07	12.2	16.2	1.14	2.83
2025 Tllverifybench 2023	4	UNSAT	7.40	26.7	10.5	13.8	-	-	2.93
2025 Tllverifybench 2023	5	SAT	6.23	6.01	7.75	12.7	16.5	1.19	2.94
2025 Tllverifybench 2023	6	UNSAT	7.51	26.9	12.3	14.0	-	-	3.00
2025 Tllverifybench 2023	7	UNSAT	7.70	26.9	30.9	13.6	-	-	2.96
2025 Tllverifybench 2023	8	UNSAT	8.21	27.2	55.6	15.7	-	-	3.24
2025 Tllverifybench 2023	9	UNSAT	8.53	27.4	81.8	16.8	-	-	3.29
2025 Tllverifybench 2023	10	SAT	6.27	6.06	7.90	13.2	17.0	2.00	3.24
2025 Tllverifybench 2023	11	SAT	6.27	6.08	7.86	12.5	17.1	1.41	3.26
2025 Tllverifybench 2023	12	UNSAT	8.60	27.3	15.6	15.5	-	-	3.76
2025 Tllverifybench 2023	13	SAT	6.36	6.24	7.97	12.4	17.2	1.85	3.79
2025 Tllverifybench 2023	14	UNSAT	8.47	27.3	28.0	17.2	-	-	4.04
2025 Tllverifybench 2023	15	UNSAT	8.82	27.4	77.3	18.8	-	-	3.99
2025 Tllverifybench 2023	16	UNSAT	10.1	28.4	146	60.8	-	-	4.36
2025 Tllverifybench 2023	17	SAT	6.39	6.66	8.40	12.2	17.8	3.30	4.28
2025 Tllverifybench 2023	18	UNSAT	9.87	28.0	40.3	57.1	-	-	4.27
2025 Tllverifybench 2023	19	SAT	6.37	6.62	8.40	12.8	18.0	4.54	4.46
2025 Tllverifybench 2023	20	SAT	6.73	7.36	9.05	13.7	18.3	6.23	5.62
2025 Tllverifybench 2023	21	SAT	6.75	7.38	9.21	44.1	18.5	10.9	5.68
2025 Tllverifybench 2023	22	UNSAT	11.0	28.8	59.9	64.4	-	-	5.60
2025 Tllverifybench 2023	23	SAT	6.76	7.35	9.03	13.7	18.3	6.22	6.03
2025 Tllverifybench 2023	24	UNSAT	12.2	30.0	59.9	78.1	-	-	8.79
2025 Tllverifybench 2023	25	SAT	7.12	8.63	10.2	14.5	18.8	12.1	7.81
2025 Tllverifybench 2023	26	SAT	7.11	8.61	10.6	13.8	19.1	14.3	8.85
2025 Tllverifybench 2023	27	SAT	7.13	8.66	11.6	14.5	19.3	11.6	9.02
2025 Tllverifybench 2023	28	SAT	7.68	10.7	12.5	13.9	20.4	25.2	10.9
2025 Tllverifybench 2023	29	SAT	7.62	10.7	12.1	15.7	20.2	23.0	11.4
2025 Tllverifybench 2023	30	SAT	7.74	10.6	12.3	15.0	20.3	24.1	11.7
2025 Tllverifybench 2023	31	SAT	7.75	10.7	12.1	14.7	20.2	22.9	12.0

B.2 Small Tolerance

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Acasxu 2023	0	UNSAT	8.45	18.1	13.2	15.9	1.42	-	3.04
2025 Acasxu 2023	1	UNSAT	7.76	18.1	16.1	14.0	1.45	-	2.84
2025 Acasxu 2023	2	UNSAT	7.90	18.3	18.9	14.0	1.52	-	2.84
2025 Acasxu 2023	3	UNSAT	7.92	18.3	16.0	12.7	1.41	-	2.83
2025 Acasxu 2023	4	UNSAT	7.77	18.2	12.7	13.8	1.45	-	2.88
2025 Acasxu 2023	5	UNSAT	7.83	18.1	16.6	13.5	1.65	-	2.82
2025 Acasxu 2023	6	UNSAT	7.75	18.0	13.1	13.5	1.32	-	2.87
2025 Acasxu 2023	7	UNSAT	7.76	18.0	10.6	12.3	1.48	-	2.85
2025 Acasxu 2023	8	UNSAT	7.61	18.0	9.78	13.2	1.40	-	2.85
2025 Acasxu 2023	9	UNSAT	7.83	18.2	20.2	13.8	1.60	-	2.84
2025 Acasxu 2023	10	UNSAT	7.97	18.3	26.5	13.9	1.94	-	2.84
2025 Acasxu 2023	11	UNSAT	7.88	18.3	18.8	13.7	1.74	-	2.87
2025 Acasxu 2023	12	UNSAT	7.80	18.3	15.5	14.0	1.41	-	2.90
2025 Acasxu 2023	13	UNSAT	8.08	18.3	30.0	14.7	1.98	-	2.89
2025 Acasxu 2023	14	UNSAT	8.11	18.3	28.6	15.2	1.92	-	2.89
2025 Acasxu 2023	15	UNSAT	8.35	19.5	56.6	16.4	2.34	-	2.87
2025 Acasxu 2023	16	UNSAT	8.27	63.0	56.3	17.8	2.18	-	2.88
2025 Acasxu 2023	17	UNSAT	8.35	19.5	58.4	17.5	62.3	-	2.88
2025 Acasxu 2023	18	UNSAT	7.92	18.3	20.0	15.0	1.70	-	3.14
2025 Acasxu 2023	19	UNSAT	8.14	18.4	19.1	13.5	1.54	-	2.89
2025 Acasxu 2023	20	UNSAT	7.91	18.3	20.3	14.5	1.56	-	2.86
2025 Acasxu 2023	21	UNSAT	7.95	18.3	14.9	14.2	1.44	-	2.85
2025 Acasxu 2023	22	UNSAT	8.03	18.4	23.7	15.2	1.72	-	2.91
2025 Acasxu 2023	23	UNSAT	8.15	18.6	41.0	16.5	2.34	-	2.88
2025 Acasxu 2023	24	UNSAT	8.14	18.4	44.6	17.0	2.19	-	3.13
2025 Acasxu 2023	25	UNSAT	8.31	18.6	41.7	17.0	2.11	-	2.88
2025 Acasxu 2023	26	UNSAT	8.52	19.7	39.8	16.3	1.89	-	2.87
2025 Acasxu 2023	27	UNSAT	7.96	19.3	24.4	14.4	1.83	-	2.85
2025 Acasxu 2023	28	UNSAT	7.85	18.4	23.9	14.5	1.72	-	2.86
2025 Acasxu 2023	29	UNSAT	7.89	18.3	18.4	14.5	1.73	-	2.87
2025 Acasxu 2023	30	UNSAT	7.96	18.3	16.0	14.0	1.48	-	2.88
2025 Acasxu 2023	31	UNSAT	8.01	18.3	29.5	15.0	1.77	-	2.88
2025 Acasxu 2023	32	UNSAT	8.29	18.7	54.6	17.4	2.87	-	2.84
2025 Acasxu 2023	33	UNSAT	8.36	19.5	71.1	17.2	2.31	-	2.87
2025 Acasxu 2023	34	UNSAT	8.24	19.5	42.6	17.0	2.08	-	2.86
2025 Acasxu 2023	35	UNSAT	8.66	20.4	76.1	19.9	3.26	-	2.85
2025 Acasxu 2023	36	UNSAT	7.83	18.3	20.8	13.8	1.49	-	2.85
2025 Acasxu 2023	37	UNSAT	7.92	18.3	18.7	13.5	1.66	-	2.89
2025 Acasxu 2023	38	UNSAT	7.89	18.2	17.8	13.8	1.41	-	2.84
2025 Acasxu 2023	39	UNSAT	7.76	18.2	14.7	13.0	1.56	-	2.85
2025 Acasxu 2023	40	UNSAT	7.97	18.3	25.8	14.7	1.62	-	2.87
2025 Acasxu 2023	41	UNSAT	8.11	19.3	38.5	14.5	2.08	-	2.86
2025 Acasxu 2023	42	UNSAT	8.11	18.4	34.4	16.2	1.88	-	2.90
2025 Acasxu 2023	43	UNSAT	8.30	21.5	57.1	17.3	61.5	-	2.86
2025 Acasxu 2023	44	UNSAT	8.20	19.5	50.8	16.3	2.42	-	2.85
2025 Acasxu 2023	45	UNSAT	8.45	19.9	14.5	19.7	1.50	-	-
2025 Acasxu 2023	46	SAT	6.34	7.91	28.4	15.9	1.19	-	12.1
2025 Acasxu 2023	47	SAT	6.40	96.1	52.3	18.7	1.61	-	✗
2025 Acasxu 2023	48	SAT	6.40	6.12	12.6	13.2	1.24	-	3.58
2025 Acasxu 2023	49	SAT	6.57	114	-	17.7	1.17	-	-
2025 Acasxu 2023	50	SAT	6.37	65.6	45.1	17.0	1.45	-	12.1
2025 Acasxu 2023	51	UNSAT	8.20	19.6	16.8	18.0	1.68	-	-
2025 Acasxu 2023	52	UNSAT	8.21	19.6	17.6	16.5	2.21	-	-
2025 Acasxu 2023	53	UNSAT	8.21	19.7	19.7	16.4	1.81	-	-
2025 Acasxu 2023	54	SAT	6.39	5.99	8.00	12.7	1.12	17.0	2.69
2025 Acasxu 2023	55	SAT	6.44	6.03	6.14	12.6	1.10	16.6	2.67
2025 Acasxu 2023	56	SAT	6.41	5.95	6.15	13.0	1.11	16.7	2.69
2025 Acasxu 2023	57	SAT	6.37	5.95	6.14	12.7	1.17	16.7	2.72
2025 Acasxu 2023	58	SAT	6.53	5.99	6.12	12.7	1.10	16.6	2.70
2025 Acasxu 2023	59	SAT	6.38	5.92	6.16	11.6	1.11	16.7	2.68
2025 Acasxu 2023	60	SAT	6.39	5.98	6.15	13.7	1.11	16.6	2.71
2025 Acasxu 2023	61	SAT	6.39	5.96	8.13	14.3	1.10	16.7	2.69
2025 Acasxu 2023	62	SAT	6.38	5.98	21.5	14.7	1.19	16.6	2.72
2025 Acasxu 2023	63	SAT	6.40	5.95	7.00	11.9	1.10	16.6	2.72
2025 Acasxu 2023	64	SAT	6.41	6.02	31.6	12.9	1.14	-	13.4
2025 Acasxu 2023	65	UNSAT	18.2	91.6	110	-	5.38	-	-
2025 Acasxu 2023	66	SAT	6.36	6.00	15.1	13.0	1.10	16.9	2.69
2025 Acasxu 2023	67	SAT	6.39	5.97	9.44	12.7	1.10	16.7	2.70

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Acasxu 2023	68	SAT	6.38	5.93	25.2	13.5	1.11	16.7	3.07
2025 Acasxu 2023	69	SAT	6.36	6.50	32.2	12.7	1.46	16.9	2.69
2025 Acasxu 2023	70	SAT	6.36	5.97	7.24	12.7	1.10	16.7	2.68
2025 Acasxu 2023	71	SAT	6.38	5.97	6.15	12.7	1.12	16.8	2.70
2025 Acasxu 2023	72	SAT	6.37	6.07	6.15	12.7	1.11	16.7	2.70
2025 Acasxu 2023	73	UNSAT	9.80	21.1	56.6	34.3	5.78	-	-
2025 Acasxu 2023	74	SAT	6.35	5.95	6.13	11.7	1.11	16.9	2.69
2025 Acasxu 2023	75	SAT	6.44	6.00	12.1	11.7	1.12	16.4	2.69
2025 Acasxu 2023	76	SAT	6.35	6.07	7.21	12.7	1.11	16.6	2.70
2025 Acasxu 2023	77	SAT	6.39	5.92	6.11	12.6	1.10	16.5	2.68
2025 Acasxu 2023	78	SAT	6.41	5.94	6.13	13.8	1.10	16.7	2.68
2025 Acasxu 2023	79	SAT	6.41	5.93	6.17	14.2	1.12	16.7	2.72
2025 Acasxu 2023	80	SAT	6.37	6.11	15.2	14.7	1.22	16.8	2.71
2025 Acasxu 2023	81	SAT	6.38	5.90	6.11	12.7	1.11	16.7	2.70
2025 Acasxu 2023	82	SAT	6.35	5.97	12.2	12.7	1.10	16.6	2.72
2025 Acasxu 2023	83	SAT	6.59	98.0	55.7	20.1	1.66	-	-
2025 Acasxu 2023	84	SAT	6.34	5.91	9.04	12.9	1.10	16.9	2.73
2025 Acasxu 2023	85	SAT	6.38	5.91	7.09	13.5	1.10	16.6	2.69
2025 Acasxu 2023	86	SAT	6.37	5.95	6.11	11.7	1.13	16.7	2.71
2025 Acasxu 2023	87	SAT	6.39	5.93	6.16	14.1	1.11	16.6	2.70
2025 Acasxu 2023	88	SAT	6.39	5.93	8.25	12.9	1.10	16.6	2.70
2025 Acasxu 2023	89	SAT	6.38	5.93	9.99	14.4	1.11	16.5	2.69
2025 Acasxu 2023	90	UNSAT	8.12	19.6	41.6	18.2	1.46	-	-
2025 Acasxu 2023	91	UNSAT	7.58	18.7	8.36	14.4	1.48	-	-
2025 Acasxu 2023	92	UNSAT	7.66	19.4	8.43	-	1.31	-	-
2025 Acasxu 2023	93	UNSAT	7.64	18.5	6.29	13.3	1.14	18.0	2.86
2025 Acasxu 2023	94	UNSAT	7.38	18.4	6.32	13.5	1.17	17.7	2.87
2025 Acasxu 2023	95	UNSAT	6.31	18.4	6.29	12.4	1.10	17.6	2.85
2025 Acasxu 2023	96	SAT	6.32	5.93	6.11	12.4	1.11	16.1	2.86
2025 Acasxu 2023	97	SAT	6.30	5.96	6.09	12.2	1.09	15.9	2.87
2025 Acasxu 2023	98	SAT	6.39	5.91	6.09	11.2	1.08	15.9	2.85
2025 Acasxu 2023	99	UNSAT	7.73	18.6	7.23	13.5	1.41	-	-
2025 Acasxu 2023	100	UNSAT	7.68	18.7	7.17	14.4	1.27	118	-
2025 Acasxu 2023	101	UNSAT	7.66	18.7	7.82	12.7	1.32	-	2.85
2025 Acasxu 2023	102	UNSAT	6.35	18.4	6.27	12.4	0.91	17.7	2.88
2025 Acasxu 2023	103	UNSAT	7.47	18.4	6.32	11.9	1.11	18.0	2.84
2025 Acasxu 2023	104	UNSAT	6.31	18.3	6.33	12.4	1.10	17.6	2.88
2025 Acasxu 2023	105	UNSAT	6.32	18.5	6.33	11.9	1.09	17.8	2.88
2025 Acasxu 2023	106	UNSAT	6.29	18.4	6.27	12.9	1.11	17.5	2.89
2025 Acasxu 2023	107	UNSAT	6.30	18.3	6.26	12.2	0.89	17.3	2.83
2025 Acasxu 2023	108	UNSAT	7.48	18.7	6.29	13.5	1.10	17.8	2.86
2025 Acasxu 2023	109	UNSAT	7.56	18.5	7.60	13.3	1.42	-	-
2025 Acasxu 2023	110	UNSAT	7.54	18.5	6.34	13.7	1.26	18.3	2.85
2025 Acasxu 2023	111	UNSAT	7.59	18.4	6.70	12.5	1.13	81.0	2.85
2025 Acasxu 2023	112	UNSAT	7.49	18.4	6.31	12.0	1.11	18.2	2.86
2025 Acasxu 2023	113	UNSAT	7.51	18.7	6.69	13.2	1.11	78.8	2.85
2025 Acasxu 2023	114	UNSAT	6.34	18.4	6.32	12.4	1.16	17.8	2.87
2025 Acasxu 2023	115	UNSAT	7.45	18.6	6.63	13.0	1.10	17.6	2.88
2025 Acasxu 2023	116	UNSAT	7.46	18.5	6.34	12.9	1.12	17.7	2.86
2025 Acasxu 2023	117	UNSAT	7.56	18.6	7.10	13.5	1.13	80.4	2.89
2025 Acasxu 2023	118	UNSAT	7.61	18.7	7.78	14.5	1.32	-	-
2025 Acasxu 2023	119	UNSAT	7.79	18.5	7.57	14.5	1.40	-	2.95
2025 Acasxu 2023	120	UNSAT	7.45	18.4	6.33	12.9	1.12	18.0	2.86
2025 Acasxu 2023	121	UNSAT	6.43	18.3	6.28	12.9	1.09	17.5	2.86
2025 Acasxu 2023	122	UNSAT	7.41	18.5	6.70	13.5	1.12	18.4	2.86
2025 Acasxu 2023	123	UNSAT	7.45	18.5	6.30	11.9	1.11	17.7	2.89
2025 Acasxu 2023	124	UNSAT	6.30	18.5	6.25	12.9	1.13	17.7	2.86
2025 Acasxu 2023	125	UNSAT	7.58	18.4	6.30	11.9	1.12	17.8	2.92
2025 Acasxu 2023	126	UNSAT	7.61	18.8	8.92	14.3	1.31	-	-
2025 Acasxu 2023	127	UNSAT	7.62	18.5	6.67	13.5	1.14	17.9	2.90
2025 Acasxu 2023	128	UNSAT	7.40	18.5	6.66	13.2	1.17	18.1	2.86
2025 Acasxu 2023	129	UNSAT	7.44	18.3	6.31	12.7	1.10	17.7	2.90
2025 Acasxu 2023	130	UNSAT	7.43	18.6	6.32	12.9	1.10	17.7	2.87
2025 Acasxu 2023	131	UNSAT	7.37	18.4	6.34	13.0	1.10	17.8	2.85
2025 Acasxu 2023	132	UNSAT	6.32	18.3	6.29	11.2	0.90	17.5	2.85
2025 Acasxu 2023	133	UNSAT	7.45	18.5	6.70	13.4	1.10	17.8	2.84
2025 Acasxu 2023	134	UNSAT	7.43	18.5	6.30	13.2	0.90	17.6	2.89
2025 Acasxu 2023	135	UNSAT	7.63	18.7	11.5	15.7	1.37	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Acasxu 2023	136	UNSAT	7.60	19.2	8.37	14.8	1.35	-	-
2025 Acasxu 2023	137	UNSAT	7.60	18.5	8.91	14.5	1.27	-	-
2025 Acasxu 2023	138	UNSAT	7.56	18.5	7.16	13.4	1.13	62.7	2.86
2025 Acasxu 2023	139	UNSAT	7.49	18.5	6.61	13.2	1.24	-	2.90
2025 Acasxu 2023	140	UNSAT	7.45	18.4	6.93	12.2	1.19	18.2	2.90
2025 Acasxu 2023	141	SAT	6.31	5.92	6.10	11.1	1.09	15.9	2.86
2025 Acasxu 2023	142	SAT	6.34	5.93	6.11	12.5	1.16	16.1	2.85
2025 Acasxu 2023	143	SAT	6.28	5.92	6.09	12.2	1.10	16.0	2.91
2025 Acasxu 2023	144	UNSAT	7.46	18.5	7.19	12.5	1.17	95.2	-
2025 Acasxu 2023	145	UNSAT	7.51	18.7	7.21	13.2	1.19	96.7	2.86
2025 Acasxu 2023	146	UNSAT	7.39	18.5	6.72	12.0	1.11	17.9	2.85
2025 Acasxu 2023	147	UNSAT	7.42	18.5	6.27	12.9	1.09	17.9	2.88
2025 Acasxu 2023	148	UNSAT	7.49	18.4	6.31	12.5	1.15	18.0	2.92
2025 Acasxu 2023	149	UNSAT	7.42	18.5	6.27	13.0	1.12	18.0	2.90
2025 Acasxu 2023	150	UNSAT	7.42	18.3	6.30	12.9	1.10	17.7	2.92
2025 Acasxu 2023	151	UNSAT	7.60	18.5	6.77	13.2	1.15	79.7	2.91
2025 Acasxu 2023	152	UNSAT	6.36	18.3	6.28	12.5	0.90	17.8	2.84
2025 Acasxu 2023	153	UNSAT	7.46	18.7	6.67	12.9	1.12	17.9	2.86
2025 Acasxu 2023	154	UNSAT	7.50	18.4	6.67	13.2	1.19	17.7	2.86
2025 Acasxu 2023	155	UNSAT	6.35	18.3	6.35	13.7	1.11	17.7	2.86
2025 Acasxu 2023	156	UNSAT	7.44	18.2	6.32	12.9	1.11	17.7	2.87
2025 Acasxu 2023	157	UNSAT	7.44	18.5	6.72	13.2	1.14	18.1	2.86
2025 Acasxu 2023	158	UNSAT	7.56	18.5	6.40	11.9	1.11	18.1	2.85
2025 Acasxu 2023	159	UNSAT	7.45	18.5	6.29	12.7	1.13	17.7	2.84
2025 Acasxu 2023	160	UNSAT	7.54	18.5	6.93	13.2	1.13	62.1	2.86
2025 Acasxu 2023	161	UNSAT	7.48	18.4	6.68	12.9	1.22	18.2	2.84
2025 Acasxu 2023	162	UNSAT	6.30	18.6	6.25	11.8	1.10	17.7	-
2025 Acasxu 2023	163	UNSAT	7.55	18.4	6.67	13.2	1.13	18.0	2.87
2025 Acasxu 2023	164	UNSAT	7.48	18.4	6.96	12.2	1.15	18.0	2.88
2025 Acasxu 2023	165	UNSAT	7.46	18.5	6.73	12.9	1.14	70.3	2.87
2025 Acasxu 2023	166	UNSAT	7.42	18.5	6.32	12.7	1.09	18.4	2.88
2025 Acasxu 2023	167	UNSAT	7.51	18.2	6.30	12.7	1.10	18.2	2.85
2025 Acasxu 2023	168	UNSAT	7.38	18.6	6.28	13.0	1.12	17.8	2.86
2025 Acasxu 2023	169	UNSAT	7.47	18.4	6.30	13.7	1.10	18.2	2.87
2025 Acasxu 2023	170	UNSAT	7.50	18.5	6.34	12.9	1.11	18.1	2.87
2025 Acasxu 2023	171	UNSAT	7.43	18.5	6.31	11.9	1.11	18.0	2.86
2025 Acasxu 2023	172	UNSAT	7.47	18.5	6.28	12.7	1.11	17.8	2.87
2025 Acasxu 2023	173	UNSAT	7.44	18.4	6.29	12.6	1.11	17.9	2.86
2025 Acasxu 2023	174	UNSAT	7.39	18.4	6.29	13.0	1.10	17.9	2.87
2025 Acasxu 2023	175	UNSAT	7.54	18.5	6.29	12.0	1.11	17.9	2.89
2025 Acasxu 2023	176	UNSAT	6.29	18.5	6.30	12.7	1.11	17.8	2.86
2025 Acasxu 2023	177	UNSAT	6.34	18.4	6.29	12.6	1.10	17.7	2.89
2025 Acasxu 2023	178	UNSAT	7.46	18.4	6.70	13.0	1.11	18.1	2.86
2025 Acasxu 2023	179	UNSAT	7.38	18.5	6.31	12.7	1.17	17.7	2.89
2025 Acasxu 2023	180	UNSAT	8.47	20.0	14.7	20.3	1.87	-	-
2025 Acasxu 2023	181	UNSAT	9.43	19.7	64.4	23.3	4.74	-	3.19
2025 Acasxu 2023	182	SAT	6.37	94.6	31.6	13.7	32.7	-	-
2025 Acasxu 2023	183	SAT	6.35	87.6	16.6	-	1.17	17.0	2.88
2025 Acasxu 2023	184	UNSAT	8.26	19.5	21.5	15.7	2.94	-	-
2025 Acasxu 2023	185	UNSAT	8.09	19.1	11.4	15.5	1.46	-	3.00
2025 Cersyve	0	SAT	6.31	12.9	6.07	14.7	-	-	3.19
2025 Cersyve	1	SAT	6.24	5.99	6.09	12.9	-	15.6	3.11
2025 Cersyve	2	UNSAT	7.60	17.4	-	14.2	-	-	-
2025 Cersyve	3	UNSAT	8.17	-	-	43.6	-	-	-
2025 Cersyve	4	SAT	6.27	17.7	6.05	✗	-	-	3.90
2025 Cersyve	5	SAT	6.29	6.02	6.06	14.3	-	16.0	3.49
2025 Cersyve	6	UNSAT	7.19	16.8	10.2	12.0	-	-	-
2025 Cersyve	7	UNSAT	8.24	18.0	-	16.0	-	-	-
2025 Cersyve	8	SAT	6.24	6.52	6.04	13.3	-	-	4.01
2025 Cersyve	9	SAT	6.23	5.99	6.07	14.0	-	15.8	3.16
2025 Cersyve	10	UNSAT	7.31	16.9	36.9	14.3	-	-	-
2025 Cersyve	11	UNSAT	8.41	-	-	47.9	-	-	-
2025 Cgan 2023	0	SAT	7.07	7.34	9.72	-	10.5	18.9	5.98
2025 Cgan 2023	1	UNSAT	7.99	28.3	9.61	-	14.3	26.3	6.05
2025 Cgan 2023	2	SAT	6.40	6.20	8.67	-	18.6	18.1	6.59
2025 Cgan 2023	3	UNSAT	7.94	28.0	9.67	-	12.1	23.5	6.26
2025 Cgan 2023	4	UNSAT	8.68	29.5	10.8	-	22.5	-	6.50

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Cgan 2023	5	UNSAT	8.66	27.8	9.62	-	10.6	22.3	6.46
2025 Cgan 2023	6	UNSAT	9.45	32.9	9.63	-	24.0	250	6.48
2025 Cgan 2023	7	SAT	6.38	6.16	8.68	-	19.3	18.0	6.47
2025 Cgan 2023	8	SAT	6.49	6.34	8.70	-	51.8	18.7	7.85
2025 Cgan 2023	9	SAT	6.40	6.23	8.65	-	1.76	18.7	8.62
2025 Cgan 2023	10	SAT	6.39	6.27	8.60	-	1.79	18.5	7.85
2025 Cgan 2023	11	SAT	6.39	6.30	8.69	-	66.8	18.6	7.90
2025 Cgan 2023	12	SAT	6.43	6.25	8.62	-	31.1	18.6	8.93
2025 Cgan 2023	13	UNSAT	14.9	141	10.1	-	81.0	-	8.52
2025 Cgan 2023	14	SAT	6.56	6.66	8.69	-	17.6	-	8.62
2025 Cgan 2023	15	UNSAT	11.7	138	9.94	-	221	45.1	8.71
2025 Cgan 2023	16	UNSAT	8.91	28.4	11.7	-	-	-	6.49
2025 Cgan 2023	17	SAT	6.48	6.17	8.64	-	17.7	18.2	7.25
2025 Cgan 2023	18	UNSAT	11.5	33.1	12.0	-	-	-	5.68
2025 Cgan 2023	19	SAT	8.40	15.6	15.3	-	-	78.2	-
2025 Cgan 2023	20	SAT	8.40	14.7	14.5	-	-	77.5	-
2025 Cifar100 2024	0	UNSAT	-	-	-	-	-	75.3	-
2025 Cifar100 2024	1	UNSAT	16.1	46.0	-	-	-	75.1	-
2025 Cifar100 2024	2	SAT	7.48	8.75	8.91	-	-	✗	-
2025 Cifar100 2024	3	UNSAT	12.6	31.4	17.5	-	-	76.3	-
2025 Cifar100 2024	4	UNSAT	18.5	53.8	-	-	-	75.5	-
2025 Cifar100 2024	5	UNSAT	-	-	-	-	-	75.1	-
2025 Cifar100 2024	6	UNSAT	14.7	43.7	-	-	-	75.8	-
2025 Cifar100 2024	7	UNSAT	13.7	34.5	30.2	-	-	75.5	-
2025 Cifar100 2024	8	UNSAT	-	-	-	-	-	75.3	-
2025 Cifar100 2024	9	UNSAT	12.7	31.6	14.8	-	-	75.1	-
2025 Cifar100 2024	10	UNSAT	10.3	22.6	11.2	-	-	75.5	-
2025 Cifar100 2024	11	SAT	7.47	11.0	-	-	-	✗	-
2025 Cifar100 2024	12	UNSAT	-	-	-	-	-	75.4	-
2025 Cifar100 2024	13	UNSAT	37.3	76.8	-	-	-	75.3	-
2025 Cifar100 2024	14	UNSAT	22.4	63.3	-	-	-	76.1	-
2025 Cifar100 2024	15	UNSAT	13.2	29.7	16.6	-	-	75.6	-
2025 Cifar100 2024	16	UNSAT	14.7	47.0	81.6	-	-	75.6	-
2025 Cifar100 2024	17	UNSAT	12.9	29.9	14.7	-	-	75.6	-
2025 Cifar100 2024	18	UNSAT	-	-	-	-	-	76.0	-
2025 Cifar100 2024	19	UNSAT	18.0	49.2	-	-	-	75.5	-
2025 Cifar100 2024	20	UNSAT	13.2	33.9	45.7	-	-	75.1	-
2025 Cifar100 2024	21	UNSAT	-	-	-	-	-	75.3	-
2025 Cifar100 2024	22	UNSAT	-	-	-	-	-	76.0	-
2025 Cifar100 2024	23	UNSAT	-	-	-	-	-	75.9	-
2025 Cifar100 2024	24	UNSAT	-	-	-	-	-	75.3	-
2025 Cifar100 2024	25	UNSAT	-	-	-	-	-	75.3	-
2025 Cifar100 2024	26	SAT	7.49	8.68	8.88	13.5	-	-	-
2025 Cifar100 2024	27	UNSAT	12.7	27.9	14.6	-	-	75.5	-
2025 Cifar100 2024	28	UNSAT	9.99	21.6	11.3	-	-	75.2	-
2025 Cifar100 2024	29	UNSAT	9.94	21.4	10.9	-	-	75.8	-
2025 Cifar100 2024	30	UNSAT	21.9	51.4	-	-	-	75.2	-
2025 Cifar100 2024	31	SAT	7.55	8.88	9.03	-	-	✗	-
2025 Cifar100 2024	32	UNSAT	-	-	-	-	-	75.7	-
2025 Cifar100 2024	33	UNSAT	13.8	47.1	46.1	-	-	75.7	-
2025 Cifar100 2024	34	UNSAT	-	-	-	-	-	75.2	-
2025 Cifar100 2024	35	UNSAT	-	-	-	-	-	75.6	-
2025 Cifar100 2024	36	UNSAT	33.0	70.4	-	-	-	76.5	-
2025 Cifar100 2024	37	UNSAT	18.5	53.7	-	-	-	75.6	-
2025 Cifar100 2024	38	UNSAT	12.6	28.8	12.6	-	-	75.9	-
2025 Cifar100 2024	39	SAT	7.53	8.83	8.81	14.5	-	-	-
2025 Cifar100 2024	40	UNSAT	-	-	-	-	-	75.3	-
2025 Cifar100 2024	41	UNSAT	14.6	43.2	84.3	-	-	76.0	-
2025 Cifar100 2024	42	UNSAT	-	-	-	-	-	77.2	-
2025 Cifar100 2024	43	SAT	7.49	8.69	8.87	14.5	-	-	-
2025 Cifar100 2024	44	UNSAT	-	-	-	-	-	75.6	-
2025 Cifar100 2024	45	UNSAT	-	-	-	-	-	75.9	-
2025 Cifar100 2024	46	UNSAT	13.6	37.1	37.2	-	-	75.9	-
2025 Cifar100 2024	47	UNSAT	15.6	43.4	-	-	-	75.7	-
2025 Cifar100 2024	48	SAT	7.52	8.55	8.83	14.5	-	-	-
2025 Cifar100 2024	49	UNSAT	-	-	-	-	-	75.0	-
2025 Cifar100 2024	50	UNSAT	12.7	27.1	12.6	-	-	75.6	-
2025 Cifar100 2024	51	UNSAT	23.4	52.6	-	-	-	75.8	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Cifar100 2024	52	UNSAT	14.7	35.3	102	-	-	75.7	-
2025 Cifar100 2024	53	UNSAT	12.8	30.5	14.5	-	-	75.1	-
2025 Cifar100 2024	54	SAT	7.54	✗	9.13	-	-	✗	-
2025 Cifar100 2024	55	UNSAT	40.7	84.9	-	-	-	76.1	-
2025 Cifar100 2024	56	UNSAT	27.7	59.4	-	-	-	76.4	-
2025 Cifar100 2024	57	UNSAT	-	-	-	-	-	76.5	-
2025 Cifar100 2024	58	UNSAT	-	-	-	-	-	75.4	-
2025 Cifar100 2024	59	UNSAT	-	-	-	-	-	75.9	-
2025 Cifar100 2024	60	UNSAT	31.2	66.6	-	-	-	75.6	-
2025 Cifar100 2024	61	SAT	7.43	8.61	8.83	14.3	-	-	-
2025 Cifar100 2024	62	UNSAT	20.6	69.0	-	-	-	75.5	-
2025 Cifar100 2024	63	UNSAT	-	-	-	-	-	74.7	-
2025 Cifar100 2024	64	SAT	7.44	8.68	8.96	-	-	✗	-
2025 Cifar100 2024	65	SAT	7.45	8.62	8.81	14.5	-	-	-
2025 Cifar100 2024	66	UNSAT	89.7	-	-	-	-	75.7	-
2025 Cifar100 2024	67	UNSAT	-	-	-	-	-	75.2	-
2025 Cifar100 2024	68	UNSAT	66.4	-	-	-	-	75.8	-
2025 Cifar100 2024	69	SAT	7.50	8.74	9.02	-	-	✗	-
2025 Cifar100 2024	70	UNSAT	13.7	45.2	62.6	-	-	75.8	-
2025 Cifar100 2024	71	UNSAT	15.7	40.6	-	-	-	76.3	-
2025 Cifar100 2024	72	UNSAT	12.6	28.2	16.9	-	-	75.1	-
2025 Cifar100 2024	73	UNSAT	-	-	-	-	-	76.0	-
2025 Cifar100 2024	74	UNSAT	-	-	-	-	-	76.2	-
2025 Cifar100 2024	75	UNSAT	12.6	30.7	18.2	-	-	75.4	-
2025 Cifar100 2024	76	UNSAT	10.3	22.5	10.9	-	-	75.7	-
2025 Cifar100 2024	77	UNSAT	-	-	-	-	-	76.0	-
2025 Cifar100 2024	78	UNSAT	-	-	-	-	-	75.8	-
2025 Cifar100 2024	79	UNSAT	-	-	-	-	-	75.8	-
2025 Cifar100 2024	80	UNSAT	13.1	36.5	28.0	-	-	75.9	-
2025 Cifar100 2024	81	UNSAT	-	-	-	-	-	76.5	-
2025 Cifar100 2024	82	UNSAT	14.0	31.6	29.5	-	-	75.5	-
2025 Cifar100 2024	83	SAT	7.51	11.6	8.99	-	-	✗	-
2025 Cifar100 2024	84	UNSAT	12.7	29.3	12.9	-	-	76.2	-
2025 Cifar100 2024	85	UNSAT	58.0	-	-	-	-	75.6	-
2025 Cifar100 2024	86	UNSAT	-	-	-	-	-	76.0	-
2025 Cifar100 2024	87	UNSAT	26.6	77.7	-	-	-	75.6	-
2025 Cifar100 2024	88	UNSAT	15.2	53.7	-	-	-	75.5	-
2025 Cifar100 2024	89	UNSAT	26.8	62.9	-	-	-	75.7	-
2025 Cifar100 2024	90	UNSAT	-	-	-	-	-	75.5	-
2025 Cifar100 2024	91	UNSAT	-	-	-	-	-	75.7	-
2025 Cifar100 2024	92	UNSAT	14.1	38.4	73.9	-	-	76.1	-
2025 Cifar100 2024	93	UNSAT	12.5	31.5	12.6	-	-	75.3	-
2025 Cifar100 2024	94	UNSAT	17.1	43.6	-	-	-	75.4	-
2025 Cifar100 2024	95	UNSAT	-	-	-	-	-	75.9	-
2025 Cifar100 2024	96	UNSAT	-	-	-	-	-	75.5	-
2025 Cifar100 2024	97	SAT	7.48	8.66	8.87	14.6	-	-	-
2025 Cifar100 2024	98	UNSAT	18.4	45.1	-	-	-	75.9	-
2025 Cifar100 2024	99	UNSAT	35.6	68.2	-	-	-	75.6	-
2025 Cifar100 2024	100	UNSAT	10.4	26.7	17.3	-	-	78.4	-
2025 Cifar100 2024	101	UNSAT	15.3	70.8	28.3	-	-	77.1	-
2025 Cifar100 2024	102	UNSAT	14.7	51.0	21.1	-	-	77.4	-
2025 Cifar100 2024	103	UNSAT	16.2	80.8	24.1	-	-	77.7	-
2025 Cifar100 2024	104	UNSAT	-	-	-	-	-	78.0	-
2025 Cifar100 2024	105	UNSAT	16.4	53.3	-	-	-	77.6	-
2025 Cifar100 2024	106	UNSAT	-	-	-	-	-	77.7	-
2025 Cifar100 2024	107	UNSAT	-	-	-	-	-	77.4	-
2025 Cifar100 2024	108	UNSAT	-	-	-	-	-	78.0	-
2025 Cifar100 2024	109	UNSAT	-	-	-	-	-	77.9	-
2025 Cifar100 2024	110	SAT	7.76	✗	-	-	-	✗	-
2025 Cifar100 2024	111	UNSAT	-	-	-	-	-	77.6	-
2025 Cifar100 2024	112	UNSAT	18.6	60.3	-	-	-	77.4	-
2025 Cifar100 2024	113	UNSAT	9.85	21.5	14.6	-	-	78.0	-
2025 Cifar100 2024	114	SAT	7.77	9.36	9.16	-	-	✗	-
2025 Cifar100 2024	115	UNSAT	-	-	-	-	-	78.4	-
2025 Cifar100 2024	116	UNSAT	14.7	52.6	27.1	-	-	77.2	-
2025 Cifar100 2024	117	UNSAT	-	-	-	-	-	77.4	-
2025 Cifar100 2024	118	SAT	7.78	8.98	8.95	14.8	-	-	-
2025 Cifar100 2024	119	SAT	7.77	9.13	8.97	-	-	✗	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Cifar100 2024	120	UNSAT	10.7	30.8	20.3	-	-	77.9	-
2025 Cifar100 2024	121	UNSAT	-	-	-	-	-	78.0	-
2025 Cifar100 2024	122	UNSAT	-	-	-	-	-	77.5	-
2025 Cifar100 2024	123	UNSAT	29.7	97.8	-	-	-	77.7	-
2025 Cifar100 2024	124	SAT	7.83	8.89	8.96	-	-	✗	-
2025 Cifar100 2024	125	UNSAT	19.3	-	-	-	-	78.5	-
2025 Cifar100 2024	126	UNSAT	24.4	-	-	-	-	77.9	-
2025 Cifar100 2024	127	UNSAT	15.7	70.4	90.0	-	-	78.8	-
2025 Cifar100 2024	128	UNSAT	14.7	54.0	20.1	-	-	77.9	-
2025 Cifar100 2024	129	UNSAT	16.2	72.1	19.9	-	-	78.5	-
2025 Cifar100 2024	130	UNSAT	-	-	-	-	-	78.5	-
2025 Cifar100 2024	131	UNSAT	-	-	-	-	-	78.3	-
2025 Cifar100 2024	132	UNSAT	10.1	24.4	15.8	-	-	77.8	-
2025 Cifar100 2024	133	UNSAT	20.9	73.2	-	-	-	77.9	-
2025 Cifar100 2024	134	UNSAT	15.6	42.7	39.6	-	-	78.6	-
2025 Cifar100 2024	135	UNSAT	16.6	102	52.3	-	-	78.0	-
2025 Cifar100 2024	136	UNSAT	-	-	-	-	-	79.2	-
2025 Cifar100 2024	137	UNSAT	14.6	42.6	26.7	-	-	78.6	-
2025 Cifar100 2024	138	UNSAT	16.8	-	61.6	-	-	77.8	-
2025 Cifar100 2024	139	UNSAT	20.6	-	-	-	-	77.6	-
2025 Cifar100 2024	140	UNSAT	-	-	-	-	-	78.0	-
2025 Cifar100 2024	141	UNSAT	16.8	74.1	74.6	-	-	77.6	-
2025 Cifar100 2024	142	UNSAT	-	-	-	-	-	77.9	-
2025 Cifar100 2024	143	UNSAT	-	-	-	-	-	78.6	-
2025 Cifar100 2024	144	UNSAT	-	-	-	-	-	77.6	-
2025 Cifar100 2024	145	UNSAT	-	-	-	-	-	77.3	-
2025 Cifar100 2024	146	UNSAT	-	-	-	-	-	77.5	-
2025 Cifar100 2024	147	UNSAT	15.9	78.6	105	-	-	77.7	-
2025 Cifar100 2024	148	SAT	7.85	9.07	8.94	14.8	-	-	-
2025 Cifar100 2024	149	UNSAT	-	-	-	-	-	78.4	-
2025 Cifar100 2024	150	UNSAT	-	-	-	-	-	77.7	-
2025 Cifar100 2024	151	UNSAT	19.5	-	-	-	-	77.7	-
2025 Cifar100 2024	152	UNSAT	15.8	-	93.3	-	-	77.9	-
2025 Cifar100 2024	153	UNSAT	-	-	-	-	-	79.2	-
2025 Cifar100 2024	154	UNSAT	15.4	74.0	25.7	-	-	78.3	-
2025 Cifar100 2024	155	SAT	7.78	9.01	9.04	-	-	✗	-
2025 Cifar100 2024	156	UNSAT	10.7	30.0	16.4	-	-	78.3	-
2025 Cifar100 2024	157	UNSAT	17.2	87.8	-	-	-	79.6	-
2025 Cifar100 2024	158	UNSAT	-	-	-	-	-	78.3	-
2025 Cifar100 2024	159	UNSAT	-	-	-	-	-	77.8	-
2025 Cifar100 2024	160	SAT	7.88	✗	-	-	-	✗	-
2025 Cifar100 2024	161	SAT	7.74	✗	-	-	-	✗	-
2025 Cifar100 2024	162	UNSAT	15.4	81.0	22.0	-	-	77.9	-
2025 Cifar100 2024	163	UNSAT	14.7	53.4	27.7	-	-	78.4	-
2025 Cifar100 2024	164	SAT	7.78	8.88	8.96	-	-	✗	-
2025 Cifar100 2024	165	UNSAT	-	-	-	-	-	78.3	-
2025 Cifar100 2024	166	SAT	7.94	9.14	9.02	-	-	✗	-
2025 Cifar100 2024	167	UNSAT	10.1	26.4	16.4	-	-	77.6	-
2025 Cifar100 2024	168	UNSAT	15.7	51.5	23.8	-	-	77.8	-
2025 Cifar100 2024	169	UNSAT	-	-	-	-	-	77.7	-
2025 Cifar100 2024	170	UNSAT	17.5	-	-	-	-	77.6	-
2025 Cifar100 2024	171	UNSAT	-	-	-	-	-	78.6	-
2025 Cifar100 2024	172	UNSAT	-	-	-	-	-	78.8	-
2025 Cifar100 2024	173	UNSAT	17.9	-	48.6	-	-	78.6	-
2025 Cifar100 2024	174	UNSAT	15.6	63.5	22.9	-	-	78.2	-
2025 Cifar100 2024	175	UNSAT	18.2	92.4	-	-	-	78.5	-
2025 Cifar100 2024	176	UNSAT	15.3	78.1	44.1	-	-	78.0	-
2025 Cifar100 2024	177	UNSAT	18.5	75.8	-	-	-	79.2	-
2025 Cifar100 2024	178	UNSAT	-	-	-	-	-	78.7	-
2025 Cifar100 2024	179	UNSAT	9.71	24.8	18.8	-	-	79.3	-
2025 Cifar100 2024	180	UNSAT	-	-	-	-	-	78.3	-
2025 Cifar100 2024	181	SAT	7.73	9.16	9.01	-	-	✗	-
2025 Cifar100 2024	182	UNSAT	-	-	-	-	-	79.1	-
2025 Cifar100 2024	183	SAT	7.76	9.05	8.94	15.1	-	-	-
2025 Cifar100 2024	184	UNSAT	15.1	64.5	24.9	-	-	78.4	-
2025 Cifar100 2024	185	UNSAT	-	-	-	-	-	78.4	-
2025 Cifar100 2024	186	UNSAT	16.7	74.7	28.6	-	-	77.9	-
2025 Cifar100 2024	187	UNSAT	9.91	18.8	17.6	-	-	79.3	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Cifar100 2024	188	UNSAT	-	-	-	-	-	78.4	-
2025 Cifar100 2024	189	UNSAT	18.6	-	-	-	-	77.5	-
2025 Cifar100 2024	190	UNSAT	16.9	71.2	-	-	-	79.2	-
2025 Cifar100 2024	191	UNSAT	-	-	-	-	-	78.4	-
2025 Cifar100 2024	192	UNSAT	-	-	-	-	-	78.8	-
2025 Cifar100 2024	193	UNSAT	-	-	-	-	-	78.3	-
2025 Cifar100 2024	194	SAT	7.70	9.03	9.02	-	-	✗	-
2025 Cifar100 2024	195	UNSAT	-	-	-	-	-	77.7	-
2025 Cifar100 2024	196	UNSAT	16.0	-	57.7	-	-	77.9	-
2025 Cifar100 2024	197	UNSAT	16.9	81.2	88.9	-	-	78.5	-
2025 Cifar100 2024	198	UNSAT	16.0	66.4	22.0	-	-	78.4	-
2025 Cifar100 2024	199	SAT	7.75	8.87	9.07	-	-	✗	-
2025 Collins Rul Cnn 2022 0		UNSAT	6.37	6.32	6.14	16.3	1.46	15.0	-
2025 Collins Rul Cnn 2022 1		UNSAT	7.06	9.55	6.29	13.4	1.50	16.4	-
2025 Collins Rul Cnn 2022 2		UNSAT	7.10	12.5	6.38	13.5	1.43	16.7	-
2025 Collins Rul Cnn 2022 3		UNSAT	7.08	12.5	6.40	13.2	1.45	16.7	-
2025 Collins Rul Cnn 2022 4		SAT	6.34	6.35	6.12	13.8	1.50	15.0	-
2025 Collins Rul Cnn 2022 5		SAT	6.36	6.34	6.12	13.5	1.44	15.1	-
2025 Collins Rul Cnn 2022 6		SAT	6.43	6.31	6.19	13.8	1.49	15.1	76.7
2025 Collins Rul Cnn 2022 7		SAT	6.42	6.38	6.10	13.7	1.56	15.3	46.5
2025 Collins Rul Cnn 2022 8		UNSAT	7.08	18.5	6.22	13.4	1.46	16.7	47.4
2025 Collins Rul Cnn 2022 9		UNSAT	7.07	18.5	6.35	13.2	1.52	16.7	46.6
2025 Collins Rul Cnn 2022 10		UNSAT	7.12	26.7	6.39	13.3	1.41	16.9	46.4
2025 Collins Rul Cnn 2022 11		UNSAT	7.04	26.7	6.50	13.5	1.42	16.8	46.6
2025 Collins Rul Cnn 2022 12		UNSAT	7.03	26.7	6.26	13.4	1.54	16.7	46.8
2025 Collins Rul Cnn 2022 13		SAT	6.36	6.35	6.10	13.5	1.41	15.2	47.0
2025 Collins Rul Cnn 2022 14		UNSAT	7.04	26.7	6.44	13.5	1.58	16.8	46.9
2025 Collins Rul Cnn 2022 15		SAT	6.36	6.32	6.08	13.7	1.63	15.1	46.8
2025 Collins Rul Cnn 2022 16		UNSAT	7.12	9.57	6.34	13.2	1.58	16.8	-
2025 Collins Rul Cnn 2022 17		UNSAT	7.07	18.5	6.31	13.2	1.55	16.5	46.8
2025 Collins Rul Cnn 2022 18		UNSAT	7.11	26.7	6.35	13.4	1.43	16.8	46.6
2025 Collins Rul Cnn 2022 19		SAT	6.36	6.37	6.08	13.7	1.44	15.0	597
2025 Collins Rul Cnn 2022 20		SAT	6.43	6.35	6.10	13.7	1.51	15.1	485
2025 Collins Rul Cnn 2022 21		SAT	6.39	6.36	6.11	13.7	1.81	15.3	453
2025 Collins Rul Cnn 2022 22		UNSAT	6.37	6.40	6.12	13.7	1.57	15.0	-
2025 Collins Rul Cnn 2022 23		UNSAT	7.15	9.54	6.26	13.4	1.53	16.9	-
2025 Collins Rul Cnn 2022 24		UNSAT	7.07	12.5	6.37	13.4	1.49	17.2	49.5
2025 Collins Rul Cnn 2022 25		UNSAT	7.08	18.4	6.35	13.5	1.49	16.8	49.5
2025 Collins Rul Cnn 2022 26		SAT	6.37	6.41	6.07	13.7	1.45	15.0	49.9
2025 Collins Rul Cnn 2022 27		SAT	6.37	6.34	6.11	13.7	1.43	15.1	49.7
2025 Collins Rul Cnn 2022 28		SAT	6.39	6.33	6.10	13.8	1.50	15.3	49.7
2025 Collins Rul Cnn 2022 29		SAT	6.40	6.33	6.11	12.7	1.67	15.1	49.6
2025 Collins Rul Cnn 2022 30		UNSAT	7.10	18.5	6.35	13.5	1.62	16.8	49.8
2025 Collins Rul Cnn 2022 31		UNSAT	7.11	26.7	6.35	13.5	1.47	16.8	49.5
2025 Collins Rul Cnn 2022 32		UNSAT	7.10	26.7	6.38	13.2	1.49	16.7	49.7
2025 Collins Rul Cnn 2022 33		UNSAT	7.08	26.7	6.47	13.2	1.58	17.0	49.5
2025 Collins Rul Cnn 2022 34		UNSAT	7.12	26.7	6.34	13.5	1.45	16.8	50.0
2025 Collins Rul Cnn 2022 35		SAT	6.40	6.33	6.11	13.7	1.66	15.1	50.2
2025 Collins Rul Cnn 2022 36		UNSAT	7.13	26.7	6.57	13.5	1.48	17.6	50.1
2025 Collins Rul Cnn 2022 37		SAT	6.44	6.37	6.07	13.7	1.50	15.0	50.0
2025 Collins Rul Cnn 2022 38		UNSAT	7.07	12.5	6.28	13.2	1.51	16.5	50.0
2025 Collins Rul Cnn 2022 39		UNSAT	7.07	24.4	6.33	13.2	1.45	16.6	49.6
2025 Collins Rul Cnn 2022 40		UNSAT	7.06	26.7	6.41	13.5	1.59	17.1	49.7
2025 Collins Rul Cnn 2022 41		SAT	6.47	6.35	6.11	13.7	1.48	15.3	488
2025 Collins Rul Cnn 2022 42		SAT	6.40	6.30	6.06	13.7	1.67	15.2	457
2025 Collins Rul Cnn 2022 43		UNSAT	7.14	12.5	6.39	13.5	1.46	16.7	-
2025 Collins Rul Cnn 2022 44		UNSAT	7.13	15.5	6.39	13.6	1.54	16.5	-
2025 Collins Rul Cnn 2022 45		UNSAT	7.13	18.5	6.43	13.5	1.54	16.9	-
2025 Collins Rul Cnn 2022 46		UNSAT	7.14	26.7	6.31	13.5	1.42	16.8	-
2025 Collins Rul Cnn 2022 47		UNSAT	6.36	6.37	6.11	13.8	1.58	15.6	-
2025 Collins Rul Cnn 2022 48		UNSAT	6.41	6.37	6.11	13.7	1.51	15.1	-
2025 Collins Rul Cnn 2022 49		UNSAT	7.12	18.5	6.34	13.5	1.55	16.4	-
2025 Collins Rul Cnn 2022 50		UNSAT	6.38	6.34	6.10	13.6	1.53	15.2	-
2025 Collins Rul Cnn 2022 51		UNSAT	7.21	18.5	6.36	13.5	1.68	16.7	-
2025 Collins Rul Cnn 2022 52		UNSAT	7.19	26.7	6.48	13.5	1.57	16.6	-
2025 Collins Rul Cnn 2022 53		UNSAT	7.20	26.7	6.50	13.5	1.56	16.9	-
2025 Collins Rul Cnn 2022 54		UNSAT	6.39	6.37	6.07	13.7	1.56	15.2	-
2025 Collins Rul Cnn 2022 55		UNSAT	7.14	26.7	6.45	13.4	1.56	17.1	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Collins Rul Cnn 2022	56	UNSAT	7.11	26.7	6.46	13.5	1.58	17.1	-
2025 Collins Rul Cnn 2022	57	UNSAT	7.16	26.7	6.63	13.5	1.58	17.4	-
2025 Collins Rul Cnn 2022	58	UNSAT	7.13	26.7	6.70	13.5	1.45	19.3	-
2025 Collins Rul Cnn 2022	59	UNSAT	7.14	18.5	6.36	13.4	1.53	16.5	-
2025 Collins Rul Cnn 2022	60	UNSAT	7.13	26.7	6.36	13.4	1.53	16.5	-
2025 Collins Rul Cnn 2022	61	UNSAT	7.13	26.7	6.34	13.4	1.46	17.1	-
2025 Cora 2024	0	SAT	6.26	6.68	7.84	12.4	-	-	-
2025 Cora 2024	1	SAT	6.23	6.74	7.89	12.4	-	-	-
2025 Cora 2024	2	UNSAT	6.97	9.25	8.89	12.2	1.29	23.4	-
2025 Cora 2024	3	SAT	6.26	6.12	7.82	12.4	-	16.8	-
2025 Cora 2024	4	?	-	-	-	-	-	-	-
2025 Cora 2024	5	UNSAT	6.99	9.27	8.68	11.2	1.28	22.4	-
2025 Cora 2024	6	SAT	6.30	6.71	7.89	12.5	-	-	-
2025 Cora 2024	7	?	-	-	-	-	-	-	-
2025 Cora 2024	8	UNSAT	7.02	9.26	8.21	12.2	1.35	18.4	-
2025 Cora 2024	9	?	-	-	-	-	-	-	-
2025 Cora 2024	10	?	-	-	-	-	-	-	-
2025 Cora 2024	11	UNSAT	7.07	9.25	8.31	12.2	1.32	18.4	-
2025 Cora 2024	12	SAT	6.31	6.74	7.87	11.4	-	-	-
2025 Cora 2024	13	?	-	-	-	-	-	-	-
2025 Cora 2024	14	UNSAT	7.04	9.23	8.92	12.2	1.28	20.4	-
2025 Cora 2024	15	SAT	6.27	6.80	7.89	-	-	-	-
2025 Cora 2024	16	?	-	-	-	-	-	-	-
2025 Cora 2024	17	UNSAT	7.00	9.22	8.46	11.2	1.30	18.3	-
2025 Cora 2024	18	SAT	6.29	6.72	7.88	11.4	-	-	-
2025 Cora 2024	19	?	-	-	-	-	-	-	-
2025 Cora 2024	20	UNSAT	7.01	9.25	8.53	11.1	1.28	18.7	-
2025 Cora 2024	21	SAT	6.30	6.71	7.82	12.4	-	-	-
2025 Cora 2024	22	?	-	-	-	-	-	-	-
2025 Cora 2024	23	UNSAT	6.98	9.24	8.19	12.2	1.27	18.6	-
2025 Cora 2024	24	SAT	6.30	6.72	7.83	12.4	-	-	-
2025 Cora 2024	25	?	-	-	-	-	-	-	-
2025 Cora 2024	26	UNSAT	7.01	9.25	8.52	12.2	1.29	19.2	-
2025 Cora 2024	27	SAT	6.30	6.71	7.78	12.4	-	-	-
2025 Cora 2024	28	?	-	-	-	-	-	-	-
2025 Cora 2024	29	UNSAT	6.97	9.25	8.91	12.2	1.30	23.2	-
2025 Cora 2024	30	SAT	6.28	6.67	7.86	-	-	-	-
2025 Cora 2024	31	?	-	-	-	-	-	-	-
2025 Cora 2024	32	UNSAT	7.01	9.30	8.63	12.2	1.27	18.8	-
2025 Cora 2024	33	SAT	6.33	6.91	7.82	-	-	-	-
2025 Cora 2024	34	?	-	-	-	-	-	-	-
2025 Cora 2024	35	UNSAT	7.01	9.23	8.30	12.2	1.27	18.5	-
2025 Cora 2024	36	SAT	6.32	6.72	7.85	13.2	-	-	-
2025 Cora 2024	37	?	-	-	-	-	-	-	-
2025 Cora 2024	38	UNSAT	7.01	9.27	8.86	12.2	1.27	23.5	-
2025 Cora 2024	39	SAT	6.24	6.71	7.78	11.4	-	16.4	-
2025 Cora 2024	40	?	-	-	-	-	-	-	-
2025 Cora 2024	41	UNSAT	7.03	9.24	8.57	12.1	1.28	19.8	-
2025 Cora 2024	42	?	-	-	-	-	-	-	-
2025 Cora 2024	43	?	-	-	-	-	-	-	-
2025 Cora 2024	44	UNSAT	6.99	9.25	8.75	12.2	1.27	18.3	-
2025 Cora 2024	45	SAT	6.26	6.71	7.91	12.4	-	-	-
2025 Cora 2024	46	?	-	-	-	-	-	-	-
2025 Cora 2024	47	SAT	6.29	6.69	7.84	12.4	17.8	-	-
2025 Cora 2024	48	SAT	6.26	6.28	7.86	12.4	-	16.5	-
2025 Cora 2024	49	SAT	6.36	6.73	-	-	-	-	-
2025 Cora 2024	50	UNSAT	7.03	9.21	8.94	12.2	1.38	20.3	-
2025 Cora 2024	51	SAT	6.31	6.68	7.80	12.4	-	-	-
2025 Cora 2024	52	?	-	-	-	-	-	-	-
2025 Cora 2024	53	UNSAT	6.98	9.23	8.47	12.2	1.27	18.4	-
2025 Cora 2024	54	SAT	6.30	6.68	7.78	11.5	-	17.0	-
2025 Cora 2024	55	?	-	-	-	-	-	-	-
2025 Cora 2024	56	UNSAT	7.02	9.24	8.90	12.1	1.28	20.6	-
2025 Cora 2024	57	SAT	6.28	6.67	7.82	12.4	-	-	-
2025 Cora 2024	58	?	-	-	-	-	-	-	-
2025 Cora 2024	59	UNSAT	6.96	9.22	8.96	12.1	1.27	24.9	-
2025 Cora 2024	60	SAT	6.29	6.87	7.87	12.8	-	17.3	-
2025 Cora 2024	61	SAT	6.29	6.87	7.86	12.5	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Cora 2024	62	SAT	6.32	6.87	7.87	12.4	-	17.9	-
2025 Cora 2024	63	SAT	6.23	6.32	7.83	12.5	-	17.2	-
2025 Cora 2024	64	SAT	6.28	6.84	7.86	12.5	-	-	-
2025 Cora 2024	65	SAT	6.26	6.31	7.82	12.5	-	17.5	-
2025 Cora 2024	66	SAT	6.31	6.28	7.83	12.5	-	17.5	-
2025 Cora 2024	67	SAT	6.33	6.42	7.88	12.5	-	17.4	-
2025 Cora 2024	68	SAT	6.27	6.27	7.80	12.5	-	17.2	-
2025 Cora 2024	69	SAT	6.27	7.01	7.87	12.5	-	17.4	-
2025 Cora 2024	70	SAT	6.34	6.38	7.86	12.5	-	17.4	-
2025 Cora 2024	71	SAT	6.25	6.26	7.85	11.5	3.43	17.4	-
2025 Cora 2024	72	SAT	6.29	6.38	7.86	12.5	-	17.6	-
2025 Cora 2024	73	SAT	6.26	6.29	7.84	12.4	-	17.5	-
2025 Cora 2024	74	SAT	6.26	6.83	7.87	12.5	-	17.4	-
2025 Cora 2024	75	SAT	6.29	6.39	7.81	12.5	-	17.3	-
2025 Cora 2024	76	SAT	6.25	6.28	7.80	12.5	-	17.3	-
2025 Cora 2024	77	SAT	6.28	6.83	7.85	12.5	-	-	-
2025 Cora 2024	78	SAT	6.32	6.97	7.84	12.5	-	17.4	-
2025 Cora 2024	79	SAT	6.28	6.43	7.80	12.5	-	17.4	-
2025 Cora 2024	80	SAT	6.30	6.84	7.83	12.4	-	-	-
2025 Cora 2024	81	SAT	6.25	6.38	7.81	12.5	-	17.6	-
2025 Cora 2024	82	SAT	6.30	6.34	7.77	11.5	-	17.3	-
2025 Cora 2024	83	SAT	6.25	6.25	7.78	12.5	-	17.3	-
2025 Cora 2024	84	SAT	6.30	6.32	7.78	12.5	-	17.3	-
2025 Cora 2024	85	SAT	6.30	6.32	7.79	12.5	-	17.4	-
2025 Cora 2024	86	SAT	6.31	6.80	7.84	12.5	-	-	-
2025 Cora 2024	87	SAT	6.29	6.37	7.80	12.5	-	17.2	-
2025 Cora 2024	88	SAT	6.27	6.37	7.78	12.5	-	17.3	-
2025 Cora 2024	89	SAT	6.30	6.85	7.85	12.5	-	17.3	-
2025 Cora 2024	90	SAT	6.29	6.31	7.79	11.6	-	17.3	-
2025 Cora 2024	91	SAT	6.27	6.25	7.79	12.5	-	17.2	-
2025 Cora 2024	92	SAT	6.30	6.84	7.81	12.5	-	-	-
2025 Cora 2024	93	SAT	6.27	6.31	7.81	12.5	-	17.1	-
2025 Cora 2024	94	SAT	6.24	6.52	7.78	11.4	-	17.4	-
2025 Cora 2024	95	SAT	6.33	6.84	7.85	12.4	-	-	-
2025 Cora 2024	96	SAT	6.29	6.46	7.85	12.5	-	17.5	-
2025 Cora 2024	97	SAT	6.30	6.30	7.83	12.5	-	17.6	-
2025 Cora 2024	98	SAT	6.32	6.85	7.82	11.5	-	17.2	-
2025 Cora 2024	99	SAT	6.27	6.30	7.84	12.4	-	17.3	-
2025 Cora 2024	100	SAT	6.31	6.89	7.83	12.5	-	17.4	-
2025 Cora 2024	101	SAT	6.33	6.81	7.85	12.5	-	-	-
2025 Cora 2024	102	SAT	6.29	6.40	7.85	11.5	-	17.4	-
2025 Cora 2024	103	SAT	6.28	6.32	7.84	12.5	-	17.4	-
2025 Cora 2024	104	SAT	6.26	6.45	7.87	12.5	-	17.1	-
2025 Cora 2024	105	SAT	6.28	6.31	7.89	11.5	-	17.4	-
2025 Cora 2024	106	SAT	6.26	6.34	7.82	12.5	-	17.4	-
2025 Cora 2024	107	SAT	6.29	6.31	7.84	12.5	-	17.2	-
2025 Cora 2024	108	SAT	6.26	6.27	7.86	11.4	-	17.3	-
2025 Cora 2024	109	SAT	6.25	6.28	7.82	12.5	-	17.3	-
2025 Cora 2024	110	SAT	6.28	6.40	7.82	12.5	-	17.3	-
2025 Cora 2024	111	SAT	6.26	6.28	7.87	12.5	-	17.7	-
2025 Cora 2024	112	SAT	6.29	6.29	7.81	11.5	-	17.4	-
2025 Cora 2024	113	SAT	6.34	6.51	7.80	12.6	-	17.3	-
2025 Cora 2024	114	SAT	6.39	6.29	7.88	12.5	-	17.4	-
2025 Cora 2024	115	SAT	6.31	6.50	7.82	12.5	-	17.1	-
2025 Cora 2024	116	SAT	6.34	6.83	7.88	12.5	-	-	-
2025 Cora 2024	117	SAT	6.24	6.28	7.86	12.5	-	17.9	-
2025 Cora 2024	118	SAT	6.26	6.26	7.84	11.5	-	17.3	-
2025 Cora 2024	119	SAT	6.27	6.86	7.86	12.5	-	-	-
2025 Cora 2024	120	SAT	6.32	6.90	7.87	12.5	-	-	-
2025 Cora 2024	121	SAT	6.29	6.81	-	12.5	-	-	-
2025 Cora 2024	122	SAT	6.34	6.86	7.88	12.4	-	-	-
2025 Cora 2024	123	SAT	6.31	6.84	7.84	11.5	-	-	-
2025 Cora 2024	124	SAT	6.29	6.88	7.87	12.5	-	-	-
2025 Cora 2024	125	SAT	6.29	6.82	7.90	11.5	-	-	-
2025 Cora 2024	126	SAT	6.34	6.80	7.86	12.7	-	-	-
2025 Cora 2024	127	?	-	-	-	-	-	-	-
2025 Cora 2024	128	UNSAT	7.90	25.1	-	-	-	-	-
2025 Cora 2024	129	SAT	6.29	6.89	7.86	12.5	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Cora 2024	130	SAT	6.28	6.85	7.91	12.5	-	-	-
2025 Cora 2024	131	UNSAT	7.90	-	-	-	-	-	-
2025 Cora 2024	132	SAT	6.32	6.85	7.90	12.5	-	-	-
2025 Cora 2024	133	SAT	6.34	6.79	7.89	-	-	-	-
2025 Cora 2024	134	SAT	6.31	6.84	7.87	11.5	-	-	-
2025 Cora 2024	135	SAT	6.29	6.93	7.82	11.5	-	-	-
2025 Cora 2024	136	SAT	6.32	6.80	7.87	12.4	-	-	-
2025 Cora 2024	137	SAT	6.31	6.84	7.90	12.5	-	-	-
2025 Cora 2024	138	?	-	-	-	-	-	-	-
2025 Cora 2024	139	?	-	-	-	-	-	-	-
2025 Cora 2024	140	SAT	6.33	6.83	7.88	12.5	20.8	-	-
2025 Cora 2024	141	SAT	6.29	6.82	7.88	-	-	-	-
2025 Cora 2024	142	SAT	6.28	6.88	7.90	12.5	-	-	-
2025 Cora 2024	143	SAT	6.31	6.84	7.85	12.5	-	-	-
2025 Cora 2024	144	SAT	6.27	6.97	7.85	-	-	-	-
2025 Cora 2024	145	?	-	-	-	-	-	-	-
2025 Cora 2024	146	SAT	6.30	6.82	7.88	12.5	-	-	-
2025 Cora 2024	147	SAT	6.28	6.85	7.86	12.5	-	-	-
2025 Cora 2024	148	SAT	6.31	6.88	7.92	12.5	-	-	-
2025 Cora 2024	149	?	-	-	-	-	-	-	-
2025 Cora 2024	150	SAT	6.32	6.83	7.89	12.5	-	-	-
2025 Cora 2024	151	SAT	6.31	6.81	7.93	11.5	-	-	-
2025 Cora 2024	152	SAT	6.30	6.85	7.92	12.5	-	-	-
2025 Cora 2024	153	SAT	6.32	6.84	7.88	12.5	-	-	-
2025 Cora 2024	154	SAT	6.28	6.83	7.88	12.4	-	-	-
2025 Cora 2024	155	SAT	6.30	6.83	7.96	11.5	-	-	-
2025 Cora 2024	156	SAT	6.31	6.83	7.95	12.5	-	-	-
2025 Cora 2024	157	SAT	6.30	6.86	7.88	11.8	-	17.3	-
2025 Cora 2024	158	SAT	6.34	6.89	7.88	12.8	-	-	-
2025 Cora 2024	159	SAT	6.31	6.85	7.88	11.4	-	-	-
2025 Cora 2024	160	SAT	6.30	6.82	-	12.5	-	-	-
2025 Cora 2024	161	SAT	6.28	6.83	7.91	12.5	-	-	-
2025 Cora 2024	162	SAT	6.28	6.93	7.91	11.5	-	-	-
2025 Cora 2024	163	SAT	6.27	6.85	7.90	12.5	-	-	-
2025 Cora 2024	164	SAT	6.33	6.85	7.90	12.6	-	-	-
2025 Cora 2024	165	SAT	6.30	6.87	7.80	12.5	-	-	-
2025 Cora 2024	166	SAT	6.28	6.88	7.87	12.5	-	-	-
2025 Cora 2024	167	SAT	6.29	6.84	7.90	12.5	-	-	-
2025 Cora 2024	168	SAT	6.31	6.86	7.92	12.5	-	-	-
2025 Cora 2024	169	SAT	6.30	6.83	7.90	12.5	-	-	-
2025 Cora 2024	170	SAT	6.27	6.83	7.91	12.5	-	-	-
2025 Cora 2024	171	SAT	6.26	6.49	7.84	12.5	-	17.3	-
2025 Cora 2024	172	?	-	-	-	-	-	-	-
2025 Cora 2024	173	UNSAT	7.14	9.40	9.01	-	-	-	-
2025 Cora 2024	174	SAT	6.33	6.90	7.92	11.5	-	-	-
2025 Cora 2024	175	SAT	6.28	6.28	7.88	12.5	-	17.5	-
2025 Cora 2024	176	?	-	-	-	-	-	-	-
2025 Cora 2024	177	SAT	6.31	6.84	7.89	12.5	-	-	-
2025 Cora 2024	178	SAT	6.31	6.90	7.88	12.5	-	-	-
2025 Cora 2024	179	SAT	6.31	6.80	7.87	12.5	27.0	-	-
2025 Dist Shift 2023	0	UNSAT	8.31	27.0	8.34	15.3	-	-	-
2025 Dist Shift 2023	1	UNSAT	6.44	26.7	7.15	15.0	-	59.3	-
2025 Dist Shift 2023	2	UNSAT	8.29	26.9	7.53	14.4	-	69.1	-
2025 Dist Shift 2023	3	UNSAT	6.47	26.8	7.06	13.7	-	57.7	-
2025 Dist Shift 2023	4	UNSAT	6.40	26.8	7.20	13.4	-	58.2	-
2025 Dist Shift 2023	5	UNSAT	6.47	26.8	7.17	13.9	-	60.3	-
2025 Dist Shift 2023	6	UNSAT	6.75	26.9	7.22	13.9	-	59.7	-
2025 Dist Shift 2023	7	UNSAT	6.41	26.9	7.08	13.4	-	57.7	-
2025 Dist Shift 2023	8	UNSAT	8.25	27.0	13.5	14.4	-	-	-
2025 Dist Shift 2023	9	UNSAT	8.32	26.9	8.97	14.4	-	-	-
2025 Dist Shift 2023	10	UNSAT	6.77	26.9	7.31	14.7	-	58.3	-
2025 Dist Shift 2023	11	UNSAT	6.45	26.8	7.12	13.4	-	59.4	-
2025 Dist Shift 2023	12	UNSAT	8.36	27.0	8.20	14.5	-	-	-
2025 Dist Shift 2023	13	UNSAT	8.29	26.9	7.18	13.9	-	-	-
2025 Dist Shift 2023	14	UNSAT	6.38	26.8	7.31	14.0	-	59.2	-
2025 Dist Shift 2023	15	SAT	7.03	6.13	6.12	13.7	-	17.5	-
2025 Dist Shift 2023	16	UNSAT	13.1	27.2	-	16.7	-	90.2	-
2025 Dist Shift 2023	17	UNSAT	6.77	26.9	7.18	13.9	-	60.8	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Dist Shift 2023	18	UNSAT	6.47	26.9	7.29	14.2	-	59.5	-
2025 Dist Shift 2023	19	UNSAT	6.48	26.9	7.26	14.0	-	61.5	-
2025 Dist Shift 2023	20	UNSAT	6.97	6.68	6.16	14.2	-	-	-
2025 Dist Shift 2023	21	UNSAT	6.97	26.8	7.34	16.0	-	63.4	-
2025 Dist Shift 2023	22	UNSAT	6.44	26.7	7.24	13.8	-	57.7	-
2025 Dist Shift 2023	23	UNSAT	7.01	6.67	6.19	13.7	-	-	-
2025 Dist Shift 2023	24	UNSAT	6.97	6.63	6.15	13.7	-	16.8	-
2025 Dist Shift 2023	25	UNSAT	6.92	26.9	7.37	16.5	-	61.3	-
2025 Dist Shift 2023	26	UNSAT	6.89	26.9	7.26	14.0	-	-	-
2025 Dist Shift 2023	27	UNSAT	6.44	26.8	7.25	13.6	-	58.6	-
2025 Dist Shift 2023	28	UNSAT	6.89	26.9	7.29	14.2	-	-	-
2025 Dist Shift 2023	29	UNSAT	6.95	27.1	7.37	15.5	-	60.6	-
2025 Dist Shift 2023	30	UNSAT	6.42	26.8	7.08	13.7	-	58.7	-
2025 Dist Shift 2023	31	UNSAT	6.44	26.9	7.18	13.4	-	61.2	-
2025 Dist Shift 2023	32	UNSAT	8.64	26.9	18.1	14.5	-	-	-
2025 Dist Shift 2023	33	UNSAT	6.45	26.8	6.96	13.7	-	57.3	-
2025 Dist Shift 2023	34	UNSAT	6.45	26.8	7.37	14.0	-	60.6	-
2025 Dist Shift 2023	35	UNSAT	6.82	26.9	7.27	14.0	-	-	-
2025 Dist Shift 2023	36	UNSAT	6.81	26.8	7.33	14.4	-	62.1	-
2025 Dist Shift 2023	37	UNSAT	6.38	26.9	7.22	14.2	-	61.9	-
2025 Dist Shift 2023	38	UNSAT	6.45	26.8	7.01	13.5	-	58.2	-
2025 Dist Shift 2023	39	UNSAT	8.28	26.9	10.4	14.5	-	-	-
2025 Dist Shift 2023	40	UNSAT	6.45	26.8	7.20	13.7	-	58.3	-
2025 Dist Shift 2023	41	UNSAT	6.83	26.9	7.29	14.2	-	59.1	-
2025 Dist Shift 2023	42	UNSAT	7.03	6.73	6.12	14.5	-	-	-
2025 Dist Shift 2023	43	UNSAT	6.46	26.9	7.31	14.7	-	61.7	-
2025 Dist Shift 2023	44	UNSAT	6.43	26.8	7.29	15.2	-	75.5	-
2025 Dist Shift 2023	45	UNSAT	6.45	26.9	7.24	13.5	-	60.1	-
2025 Dist Shift 2023	46	SAT	7.02	6.19	6.11	13.7	-	16.7	-
2025 Dist Shift 2023	47	UNSAT	6.41	26.8	7.16	13.7	-	60.0	-
2025 Dist Shift 2023	48	UNSAT	9.88	27.4	20.3	15.3	-	-	-
2025 Dist Shift 2023	49	UNSAT	6.41	26.8	6.96	13.7	-	58.0	-
2025 Dist Shift 2023	50	UNSAT	6.44	26.8	6.94	14.0	-	57.9	-
2025 Dist Shift 2023	51	UNSAT	10.0	27.3	40.0	16.1	-	-	-
2025 Dist Shift 2023	52	UNSAT	6.86	26.9	7.24	14.0	-	-	-
2025 Dist Shift 2023	53	UNSAT	6.40	26.8	7.15	13.7	-	58.6	-
2025 Dist Shift 2023	54	UNSAT	6.70	26.9	7.33	14.0	-	61.4	-
2025 Dist Shift 2023	55	UNSAT	8.30	26.9	7.43	15.0	-	62.4	-
2025 Dist Shift 2023	56	UNSAT	6.41	26.9	7.28	13.5	-	59.6	-
2025 Dist Shift 2023	57	UNSAT	6.42	26.8	7.20	14.0	-	62.4	-
2025 Dist Shift 2023	58	UNSAT	8.99	26.9	7.35	14.4	-	-	-
2025 Dist Shift 2023	59	UNSAT	6.58	26.9	7.39	14.7	-	62.8	-
2025 Dist Shift 2023	60	UNSAT	6.45	26.8	7.35	13.7	-	60.2	-
2025 Dist Shift 2023	61	UNSAT	6.38	26.8	7.26	14.5	-	61.0	-
2025 Dist Shift 2023	62	UNSAT	6.91	26.9	7.33	14.2	-	90.3	-
2025 Dist Shift 2023	63	UNSAT	6.43	26.8	7.17	13.7	-	60.3	-
2025 Dist Shift 2023	64	UNSAT	6.40	26.7	7.12	13.7	-	58.4	-
2025 Dist Shift 2023	65	UNSAT	6.39	26.9	7.06	13.6	-	58.7	-
2025 Dist Shift 2023	66	UNSAT	6.76	26.9	7.18	13.9	-	58.5	-
2025 Dist Shift 2023	67	UNSAT	6.42	26.7	7.16	13.7	-	60.7	-
2025 Dist Shift 2023	68	UNSAT	6.80	26.8	7.28	14.5	-	61.3	-
2025 Dist Shift 2023	69	SAT	7.02	6.11	6.15	13.7	-	16.9	-
2025 Dist Shift 2023	70	UNSAT	6.39	26.8	7.10	13.7	-	57.0	-
2025 Dist Shift 2023	71	UNSAT	8.66	26.9	12.0	14.4	-	-	-
2025 Linearizenn 2024	0	SAT	6.52	7.11	12.4	13.4	2.07	16.5	3.02
2025 Linearizenn 2024	1	UNSAT	6.51	26.6	6.40	12.0	1.80	66.8	2.97
2025 Linearizenn 2024	2	UNSAT	6.52	26.6	6.47	13.2	1.86	68.5	2.99
2025 Linearizenn 2024	3	UNSAT	6.51	26.7	6.78	13.2	1.96	68.5	2.97
2025 Linearizenn 2024	4	UNSAT	6.52	26.7	6.45	13.0	1.85	67.8	2.97
2025 Linearizenn 2024	5	UNSAT	6.54	26.7	6.54	12.0	1.84	69.2	2.99
2025 Linearizenn 2024	6	UNSAT	8.09	26.8	8.66	14.5	2.74	-	3.01
2025 Linearizenn 2024	7	UNSAT	6.48	26.6	6.43	13.2	1.99	68.4	2.99
2025 Linearizenn 2024	8	UNSAT	6.52	26.6	6.12	11.9	2.11	68.9	2.99
2025 Linearizenn 2024	9	UNSAT	6.52	26.6	6.45	13.2	2.24	68.9	3.11
2025 Linearizenn 2024	10	UNSAT	6.50	26.7	7.10	13.2	2.28	69.2	3.09
2025 Linearizenn 2024	11	UNSAT	7.81	26.6	6.48	13.2	2.07	68.9	3.06
2025 Linearizenn 2024	12	UNSAT	8.40	26.9	12.1	14.5	9.57	-	3.10
2025 Linearizenn 2024	13	UNSAT	8.08	26.9	9.29	14.2	5.80	69.0	3.05

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Linearizenn 2024	14	UNSAT	8.04	26.8	9.24	13.0	5.31	69.2	2.99
2025 Linearizenn 2024	15	UNSAT	8.07	26.7	8.68	13.7	2.92	-	2.98
2025 Linearizenn 2024	16	UNSAT	8.03	26.7	8.63	12.7	3.87	-	3.01
2025 Linearizenn 2024	17	UNSAT	7.93	26.7	7.92	12.7	3.47	-	2.98
2025 Linearizenn 2024	18	UNSAT	8.45	26.9	14.8	15.5	4.67	68.1	2.96
2025 Linearizenn 2024	19	UNSAT	8.11	26.7	9.56	14.0	3.05	69.1	2.95
2025 Linearizenn 2024	20	UNSAT	7.91	26.7	8.87	14.0	2.82	-	2.98
2025 Linearizenn 2024	21	UNSAT	8.04	26.7	9.28	14.3	3.00	-	2.98
2025 Linearizenn 2024	22	UNSAT	8.09	26.7	9.28	14.2	2.96	-	2.99
2025 Linearizenn 2024	23	UNSAT	8.17	26.7	9.74	14.2	3.17	69.1	2.96
2025 Linearizenn 2024	24	UNSAT	8.51	27.1	26.4	16.5	9.02	-	2.97
2025 Linearizenn 2024	25	UNSAT	8.38	27.0	16.3	15.8	5.55	-	2.99
2025 Linearizenn 2024	26	UNSAT	8.26	26.9	14.0	15.2	4.94	69.3	2.97
2025 Linearizenn 2024	27	UNSAT	8.36	26.9	14.0	15.3	5.28	-	3.00
2025 Linearizenn 2024	28	UNSAT	8.30	26.9	16.1	14.5	5.52	-	2.99
2025 Linearizenn 2024	29	UNSAT	8.20	26.9	14.7	15.2	4.95	-	2.98
2025 Linearizenn 2024	30	UNSAT	8.58	27.9	31.5	17.5	19.5	69.0	2.96
2025 Linearizenn 2024	31	UNSAT	8.31	27.7	17.7	15.5	8.61	-	2.98
2025 Linearizenn 2024	32	UNSAT	8.28	27.7	15.8	14.2	7.30	-	2.97
2025 Linearizenn 2024	33	UNSAT	8.18	27.8	16.4	14.9	8.20	69.0	3.01
2025 Linearizenn 2024	34	UNSAT	8.16	27.8	14.3	14.0	5.91	68.8	2.98
2025 Linearizenn 2024	35	UNSAT	8.14	27.8	15.4	15.0	6.54	68.5	3.00
2025 Linearizenn 2024	36	UNSAT	8.49	27.1	13.6	15.0	10.8	69.4	2.97
2025 Linearizenn 2024	37	UNSAT	8.13	26.9	8.92	14.1	4.65	69.3	2.98
2025 Linearizenn 2024	38	UNSAT	7.86	26.9	7.69	14.0	3.19	69.3	2.99
2025 Linearizenn 2024	39	UNSAT	8.19	27.0	9.83	13.0	3.89	69.5	2.97
2025 Linearizenn 2024	40	UNSAT	8.08	26.9	9.41	13.0	4.90	69.2	2.99
2025 Linearizenn 2024	41	UNSAT	8.09	27.0	9.48	14.0	3.83	68.9	2.97
2025 Linearizenn 2024	42	UNSAT	8.55	26.9	19.2	16.3	9.09	69.5	2.97
2025 Linearizenn 2024	43	UNSAT	8.14	26.9	9.59	14.2	4.42	-	2.96
2025 Linearizenn 2024	44	UNSAT	8.21	26.9	12.6	13.8	5.57	-	2.99
2025 Linearizenn 2024	45	UNSAT	8.29	26.9	12.4	14.8	5.95	-	2.98
2025 Linearizenn 2024	46	UNSAT	8.19	26.9	11.0	14.5	4.83	69.4	2.98
2025 Linearizenn 2024	47	UNSAT	8.42	26.9	13.2	14.7	5.78	-	2.99
2025 Linearizenn 2024	48	UNSAT	8.35	26.9	11.5	15.1	6.70	69.5	2.99
2025 Linearizenn 2024	49	UNSAT	8.22	26.9	8.60	13.9	4.01	69.5	2.98
2025 Linearizenn 2024	50	UNSAT	8.12	26.8	8.69	13.9	3.56	70.5	2.97
2025 Linearizenn 2024	51	UNSAT	8.14	26.8	9.03	14.0	3.80	69.2	2.97
2025 Linearizenn 2024	52	UNSAT	8.15	26.9	8.52	13.9	3.78	69.2	2.98
2025 Linearizenn 2024	53	UNSAT	8.13	26.8	9.39	12.7	3.06	68.5	2.97
2025 Linearizenn 2024	54	UNSAT	7.99	26.7	7.84	14.0	2.12	69.5	2.98
2025 Linearizenn 2024	55	UNSAT	7.99	26.7	7.22	13.2	2.00	69.9	2.95
2025 Linearizenn 2024	56	UNSAT	7.85	26.6	6.54	11.9	1.87	68.9	2.97
2025 Linearizenn 2024	57	UNSAT	7.87	26.7	6.78	13.2	2.01	69.7	3.00
2025 Linearizenn 2024	58	UNSAT	7.85	26.6	6.91	13.0	1.88	69.4	2.97
2025 Linearizenn 2024	59	UNSAT	7.96	26.6	7.36	13.7	1.97	69.5	2.99
2025 Malbeware	0	UNSAT	6.27	16.4	7.85	11.0	3.88	49.1	-
2025 Malbeware	1	UNSAT	6.24	16.3	7.83	11.9	3.89	52.3	-
2025 Malbeware	2	UNSAT	6.25	16.3	7.85	12.0	3.86	51.8	-
2025 Malbeware	3	UNSAT	6.24	16.3	7.85	10.9	3.86	51.7	-
2025 Malbeware	4	UNSAT	6.25	16.3	7.86	11.9	3.89	51.6	-
2025 Malbeware	5	UNSAT	6.24	16.3	7.85	11.9	3.89	52.3	-
2025 Malbeware	6	UNSAT	6.22	16.3	7.84	12.0	3.85	51.5	-
2025 Malbeware	7	UNSAT	6.23	16.3	7.88	11.9	3.88	51.8	-
2025 Malbeware	8	UNSAT	6.18	16.3	7.89	12.0	3.88	51.4	-
2025 Malbeware	9	UNSAT	6.22	16.4	7.84	11.9	3.92	51.7	-
2025 Malbeware	10	UNSAT	6.21	16.3	7.86	11.9	3.89	51.7	-
2025 Malbeware	11	UNSAT	6.23	16.3	7.85	12.0	3.90	51.6	-
2025 Malbeware	12	UNSAT	6.20	16.3	7.85	12.0	3.87	50.5	-
2025 Malbeware	13	UNSAT	6.23	16.3	7.91	11.9	3.86	51.2	-
2025 Malbeware	14	UNSAT	6.24	16.3	7.88	11.9	3.91	51.7	-
2025 Malbeware	15	UNSAT	6.23	16.3	7.84	11.9	3.87	52.2	-
2025 Malbeware	16	UNSAT	6.22	16.3	7.91	11.9	3.89	51.9	-
2025 Malbeware	17	UNSAT	6.22	16.3	7.86	10.9	3.84	51.6	-
2025 Malbeware	18	UNSAT	6.23	16.3	7.87	12.0	3.90	51.9	-
2025 Malbeware	19	UNSAT	6.23	16.3	7.89	11.9	4.02	51.9	-
2025 Malbeware	20	UNSAT	6.24	16.3	7.87	12.0	3.88	52.3	-
2025 Malbeware	21	SAT	6.28	6.59	7.77	11.3	5.80	15.3	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Malbeware	22	UNSAT	6.22	16.3	7.84	10.9	3.87	50.8	-
2025 Malbeware	23	UNSAT	6.25	16.3	7.87	11.9	4.11	50.3	-
2025 Malbeware	24	UNSAT	6.24	16.3	7.89	10.9	3.87	52.1	-
2025 Malbeware	25	UNSAT	6.27	16.3	7.88	11.9	3.82	51.7	-
2025 Malbeware	26	UNSAT	6.24	16.3	7.88	11.9	3.90	52.6	-
2025 Malbeware	27	UNSAT	6.18	16.4	7.93	12.0	3.85	50.7	-
2025 Malbeware	28	UNSAT	6.24	16.3	7.87	11.9	3.92	51.5	-
2025 Malbeware	29	UNSAT	6.21	16.3	7.90	12.0	3.89	51.7	-
2025 Malbeware	30	UNSAT	6.22	16.3	7.85	11.9	3.91	52.3	-
2025 Malbeware	31	UNSAT	6.20	16.3	7.88	12.0	3.90	51.4	-
2025 Malbeware	32	UNSAT	6.20	16.3	7.89	12.0	3.92	51.3	-
2025 Malbeware	33	UNSAT	6.22	16.3	7.89	11.9	3.92	50.9	-
2025 Malbeware	34	UNSAT	6.21	16.4	7.91	11.9	3.87	51.7	-
2025 Malbeware	35	UNSAT	6.23	16.3	7.91	12.0	3.92	53.2	-
2025 Malbeware	36	UNSAT	6.22	16.4	7.88	11.9	3.88	51.1	-
2025 Malbeware	37	UNSAT	6.25	16.4	7.86	12.0	3.87	49.5	-
2025 Malbeware	38	UNSAT	6.24	16.3	7.88	10.9	3.89	50.8	-
2025 Malbeware	39	UNSAT	6.40	16.3	7.91	12.0	3.86	51.9	-
2025 Malbeware	40	UNSAT	6.21	16.3	7.92	12.0	3.88	51.5	-
2025 Malbeware	41	UNSAT	6.23	16.3	7.88	10.9	3.86	51.9	-
2025 Malbeware	42	UNSAT	6.19	16.3	7.94	11.9	3.90	52.2	-
2025 Malbeware	43	UNSAT	6.21	16.3	7.94	11.9	3.91	51.4	-
2025 Malbeware	44	UNSAT	6.22	16.3	7.90	11.9	3.95	51.2	-
2025 Malbeware	45	UNSAT	6.23	16.3	7.90	11.9	3.95	52.5	-
2025 Malbeware	46	UNSAT	6.23	16.3	7.90	11.9	3.85	52.0	-
2025 Malbeware	47	UNSAT	6.23	16.3	7.93	11.9	3.87	51.8	-
2025 Malbeware	48	UNSAT	6.22	16.3	7.93	12.0	3.86	51.9	-
2025 Malbeware	49	UNSAT	6.23	16.3	7.90	12.0	3.89	51.5	-
2025 Malbeware	50	UNSAT	6.51	16.7	8.87	12.8	8.92	-	-
2025 Malbeware	51	UNSAT	6.55	16.7	8.80	12.8	8.47	-	-
2025 Malbeware	52	UNSAT	16.2	-	-	-	-	-	-
2025 Malbeware	53	UNSAT	6.55	16.7	8.80	12.7	8.79	-	-
2025 Malbeware	54	UNSAT	6.55	16.7	8.80	12.8	8.79	-	-
2025 Malbeware	55	UNSAT	6.50	16.6	8.82	11.8	8.50	-	-
2025 Malbeware	56	SAT	7.26	7.27	8.62	13.3	84.5	-	-
2025 Malbeware	57	UNSAT	6.52	16.7	8.81	12.8	9.29	-	-
2025 Malbeware	58	UNSAT	6.50	16.7	8.78	12.8	9.25	-	-
2025 Malbeware	59	SAT	7.30	7.33	8.62	13.0	67.8	-	-
2025 Malbeware	60	UNSAT	6.52	16.7	8.86	12.9	8.65	-	-
2025 Malbeware	61	UNSAT	6.54	16.7	8.82	12.8	8.39	-	-
2025 Malbeware	62	UNSAT	6.52	16.7	8.81	12.7	9.36	-	-
2025 Malbeware	63	UNSAT	6.54	16.7	8.89	12.7	9.37	-	-
2025 Malbeware	64	UNSAT	6.60	16.7	8.81	12.8	8.28	-	-
2025 Malbeware	65	UNSAT	17.4	-	-	-	-	-	-
2025 Malbeware	66	UNSAT	6.52	16.7	8.76	12.9	8.24	-	-
2025 Malbeware	67	UNSAT	6.52	16.7	8.87	12.7	9.75	-	-
2025 Malbeware	68	UNSAT	6.51	16.7	8.80	12.8	8.37	-	-
2025 Malbeware	69	UNSAT	6.52	16.7	8.80	12.7	8.45	-	-
2025 Malbeware	70	UNSAT	6.53	16.7	8.79	12.6	8.07	-	-
2025 Malbeware	71	SAT	7.24	7.33	8.63	13.3	65.1	-	-
2025 Malbeware	72	UNSAT	6.50	16.7	8.87	12.8	10.2	-	-
2025 Malbeware	73	UNSAT	6.50	16.7	8.73	12.8	8.96	-	-
2025 Malbeware	74	UNSAT	6.52	16.7	8.87	13.0	8.75	-	-
2025 Malbeware	75	UNSAT	6.51	16.7	8.84	12.8	8.43	-	-
2025 Malbeware	76	UNSAT	11.4	25.3	-	-	-	-	-
2025 Malbeware	77	UNSAT	6.48	16.7	8.81	13.1	8.77	-	-
2025 Malbeware	78	UNSAT	6.52	16.7	8.82	12.8	8.11	-	-
2025 Malbeware	79	UNSAT	6.50	16.7	8.87	13.0	8.61	-	-
2025 Malbeware	80	UNSAT	6.49	16.7	8.82	12.8	8.30	-	-
2025 Malbeware	81	UNSAT	6.51	16.7	8.82	12.8	8.44	-	-
2025 Malbeware	82	SAT	7.24	7.28	8.62	13.0	57.3	-	-
2025 Malbeware	83	UNSAT	6.53	16.7	8.84	12.7	9.48	-	-
2025 Malbeware	84	UNSAT	6.56	16.7	8.73	12.8	8.59	-	-
2025 Malbeware	85	SAT	7.23	7.29	8.61	12.1	82.5	-	-
2025 Malbeware	86	UNSAT	6.51	16.7	8.81	12.8	8.41	-	-
2025 Malbeware	87	SAT	7.23	7.30	8.63	13.0	79.6	-	-
2025 Malbeware	88	UNSAT	6.51	16.7	8.83	13.1	8.87	-	-
2025 Malbeware	89	SAT	7.20	7.33	8.68	13.0	50.4	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Malbeware	90	UNSAT	6.51	16.7	8.79	12.8	8.69	-	-
2025 Malbeware	91	UNSAT	6.50	16.7	8.83	11.7	8.62	-	-
2025 Malbeware	92	UNSAT	6.48	16.7	8.79	12.8	8.41	-	-
2025 Malbeware	93	UNSAT	6.53	16.7	8.86	12.8	9.28	-	-
2025 Malbeware	94	SAT	7.19	7.35	8.62	13.0	54.3	-	-
2025 Malbeware	95	UNSAT	6.62	16.7	8.86	12.7	8.58	-	-
2025 Malbeware	96	UNSAT	6.52	16.7	8.82	12.7	9.21	-	-
2025 Malbeware	97	UNSAT	6.47	16.7	8.79	12.8	8.72	-	-
2025 Malbeware	98	UNSAT	6.48	16.7	8.85	12.8	8.82	-	-
2025 Malbeware	99	UNSAT	6.48	16.7	8.89	12.8	9.42	-	-
2025 Malbeware	100	UNSAT	6.56	16.7	9.18	-	25.1	-	-
2025 Malbeware	101	UNSAT	6.58	16.7	9.40	-	30.5	-	-
2025 Malbeware	102	SAT	7.30	7.35	-	-	-	-	-
2025 Malbeware	103	UNSAT	6.57	16.7	-	-	43.7	-	-
2025 Malbeware	104	UNSAT	6.54	16.7	9.20	-	30.8	-	-
2025 Malbeware	105	UNSAT	6.57	16.7	9.12	-	30.9	-	-
2025 Malbeware	106	UNSAT	17.0	-	-	-	-	-	-
2025 Malbeware	107	UNSAT	6.50	16.7	9.37	-	30.6	-	-
2025 Malbeware	108	UNSAT	6.57	16.7	-	-	38.7	-	-
2025 Malbeware	109	SAT	7.37	7.33	8.69	-	-	-	-
2025 Malbeware	110	UNSAT	6.58	16.7	9.23	-	30.3	-	-
2025 Malbeware	111	UNSAT	6.55	16.7	9.14	-	28.5	-	-
2025 Malbeware	112	SAT	7.30	7.32	8.68	-	-	-	-
2025 Malbeware	113	UNSAT	6.59	16.7	9.19	-	31.5	-	-
2025 Malbeware	114	UNSAT	6.58	16.7	9.13	-	28.7	-	-
2025 Malbeware	115	SAT	7.29	7.33	8.60	-	-	-	-
2025 Malbeware	116	UNSAT	6.60	16.7	-	-	41.8	-	-
2025 Malbeware	117	UNSAT	6.54	16.7	9.15	-	31.3	-	-
2025 Malbeware	118	UNSAT	6.58	16.7	9.06	-	22.0	-	-
2025 Malbeware	119	UNSAT	6.56	16.7	9.04	-	25.7	-	-
2025 Malbeware	120	UNSAT	6.59	16.7	9.09	-	25.0	-	-
2025 Malbeware	121	SAT	7.27	6.79	8.65	-	14.6	16.2	-
2025 Malbeware	122	UNSAT	6.51	16.7	9.39	-	32.7	-	-
2025 Malbeware	123	UNSAT	6.55	16.7	9.09	-	27.6	-	-
2025 Malbeware	124	UNSAT	6.58	16.7	9.14	-	29.7	-	-
2025 Malbeware	125	UNSAT	6.55	16.7	9.12	-	29.7	-	-
2025 Malbeware	126	SAT	7.32	7.35	8.67	-	-	-	-
2025 Malbeware	127	UNSAT	6.52	16.7	9.10	-	28.1	-	-
2025 Malbeware	128	UNSAT	6.58	16.7	9.02	-	25.5	-	-
2025 Malbeware	129	UNSAT	6.66	16.7	9.38	-	34.2	-	-
2025 Malbeware	130	UNSAT	6.54	16.7	9.06	-	25.9	-	-
2025 Malbeware	131	UNSAT	6.59	16.7	9.13	-	28.7	-	-
2025 Malbeware	132	SAT	7.29	7.36	8.62	-	-	-	-
2025 Malbeware	133	UNSAT	6.57	16.7	9.18	-	29.6	-	-
2025 Malbeware	134	UNSAT	6.57	16.7	9.02	-	30.5	-	-
2025 Malbeware	135	UNSAT	17.5	-	-	-	-	-	-
2025 Malbeware	136	UNSAT	6.55	16.7	9.11	-	27.9	-	-
2025 Malbeware	137	UNSAT	6.76	17.2	-	-	-	-	-
2025 Malbeware	138	UNSAT	6.58	16.7	9.10	-	26.8	-	-
2025 Malbeware	139	SAT	7.24	6.78	8.56	-	14.9	15.9	-
2025 Malbeware	140	UNSAT	6.54	16.7	9.38	-	33.0	-	-
2025 Malbeware	141	UNSAT	6.59	16.7	-	-	35.1	-	-
2025 Malbeware	142	UNSAT	6.56	16.7	9.20	-	29.5	-	-
2025 Malbeware	143	SAT	7.24	6.81	8.60	-	12.7	16.0	-
2025 Malbeware	144	SAT	7.29	7.31	8.63	-	-	-	-
2025 Malbeware	145	UNSAT	6.56	16.7	9.11	-	27.1	-	-
2025 Malbeware	146	UNSAT	6.53	16.7	9.33	-	31.4	-	-
2025 Malbeware	147	UNSAT	6.58	16.7	9.12	-	26.2	-	-
2025 Malbeware	148	UNSAT	6.58	16.7	9.11	-	27.7	-	-
2025 Malbeware	149	UNSAT	6.53	16.7	9.18	-	31.1	-	-
2025 Metaroom 2023	0	UNSAT	6.86	28.5	11.5	13.8	-	17.4	-
2025 Metaroom 2023	1	UNSAT	6.56	27.3	8.70	12.0	-	16.0	-
2025 Metaroom 2023	2	UNSAT	6.82	28.4	11.5	13.8	-	16.7	-
2025 Metaroom 2023	3	UNSAT	6.98	28.1	12.5	13.8	2.56	18.8	-
2025 Metaroom 2023	4	UNSAT	6.56	27.3	8.71	13.3	-	15.9	-
2025 Metaroom 2023	5	UNSAT	6.80	27.8	11.5	13.7	-	16.7	-
2025 Metaroom 2023	6	UNSAT	6.54	27.3	8.72	12.9	-	15.8	-
2025 Metaroom 2023	7	UNSAT	6.59	27.2	8.78	13.0	-	15.8	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Metaroom 2023	8	UNSAT	6.94	28.1	12.6	13.7	2.60	18.4	-
2025 Metaroom 2023	9	UNSAT	6.88	27.9	13.2	13.7	3.78	20.0	-
2025 Metaroom 2023	10	UNSAT	6.60	27.3	8.81	13.1	1.94	17.2	-
2025 Metaroom 2023	11	UNSAT	6.54	27.3	8.79	13.0	-	16.1	-
2025 Metaroom 2023	12	UNSAT	6.87	28.0	12.3	13.7	2.64	18.3	-
2025 Metaroom 2023	13	UNSAT	6.51	27.3	8.78	13.0	-	16.0	-
2025 Metaroom 2023	14	SAT	7.09	8.64	✗	14.1	-	-	-
2025 Metaroom 2023	15	UNSAT	6.52	27.2	8.87	13.0	1.84	17.6	-
2025 Metaroom 2023	16	UNSAT	6.81	27.6	11.5	13.7	-	17.0	-
2025 Metaroom 2023	17	UNSAT	6.96	27.7	12.8	13.8	2.55	18.6	-
2025 Metaroom 2023	18	UNSAT	6.77	27.8	11.5	13.7	-	16.6	-
2025 Metaroom 2023	19	UNSAT	6.91	28.4	12.6	13.7	2.52	18.2	-
2025 Metaroom 2023	20	UNSAT	6.50	27.2	8.90	12.9	1.81	17.3	-
2025 Metaroom 2023	21	UNSAT	6.54	27.3	8.73	13.0	-	16.3	-
2025 Metaroom 2023	22	UNSAT	8.34	27.5	9.46	-	3.26	17.8	-
2025 Metaroom 2023	23	UNSAT	6.53	27.3	8.82	13.0	1.82	17.2	-
2025 Metaroom 2023	24	UNSAT	6.55	27.3	8.87	13.2	1.83	17.4	-
2025 Metaroom 2023	25	UNSAT	6.51	27.3	8.82	12.0	1.82	17.5	-
2025 Metaroom 2023	26	SAT	7.03	8.44	✗	14.0	-	-	-
2025 Metaroom 2023	27	UNSAT	6.93	28.4	13.2	13.7	3.77	20.2	-
2025 Metaroom 2023	28	UNSAT	6.84	28.0	11.5	13.7	-	16.5	-
2025 Metaroom 2023	29	UNSAT	6.91	28.5	12.7	13.7	3.08	19.8	-
2025 Metaroom 2023	30	UNSAT	6.85	27.7	11.5	13.7	-	16.7	-
2025 Metaroom 2023	31	UNSAT	6.92	27.9	12.8	13.8	2.57	18.7	-
2025 Metaroom 2023	32	UNSAT	6.54	27.3	8.84	13.2	1.79	17.2	-
2025 Metaroom 2023	33	UNSAT	6.83	28.3	11.5	13.8	-	16.8	-
2025 Metaroom 2023	34	UNSAT	6.57	27.3	8.85	12.0	1.82	17.2	-
2025 Metaroom 2023	35	SAT	6.79	7.26	8.57	13.5	3.45	-	-
2025 Metaroom 2023	36	UNSAT	6.55	27.3	8.74	13.2	-	15.9	-
2025 Metaroom 2023	37	UNSAT	6.93	27.9	12.2	13.8	2.65	18.7	-
2025 Metaroom 2023	38	UNSAT	6.94	27.8	12.2	13.7	2.64	18.2	-
2025 Metaroom 2023	39	UNSAT	6.84	28.2	11.4	13.8	-	16.6	-
2025 Metaroom 2023	40	UNSAT	6.79	27.8	11.5	13.8	-	16.6	-
2025 Metaroom 2023	41	UNSAT	6.94	27.8	12.6	13.7	2.63	18.4	-
2025 Metaroom 2023	42	UNSAT	6.47	27.3	8.74	13.0	-	15.9	-
2025 Metaroom 2023	43	UNSAT	6.53	27.2	8.87	13.0	1.85	17.2	-
2025 Metaroom 2023	44	UNSAT	6.67	27.3	8.89	13.0	1.99	17.4	-
2025 Metaroom 2023	45	SAT	7.03	7.82	9.16	14.1	-	16.8	-
2025 Metaroom 2023	46	UNSAT	6.82	28.0	11.5	13.8	-	16.7	-
2025 Metaroom 2023	47	UNSAT	6.86	27.9	11.6	13.8	-	16.7	-
2025 Metaroom 2023	48	UNSAT	6.85	27.8	11.4	13.8	-	16.7	-
2025 Metaroom 2023	49	UNSAT	6.94	28.6	12.8	13.7	2.63	18.4	-
2025 Metaroom 2023	50	UNSAT	6.88	28.2	12.8	13.7	2.60	18.6	-
2025 Metaroom 2023	51	UNSAT	6.52	27.3	8.88	13.2	1.84	17.4	-
2025 Metaroom 2023	52	UNSAT	6.95	27.9	12.9	13.8	2.55	18.7	-
2025 Metaroom 2023	53	UNSAT	6.94	28.4	12.2	13.8	2.63	18.3	-
2025 Metaroom 2023	54	UNSAT	6.86	27.7	11.5	12.7	-	16.7	-
2025 Metaroom 2023	55	UNSAT	6.66	27.3	8.88	13.0	1.91	17.3	-
2025 Metaroom 2023	56	UNSAT	6.81	27.9	11.5	13.7	-	16.8	-
2025 Metaroom 2023	57	UNSAT	6.64	27.3	8.86	13.0	1.94	17.9	-
2025 Metaroom 2023	58	UNSAT	6.56	27.3	8.72	13.2	-	16.0	-
2025 Metaroom 2023	59	UNSAT	6.83	28.3	11.5	13.7	-	16.5	-
2025 Metaroom 2023	60	UNSAT	6.80	27.6	11.4	13.7	-	16.7	-
2025 Metaroom 2023	61	UNSAT	6.62	27.3	8.79	13.0	1.81	17.4	-
2025 Metaroom 2023	62	UNSAT	6.58	27.3	8.75	13.2	-	16.1	-
2025 Metaroom 2023	63	UNSAT	6.99	28.4	11.6	13.8	2.65	18.4	-
2025 Metaroom 2023	64	UNSAT	6.89	28.1	11.8	13.7	2.69	18.2	-
2025 Metaroom 2023	65	UNSAT	6.96	29.4	12.6	13.7	2.53	18.8	-
2025 Metaroom 2023	66	UNSAT	6.95	27.8	12.9	13.7	2.70	19.1	-
2025 Metaroom 2023	67	UNSAT	6.92	27.6	11.5	13.7	-	16.9	-
2025 Metaroom 2023	68	UNSAT	6.78	29.0	11.6	13.7	-	16.6	-
2025 Metaroom 2023	69	UNSAT	6.57	27.3	8.73	13.0	-	15.8	-
2025 Metaroom 2023	70	UNSAT	7.08	28.0	12.4	13.7	2.63	18.5	-
2025 Metaroom 2023	71	UNSAT	6.65	27.3	8.82	13.0	1.81	17.2	-
2025 Metaroom 2023	72	UNSAT	6.58	27.3	8.78	13.3	-	15.9	-
2025 Metaroom 2023	73	UNSAT	6.66	27.3	8.82	13.1	1.81	17.1	-
2025 Metaroom 2023	74	UNSAT	6.85	27.7	11.4	13.7	-	16.7	-
2025 Metaroom 2023	75	UNSAT	6.92	27.9	13.1	13.7	3.54	20.3	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Metaroom 2023	76	UNSAT	6.57	27.3	8.76	13.2	-	15.8	-
2025 Metaroom 2023	77	UNSAT	6.59	27.2	8.78	13.0	-	16.0	-
2025 Metaroom 2023	78	UNSAT	10.00	110	10.6	-	48.2	-	-
2025 Metaroom 2023	79	UNSAT	6.93	28.0	12.9	13.7	3.99	21.1	-
2025 Metaroom 2023	80	UNSAT	6.55	27.2	8.74	12.0	-	16.1	-
2025 Metaroom 2023	81	UNSAT	6.52	27.3	8.74	13.0	-	15.9	-
2025 Metaroom 2023	82	UNSAT	6.63	27.2	8.79	13.0	1.83	17.2	-
2025 Metaroom 2023	83	UNSAT	6.97	28.0	12.4	13.7	2.63	18.6	-
2025 Metaroom 2023	84	UNSAT	6.91	27.8	12.6	13.7	2.60	18.2	-
2025 Metaroom 2023	85	UNSAT	6.57	27.3	8.73	13.0	-	15.7	-
2025 Metaroom 2023	86	UNSAT	6.85	27.8	11.3	13.8	-	17.1	-
2025 Metaroom 2023	87	UNSAT	6.97	27.7	12.7	12.7	2.65	18.7	-
2025 Metaroom 2023	88	UNSAT	6.91	27.7	12.9	13.7	2.69	19.3	-
2025 Metaroom 2023	89	UNSAT	6.52	27.3	8.77	13.0	-	15.9	-
2025 Metaroom 2023	90	UNSAT	6.92	27.6	12.9	13.7	2.72	19.0	-
2025 Metaroom 2023	91	UNSAT	6.86	27.7	11.5	13.8	-	16.6	-
2025 Metaroom 2023	92	UNSAT	6.85	28.3	11.5	13.7	-	16.9	-
2025 Metaroom 2023	93	UNSAT	6.91	27.8	12.3	12.7	2.72	18.1	-
2025 Metaroom 2023	94	UNSAT	6.94	27.6	12.9	13.7	2.75	18.8	-
2025 Metaroom 2023	95	SAT	7.04	7.28	9.08	14.1	-	16.8	-
2025 Metaroom 2023	96	UNSAT	6.92	27.7	12.7	13.7	2.64	19.0	-
2025 Metaroom 2023	97	UNSAT	-	-	13.2	-	-	-	-
2025 Metaroom 2023	98	UNSAT	6.59	27.3	8.67	12.9	-	16.0	-
2025 Metaroom 2023	99	UNSAT	6.82	27.8	11.5	13.7	-	16.5	-
2025 Nn4sys	0	UNSAT	6.62	9.81	6.07	-	-	-	18.3
2025 Nn4sys	1	UNSAT	7.50	11.8	-	-	-	-	24.1
2025 Nn4sys	2	UNSAT	6.60	9.82	6.09	-	-	-	17.4
2025 Nn4sys	3	UNSAT	6.62	9.79	6.12	-	-	-	17.3
2025 Nn4sys	4	UNSAT	7.11	10.9	-	-	-	-	21.0
2025 Nn4sys	5	UNSAT	6.66	9.91	6.08	-	-	-	17.2
2025 Nn4sys	6	UNSAT	6.78	10.2	6.20	-	-	-	17.5
2025 Nn4sys	7	UNSAT	6.79	10.3	6.17	-	-	-	17.6
2025 Nn4sys	8	UNSAT	7.47	11.6	-	-	-	-	22.0
2025 Nn4sys	9	UNSAT	7.17	10.9	-	-	-	-	21.1
2025 Nn4sys	10	UNSAT	6.83	10.4	6.16	-	-	-	17.5
2025 Nn4sys	11	UNSAT	6.78	10.2	6.12	-	-	-	17.5
2025 Nn4sys	12	UNSAT	6.80	10.3	6.13	-	-	-	17.5
2025 Nn4sys	13	UNSAT	6.65	9.78	6.07	-	-	-	17.3
2025 Nn4sys	14	UNSAT	6.82	10.2	6.17	-	-	-	17.6
2025 Nn4sys	15	UNSAT	6.63	9.80	6.12	-	-	-	17.3
2025 Nn4sys	16	UNSAT	6.59	9.85	6.11	-	-	-	17.4
2025 Nn4sys	17	UNSAT	7.10	10.9	-	-	-	-	21.0
2025 Nn4sys	18	UNSAT	6.65	9.82	6.11	-	-	-	17.3
2025 Nn4sys	19	UNSAT	7.17	10.8	-	-	-	-	21.0
2025 Nn4sys	20	UNSAT	7.12	10.9	-	-	-	-	20.9
2025 Nn4sys	21	UNSAT	6.76	10.2	6.12	-	-	-	17.5
2025 Nn4sys	22	UNSAT	6.78	10.3	6.17	-	-	-	17.6
2025 Nn4sys	23	UNSAT	7.47	11.8	-	-	-	-	22.1
2025 Nn4sys	24	UNSAT	7.47	11.9	-	-	-	-	22.1
2025 Nn4sys	25	UNSAT	6.78	10.3	6.16	-	-	-	17.6
2025 Nn4sys	26	UNSAT	6.85	10.3	6.15	-	-	-	17.5
2025 Nn4sys	27	UNSAT	7.11	10.9	-	-	-	-	21.0
2025 Nn4sys	28	UNSAT	6.62	9.91	6.06	-	-	-	17.3
2025 Nn4sys	29	UNSAT	6.77	10.3	6.16	-	-	-	17.5
2025 Nn4sys	30	UNSAT	7.47	11.6	-	-	-	-	21.9
2025 Nn4sys	31	UNSAT	6.77	10.3	6.14	-	-	-	17.5
2025 Nn4sys	32	UNSAT	7.08	10.9	-	-	-	-	21.0
2025 Nn4sys	33	UNSAT	7.13	10.8	-	-	-	-	21.0
2025 Nn4sys	34	UNSAT	6.60	9.80	6.09	-	-	-	17.4
2025 Nn4sys	35	UNSAT	10.7	-	-	-	-	-	22.2
2025 Nn4sys	36	UNSAT	10.8	-	-	-	-	-	22.1
2025 Nn4sys	37	UNSAT	10.8	-	-	-	-	-	22.0
2025 Nn4sys	38	UNSAT	10.4	-	-	-	-	-	22.1
2025 Nn4sys	39	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	40	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	41	UNSAT	10.8	-	-	-	-	-	22.2
2025 Nn4sys	42	UNSAT	10.4	-	-	-	-	-	21.9
2025 Nn4sys	43	UNSAT	10.4	-	-	-	-	-	22.0

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Nn4sys	44	UNSAT	10.5	-	-	-	-	-	22.0
2025 Nn4sys	45	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	46	UNSAT	10.4	-	-	-	-	-	22.1
2025 Nn4sys	47	UNSAT	10.5	-	-	-	-	-	22.0
2025 Nn4sys	48	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	49	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	50	UNSAT	10.2	-	-	-	-	-	22.1
2025 Nn4sys	51	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	52	UNSAT	10.00	-	-	-	-	-	22.1
2025 Nn4sys	53	UNSAT	10.4	-	-	-	-	-	22.1
2025 Nn4sys	54	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	55	UNSAT	11.2	-	-	-	-	-	22.0
2025 Nn4sys	56	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	57	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	58	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	59	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	60	UNSAT	10.8	-	-	-	-	-	21.9
2025 Nn4sys	61	UNSAT	10.7	-	-	-	-	-	21.9
2025 Nn4sys	62	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	63	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	64	UNSAT	10.5	-	-	-	-	-	22.0
2025 Nn4sys	65	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	66	UNSAT	10.4	-	-	-	-	-	22.0
2025 Nn4sys	67	UNSAT	10.4	-	-	-	-	-	21.9
2025 Nn4sys	68	UNSAT	10.8	-	-	-	-	-	22.1
2025 Nn4sys	69	UNSAT	10.7	-	-	-	-	-	22.2
2025 Nn4sys	70	UNSAT	11.1	-	-	-	-	-	21.8
2025 Nn4sys	71	UNSAT	11.0	-	-	-	-	108	22.2
2025 Nn4sys	72	UNSAT	11.0	-	-	-	-	88.3	21.9
2025 Nn4sys	73	UNSAT	10.7	-	-	-	-	-	22.0
2025 Nn4sys	74	UNSAT	10.8	-	-	-	-	-	22.0
2025 Nn4sys	75	UNSAT	11.3	-	-	-	-	90.3	22.1
2025 Nn4sys	76	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	77	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	78	UNSAT	11.1	-	-	-	-	-	22.0
2025 Nn4sys	79	UNSAT	11.7	-	-	-	-	87.7	22.0
2025 Nn4sys	80	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	81	UNSAT	11.1	-	-	-	-	88.7	22.0
2025 Nn4sys	82	UNSAT	11.0	-	-	-	-	-	22.0
2025 Nn4sys	83	UNSAT	11.7	-	-	-	-	90.0	21.9
2025 Nn4sys	84	UNSAT	11.0	-	-	-	-	-	22.1
2025 Nn4sys	85	UNSAT	10.7	-	-	-	-	94.5	21.9
2025 Nn4sys	86	UNSAT	11.0	-	-	-	-	88.6	21.9
2025 Nn4sys	87	UNSAT	10.9	-	-	-	-	87.2	22.0
2025 Nn4sys	88	UNSAT	11.4	-	-	-	-	-	22.2
2025 Nn4sys	89	UNSAT	11.0	-	-	-	-	-	22.2
2025 Nn4sys	90	UNSAT	11.3	-	-	-	-	91.8	22.0
2025 Nn4sys	91	UNSAT	11.0	-	-	-	-	-	22.1
2025 Nn4sys	92	UNSAT	11.0	-	-	-	-	90.1	22.1
2025 Nn4sys	93	UNSAT	11.0	-	-	-	-	89.9	22.2
2025 Nn4sys	94	UNSAT	10.7	-	-	-	-	90.7	22.1
2025 Nn4sys	95	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	96	UNSAT	11.0	-	-	-	-	-	22.0
2025 Nn4sys	97	UNSAT	10.7	-	-	-	-	98.5	22.1
2025 Nn4sys	98	UNSAT	10.7	-	-	-	-	-	22.1
2025 Nn4sys	99	UNSAT	11.1	-	-	-	-	-	22.1
2025 Nn4sys	100	UNSAT	11.0	-	-	-	-	102	22.0
2025 Nn4sys	101	UNSAT	11.3	-	-	-	-	-	22.0
2025 Nn4sys	102	UNSAT	11.3	-	-	-	-	-	22.0
2025 Nn4sys	103	UNSAT	10.9	-	-	-	-	103	22.1
2025 Nn4sys	104	UNSAT	10.7	-	-	-	-	95.3	22.1
2025 Nn4sys	105	UNSAT	6.27	9.33	6.33	-	0.90	-	2.81
2025 Nn4sys	106	UNSAT	6.37	9.37	6.39	-	0.90	-	2.83
2025 Nn4sys	107	UNSAT	6.31	9.39	17.9	-	1.29	-	-
2025 Nn4sys	108	UNSAT	6.38	9.55	21.4	-	1.32	-	-
2025 Nn4sys	109	UNSAT	6.32	9.87	28.2	-	1.82	-	-
2025 Nn4sys	110	UNSAT	6.37	9.90	35.6	-	1.74	-	-
2025 Nn4sys	111	UNSAT	6.38	10.2	30.6	-	2.02	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Nn4sys	112	UNSAT	6.39	10.3	46.4	-	2.14	-	-
2025 Nn4sys	113	UNSAT	6.32	10.5	45.2	-	2.39	-	-
2025 Nn4sys	114	UNSAT	6.39	10.6	58.2	-	2.63	-	-
2025 Nn4sys	115	UNSAT	6.37	10.8	58.0	-	2.84	-	-
2025 Nn4sys	116	UNSAT	6.43	10.9	61.9	-	3.03	-	-
2025 Nn4sys	117	UNSAT	6.40	14.7	85.8	-	6.52	-	-
2025 Nn4sys	118	UNSAT	6.42	14.7	-	-	7.21	-	-
2025 Nn4sys	119	UNSAT	6.39	19.2	82.2	-	10.3	-	-
2025 Nn4sys	120	UNSAT	6.43	19.4	-	-	11.2	-	-
2025 Nn4sys	121	UNSAT	6.64	24.5	-	-	13.9	-	-
2025 Nn4sys	122	UNSAT	6.67	24.9	-	-	15.5	-	-
2025 Nn4sys	123	UNSAT	6.61	30.4	-	-	17.7	-	-
2025 Nn4sys	124	UNSAT	6.63	30.3	-	-	19.5	-	-
2025 Nn4sys	125	UNSAT	6.64	33.2	-	-	19.6	-	-
2025 Nn4sys	126	UNSAT	6.65	33.3	-	-	21.4	-	-
2025 Nn4sys	127	UNSAT	8.09	-	-	-	-	-	-
2025 Nn4sys	128	UNSAT	8.10	-	-	-	-	-	-
2025 Nn4sys	129	UNSAT	7.33	10.1	6.44	-	-	-	-
2025 Nn4sys	130	UNSAT	7.47	12.4	51.3	-	-	-	-
2025 Nn4sys	131	UNSAT	7.49	15.0	-	-	-	-	-
2025 Nn4sys	132	UNSAT	7.42	16.2	-	-	-	-	-
2025 Nn4sys	133	UNSAT	7.71	26.2	-	-	-	-	-
2025 Nn4sys	134	UNSAT	7.69	31.5	-	-	-	-	-
2025 Nn4sys	135	UNSAT	7.76	29.4	-	-	-	-	-
2025 Nn4sys	136	UNSAT	7.90	32.5	-	-	-	-	-
2025 Nn4sys	137	UNSAT	7.70	10.6	7.37	-	-	-	-
2025 Nn4sys	138	UNSAT	8.36	17.3	-	-	-	-	-
2025 Nn4sys	139	UNSAT	8.39	15.1	-	-	-	-	-
2025 Nn4sys	140	UNSAT	8.73	15.5	-	-	-	-	-
2025 Nn4sys	141	UNSAT	8.70	16.0	-	-	-	-	-
2025 Nn4sys	142	UNSAT	8.74	18.0	-	-	-	-	-
2025 Nn4sys	143	UNSAT	8.77	18.9	-	-	-	-	-
2025 Nn4sys	144	UNSAT	8.86	19.5	-	-	-	-	-
2025 Nn4sys	145	UNSAT	9.27	32.6	-	-	-	-	-
2025 Nn4sys	146	UNSAT	9.62	35.6	-	-	-	-	-
2025 Nn4sys	147	UNSAT	9.94	42.5	-	-	-	-	-
2025 Nn4sys	148	UNSAT	10.1	49.9	-	-	-	-	-
2025 Nn4sys	149	UNSAT	10.1	52.8	-	-	-	-	-
2025 Nn4sys	150	UNSAT	10.3	57.6	-	-	-	-	-
2025 Nn4sys	151	UNSAT	10.5	63.2	-	-	-	-	-
2025 Nn4sys	152	UNSAT	10.9	66.8	-	-	-	-	-
2025 Nn4sys	153	UNSAT	11.1	72.8	-	-	-	-	-
2025 Nn4sys	154	UNSAT	11.4	78.6	-	-	-	-	-
2025 Nn4sys	155	UNSAT	11.7	82.8	-	-	-	-	-
2025 Nn4sys	156	UNSAT	11.9	87.8	-	-	-	-	-
2025 Nn4sys	157	UNSAT	21.7	92.0	-	-	-	-	-
2025 Nn4sys	158	UNSAT	22.9	97.8	-	-	-	-	-
2025 Nn4sys	159	UNSAT	23.4	105	-	-	-	-	-
2025 Nn4sys	160	UNSAT	8.88	13.0	16.1	-	-	-	-
2025 Nn4sys	161	UNSAT	9.50	-	-	-	-	-	-
2025 Nn4sys	162	UNSAT	10.4	20.3	-	-	-	-	-
2025 Nn4sys	163	UNSAT	10.8	22.2	-	-	-	-	-
2025 Nn4sys	164	UNSAT	12.7	28.8	-	-	-	-	-
2025 Nn4sys	165	UNSAT	13.6	33.8	-	-	-	-	-
2025 Nn4sys	166	UNSAT	14.4	38.5	-	-	-	-	-
2025 Nn4sys	167	UNSAT	15.8	45.1	-	-	-	-	-
2025 Nn4sys	168	UNSAT	16.5	49.5	-	-	-	-	-
2025 Nn4sys	169	UNSAT	17.5	53.9	-	-	-	-	-
2025 Nn4sys	170	UNSAT	18.7	60.4	-	-	-	-	-
2025 Nn4sys	171	UNSAT	10.1	20.1	-	-	-	-	-
2025 Nn4sys	172	UNSAT	11.7	30.4	-	-	-	-	-
2025 Nn4sys	173	UNSAT	12.9	35.7	-	-	-	-	-
2025 Nn4sys	174	UNSAT	13.1	37.0	-	-	-	-	-
2025 Nn4sys	175	UNSAT	13.3	38.3	-	-	-	-	-
2025 Nn4sys	176	UNSAT	15.9	48.0	-	-	-	-	-
2025 Nn4sys	177	UNSAT	15.5	48.0	-	-	-	-	-
2025 Nn4sys	178	UNSAT	17.1	50.6	-	-	-	-	-
2025 Nn4sys	179	UNSAT	23.4	60.7	-	-	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Nn4sys	180	UNSAT	29.2	70.6	-	-	-	-	-
2025 Nn4sys	181	UNSAT	36.4	97.9	-	-	-	-	-
2025 Nn4sys	182	UNSAT	36.3	99.4	-	-	-	-	-
2025 Nn4sys	183	UNSAT	42.1	112	-	-	-	-	-
2025 Nn4sys	184	UNSAT	48.5	129	-	-	-	-	-
2025 Nn4sys	185	UNSAT	48.7	140	-	-	-	-	-
2025 Nn4sys	186	UNSAT	56.1	159	-	-	-	-	-
2025 Nn4sys	187	UNSAT	57.9	167	-	-	-	-	-
2025 Nn4sys	188	UNSAT	65.4	184	-	-	-	-	-
2025 Nn4sys	189	UNSAT	67.4	-	-	-	-	-	-
2025 Nn4sys	190	UNSAT	70.3	201	-	-	-	-	-
2025 Nn4sys	191	UNSAT	80.1	217	-	-	-	-	-
2025 Nn4sys	192	UNSAT	80.5	236	-	-	-	-	-
2025 Nn4sys	193	UNSAT	78.5	249	-	-	-	-	-
2025 Safenlp 2024	0	SAT	6.64	8.99	6.12	12.2	1.23	-	✗
2025 Safenlp 2024	1	UNSAT	8.26	10.4	-	-	-	-	17.9
2025 Safenlp 2024	2	SAT	6.87	8.91	6.17	12.2	1.24	-	✗
2025 Safenlp 2024	3	SAT	6.86	-	6.11	14.3	-	-	✗
2025 Safenlp 2024	4	UNSAT	6.27	7.94	6.37	11.9	1.07	17.0	19.0
2025 Safenlp 2024	5	SAT	6.80	8.21	6.10	12.2	1.30	-	✗
2025 Safenlp 2024	6	SAT	6.77	8.14	6.08	12.2	1.25	-	-
2025 Safenlp 2024	7	UNSAT	7.61	8.55	-	-	-	-	-
2025 Safenlp 2024	8	UNSAT	6.32	7.94	6.34	12.0	1.07	16.8	18.0
2025 Safenlp 2024	9	UNSAT	7.29	8.01	9.81	13.3	2.00	-	17.9
2025 Safenlp 2024	10	UNSAT	7.02	8.02	7.17	12.7	2.01	-	17.8
2025 Safenlp 2024	11	UNSAT	7.33	8.03	6.86	12.9	1.60	-	17.8
2025 Safenlp 2024	12	SAT	6.59	8.05	6.13	12.2	1.30	-	✗
2025 Safenlp 2024	13	SAT	6.71	6.00	6.14	11.2	1.29	-	18.1
2025 Safenlp 2024	14	SAT	6.81	8.92	6.12	12.2	1.26	-	✗
2025 Safenlp 2024	15	SAT	6.79	6.27	6.12	11.2	1.24	-	18.0
2025 Safenlp 2024	16	UNSAT	6.32	7.91	6.40	12.0	1.13	16.8	17.6
2025 Safenlp 2024	17	SAT	6.51	7.99	6.12	21.0	1.53	-	✗
2025 Safenlp 2024	18	UNSAT	7.14	8.01	11.7	13.5	2.43	-	17.9
2025 Safenlp 2024	19	SAT	6.63	9.12	6.10	12.2	1.24	-	✗
2025 Safenlp 2024	20	SAT	6.87	5.90	6.04	12.2	1.23	14.9	17.9
2025 Safenlp 2024	21	UNSAT	8.35	9.00	-	-	-	-	17.9
2025 Safenlp 2024	22	UNSAT	6.32	7.91	6.40	10.9	1.07	16.6	17.8
2025 Safenlp 2024	23	SAT	6.71	5.98	6.07	12.2	1.23	15.0	18.0
2025 Safenlp 2024	24	SAT	6.82	6.01	6.11	12.2	1.24	14.9	18.1
2025 Safenlp 2024	25	UNSAT	7.14	8.29	15.2	13.8	3.67	-	-
2025 Safenlp 2024	26	UNSAT	6.32	7.88	6.38	11.9	1.13	16.3	17.7
2025 Safenlp 2024	27	SAT	6.83	8.97	6.11	12.3	1.24	-	-
2025 Safenlp 2024	28	UNSAT	7.18	8.02	14.6	13.6	3.33	-	17.9
2025 Safenlp 2024	29	SAT	6.79	5.97	6.05	11.1	1.26	15.2	18.2
2025 Safenlp 2024	30	SAT	6.51	5.99	6.12	11.2	1.25	14.9	18.1
2025 Safenlp 2024	31	SAT	6.72	8.97	6.13	12.2	1.26	-	✗
2025 Safenlp 2024	32	UNSAT	7.08	8.00	8.61	13.5	1.93	-	17.7
2025 Safenlp 2024	33	UNSAT	6.39	7.99	6.46	11.7	1.07	17.0	18.1
2025 Safenlp 2024	34	SAT	6.79	9.03	6.11	12.2	1.23	-	✗
2025 Safenlp 2024	35	SAT	6.62	7.93	6.10	11.2	1.24	-	✗
2025 Safenlp 2024	36	SAT	6.89	8.09	6.10	13.0	1.23	-	✗
2025 Safenlp 2024	37	UNSAT	6.34	7.89	6.39	12.0	1.07	16.5	17.6
2025 Safenlp 2024	38	SAT	7.04	8.00	6.11	12.2	1.24	-	✗
2025 Safenlp 2024	39	SAT	6.57	8.05	6.12	12.7	1.47	-	✗
2025 Safenlp 2024	40	SAT	6.71	8.01	6.12	12.7	1.26	-	✗
2025 Safenlp 2024	41	SAT	6.68	8.06	6.12	11.4	1.24	-	✗
2025 Safenlp 2024	42	UNSAT	7.05	7.96	6.62	12.7	1.27	-	17.9
2025 Safenlp 2024	43	UNSAT	7.17	8.19	12.4	15.8	2.73	-	17.8
2025 Safenlp 2024	44	UNSAT	8.30	8.86	-	-	-	-	17.9
2025 Safenlp 2024	45	UNSAT	7.19	8.04	8.26	13.2	2.22	-	17.9
2025 Safenlp 2024	46	SAT	6.69	8.12	6.11	12.8	1.43	-	✗
2025 Safenlp 2024	47	SAT	6.69	8.96	6.10	12.2	1.24	-	-
2025 Safenlp 2024	48	UNSAT	6.33	7.90	6.42	10.9	1.10	16.4	17.5
2025 Safenlp 2024	49	SAT	6.74	8.98	6.06	12.7	1.23	-	✗
2025 Safenlp 2024	50	SAT	6.72	8.88	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	51	SAT	6.78	6.05	6.08	11.2	1.24	15.6	18.1
2025 Safenlp 2024	52	SAT	6.76	7.95	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	53	SAT	6.58	8.95	6.10	12.2	1.27	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	54	UNSAT	7.15	8.19	17.6	-	20.8	-	17.9
2025 Safenlp 2024	55	UNSAT	6.27	7.93	6.38	11.9	1.07	16.4	17.8
2025 Safenlp 2024	56	SAT	6.86	8.06	6.11	12.2	1.29	-	✗
2025 Safenlp 2024	57	SAT	6.79	8.90	6.08	13.5	1.78	-	✗
2025 Safenlp 2024	58	UNSAT	7.41	8.32	-	17.3	-	-	18.0
2025 Safenlp 2024	59	UNSAT	11.7	26.7	-	-	-	-	-
2025 Safenlp 2024	60	UNSAT	7.35	8.01	9.04	13.3	2.03	-	17.7
2025 Safenlp 2024	61	SAT	6.84	5.96	6.07	12.3	1.24	15.1	-
2025 Safenlp 2024	62	UNSAT	7.25	8.24	14.5	15.5	2.71	-	18.0
2025 Safenlp 2024	63	UNSAT	7.20	8.04	6.75	12.8	1.47	-	17.8
2025 Safenlp 2024	64	SAT	6.73	8.00	6.10	12.2	1.27	-	✗
2025 Safenlp 2024	65	SAT	6.85	8.99	6.07	11.2	1.23	-	✗
2025 Safenlp 2024	66	SAT	6.85	6.34	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	67	SAT	6.80	8.95	6.09	12.3	1.24	-	✗
2025 Safenlp 2024	68	SAT	6.57	8.00	6.11	12.3	1.22	-	✗
2025 Safenlp 2024	69	SAT	6.72	8.03	6.11	12.3	1.25	-	✗
2025 Safenlp 2024	70	SAT	6.82	6.11	6.07	12.2	1.24	-	18.1
2025 Safenlp 2024	71	SAT	6.64	5.97	6.06	12.2	1.22	15.1	18.0
2025 Safenlp 2024	72	SAT	6.89	7.99	6.13	12.3	1.25	-	✗
2025 Safenlp 2024	73	SAT	6.78	7.91	6.11	12.1	1.23	-	✗
2025 Safenlp 2024	74	UNSAT	6.32	7.97	6.36	11.9	1.07	16.7	17.6
2025 Safenlp 2024	75	UNSAT	8.80	43.0	-	-	-	-	17.7
2025 Safenlp 2024	76	SAT	6.86	6.47	6.12	12.2	1.23	-	✗
2025 Safenlp 2024	77	SAT	6.82	7.70	6.11	11.2	1.25	-	18.1
2025 Safenlp 2024	78	SAT	6.77	7.97	6.07	11.2	1.23	-	✗
2025 Safenlp 2024	79	SAT	6.80	9.00	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	80	SAT	6.67	5.95	6.06	11.2	1.26	14.9	17.8
2025 Safenlp 2024	81	SAT	6.72	8.94	6.13	11.2	1.23	-	✗
2025 Safenlp 2024	82	UNSAT	6.32	7.97	6.38	12.0	1.08	16.7	17.8
2025 Safenlp 2024	83	SAT	6.83	8.93	6.10	13.0	1.24	-	✗
2025 Safenlp 2024	84	SAT	6.64	5.97	6.10	12.2	1.29	15.1	18.0
2025 Safenlp 2024	85	SAT	6.88	7.93	6.12	12.2	1.28	-	✗
2025 Safenlp 2024	86	SAT	6.80	8.94	6.14	13.0	1.44	-	✗
2025 Safenlp 2024	87	UNSAT	6.35	8.00	6.36	11.9	1.07	16.7	17.8
2025 Safenlp 2024	88	UNSAT	6.40	8.02	6.46	11.5	1.08	16.8	17.7
2025 Safenlp 2024	89	SAT	6.80	5.95	6.06	12.2	1.28	14.8	18.1
2025 Safenlp 2024	90	SAT	6.67	7.92	6.12	13.3	1.76	-	-
2025 Safenlp 2024	91	SAT	6.84	5.94	6.06	12.1	1.26	15.0	18.2
2025 Safenlp 2024	92	SAT	6.67	5.97	6.08	12.2	1.23	14.9	17.9
2025 Safenlp 2024	93	UNSAT	7.26	8.95	-	20.0	-	-	18.0
2025 Safenlp 2024	94	UNSAT	6.31	7.93	6.39	10.9	1.07	16.3	17.6
2025 Safenlp 2024	95	UNSAT	8.10	20.6	-	-	-	-	17.8
2025 Safenlp 2024	96	SAT	6.70	8.93	6.08	11.2	1.23	-	✗
2025 Safenlp 2024	97	SAT	6.85	9.66	6.09	13.2	1.73	-	✗
2025 Safenlp 2024	98	SAT	6.76	8.00	6.11	12.2	1.25	-	✗
2025 Safenlp 2024	99	UNSAT	6.32	7.94	6.37	12.0	1.07	16.2	17.8
2025 Safenlp 2024	100	SAT	6.74	5.98	6.05	12.2	1.07	14.9	17.9
2025 Safenlp 2024	101	UNSAT	6.29	7.93	6.36	12.0	1.09	16.3	17.6
2025 Safenlp 2024	102	SAT	6.53	6.01	6.07	12.2	1.27	15.1	17.9
2025 Safenlp 2024	103	SAT	6.55	6.05	6.08	12.2	1.23	14.8	17.8
2025 Safenlp 2024	104	SAT	6.76	7.99	6.13	12.3	1.22	-	✗
2025 Safenlp 2024	105	SAT	6.82	8.96	6.13	11.2	1.28	-	✗
2025 Safenlp 2024	106	UNSAT	6.33	7.94	6.41	11.9	1.13	16.3	17.7
2025 Safenlp 2024	107	UNSAT	7.44	8.12	12.5	14.7	2.85	-	17.8
2025 Safenlp 2024	108	SAT	6.85	9.00	6.12	13.0	1.24	-	✗
2025 Safenlp 2024	109	SAT	6.86	7.96	6.09	12.2	1.29	-	✗
2025 Safenlp 2024	110	SAT	6.66	8.92	6.13	12.0	1.48	-	✗
2025 Safenlp 2024	111	SAT	6.80	5.90	6.07	12.2	1.24	14.9	17.8
2025 Safenlp 2024	112	UNSAT	6.30	7.99	6.38	11.9	1.07	16.5	17.6
2025 Safenlp 2024	113	SAT	6.80	5.93	6.10	12.2	1.24	14.9	18.0
2025 Safenlp 2024	114	SAT	6.55	8.95	6.10	12.3	1.23	-	✗
2025 Safenlp 2024	115	SAT	6.81	5.91	6.04	12.3	1.24	15.3	17.9
2025 Safenlp 2024	116	UNSAT	7.26	8.02	8.80	13.1	2.25	-	-
2025 Safenlp 2024	117	UNSAT	6.28	7.92	6.38	11.9	1.07	16.6	17.6
2025 Safenlp 2024	118	SAT	6.82	5.95	6.06	12.2	1.25	15.0	17.8
2025 Safenlp 2024	119	UNSAT	6.33	7.96	6.40	11.9	1.07	16.8	17.8
2025 Safenlp 2024	120	SAT	6.80	7.97	6.12	11.2	1.25	-	✗
2025 Safenlp 2024	121	UNSAT	6.32	7.86	6.37	11.9	1.12	16.5	17.7

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	122	SAT	6.77	9.02	6.11	13.8	-	-	✗
2025 Safenlp 2024	123	SAT	6.49	5.94	6.10	12.1	1.09	14.9	17.9
2025 Safenlp 2024	124	SAT	6.80	5.97	6.04	12.2	1.25	14.8	18.3
2025 Safenlp 2024	125	UNSAT	7.21	8.25	-	-	12.6	-	17.7
2025 Safenlp 2024	126	UNSAT	7.10	8.04	15.2	14.3	5.54	-	17.9
2025 Safenlp 2024	127	UNSAT	8.84	17.2	-	-	-	-	18.1
2025 Safenlp 2024	128	SAT	6.82	9.02	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	129	SAT	6.61	5.95	6.06	12.2	1.23	14.9	17.9
2025 Safenlp 2024	130	SAT	6.86	8.96	6.12	12.2	1.23	-	✗
2025 Safenlp 2024	131	SAT	6.72	8.10	6.14	11.2	1.24	-	✗
2025 Safenlp 2024	132	SAT	6.86	6.08	6.09	12.2	1.24	14.9	18.2
2025 Safenlp 2024	133	SAT	6.87	6.00	6.05	12.2	1.06	14.8	-
2025 Safenlp 2024	134	UNSAT	6.32	7.92	6.39	12.0	1.08	16.1	-
2025 Safenlp 2024	135	SAT	6.78	8.00	6.12	12.3	1.28	-	✗
2025 Safenlp 2024	136	UNSAT	6.33	7.92	6.37	11.9	1.07	16.5	17.6
2025 Safenlp 2024	137	SAT	6.90	8.25	6.10	12.2	1.61	-	✗
2025 Safenlp 2024	138	UNSAT	6.26	7.87	6.39	11.9	1.12	16.6	17.7
2025 Safenlp 2024	139	SAT	6.83	5.98	6.04	12.2	1.24	14.9	18.0
2025 Safenlp 2024	140	SAT	6.68	6.75	6.08	11.2	1.25	15.2	18.0
2025 Safenlp 2024	141	UNSAT	7.33	8.27	-	15.8	14.4	-	18.1
2025 Safenlp 2024	142	UNSAT	7.40	8.13	10.8	14.3	2.12	-	17.8
2025 Safenlp 2024	143	SAT	6.84	5.96	6.10	12.2	1.08	15.0	17.7
2025 Safenlp 2024	144	UNSAT	6.31	7.87	6.35	11.0	1.14	16.4	17.7
2025 Safenlp 2024	145	SAT	6.77	5.91	6.07	11.2	1.24	15.0	18.3
2025 Safenlp 2024	146	UNSAT	6.29	7.94	6.41	12.0	1.09	16.5	17.7
2025 Safenlp 2024	147	SAT	6.78	8.04	6.13	12.2	1.23	-	✗
2025 Safenlp 2024	148	UNSAT	7.79	8.35	20.8	-	-	-	18.1
2025 Safenlp 2024	149	SAT	6.72	7.93	6.09	12.2	1.24	-	✗
2025 Safenlp 2024	150	UNSAT	6.31	7.96	6.36	12.0	1.08	16.5	17.5
2025 Safenlp 2024	151	UNSAT	8.13	8.61	-	-	-	-	18.0
2025 Safenlp 2024	152	UNSAT	7.24	8.03	13.8	15.5	2.79	-	17.9
2025 Safenlp 2024	153	SAT	6.80	6.07	6.10	11.2	1.25	15.0	17.9
2025 Safenlp 2024	154	UNSAT	6.29	7.94	6.38	11.0	1.07	16.6	17.6
2025 Safenlp 2024	155	UNSAT	7.17	7.99	6.87	12.7	1.27	-	17.9
2025 Safenlp 2024	156	UNSAT	8.26	14.5	-	-	-	-	18.0
2025 Safenlp 2024	157	UNSAT	6.26	7.82	6.45	12.5	1.08	16.7	17.8
2025 Safenlp 2024	158	SAT	6.59	5.93	6.07	12.2	1.24	15.1	18.0
2025 Safenlp 2024	159	UNSAT	7.06	7.96	6.46	11.5	1.37	-	17.5
2025 Safenlp 2024	160	SAT	6.75	7.97	6.10	11.2	1.33	-	✗
2025 Safenlp 2024	161	SAT	6.66	8.97	6.11	12.2	1.27	-	✗
2025 Safenlp 2024	162	UNSAT	7.91	8.66	-	-	-	-	18.1
2025 Safenlp 2024	163	SAT	6.70	8.98	6.10	12.2	1.24	-	-
2025 Safenlp 2024	164	SAT	6.84	9.01	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	165	UNSAT	6.26	7.90	6.40	10.9	1.07	16.8	17.8
2025 Safenlp 2024	166	SAT	6.70	8.06	6.14	12.2	1.25	-	✗
2025 Safenlp 2024	167	SAT	6.50	8.89	6.14	12.3	1.25	-	✗
2025 Safenlp 2024	168	UNSAT	6.25	7.95	6.36	12.0	1.08	16.4	17.6
2025 Safenlp 2024	169	SAT	6.82	9.01	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	170	SAT	6.78	6.11	6.06	12.3	1.25	15.2	17.9
2025 Safenlp 2024	171	UNSAT	7.11	8.09	11.3	13.5	2.57	-	17.9
2025 Safenlp 2024	172	SAT	6.81	6.02	6.08	12.3	1.25	14.9	18.1
2025 Safenlp 2024	173	UNSAT	6.33	7.87	6.35	12.0	1.07	16.5	18.8
2025 Safenlp 2024	174	UNSAT	6.27	7.91	6.37	12.0	1.07	17.1	17.8
2025 Safenlp 2024	175	UNSAT	7.25	8.30	23.2	16.7	7.74	-	18.0
2025 Safenlp 2024	176	UNSAT	6.31	7.94	6.36	11.9	1.07	16.6	17.6
2025 Safenlp 2024	177	UNSAT	6.31	7.90	6.43	12.0	1.07	16.3	17.7
2025 Safenlp 2024	178	SAT	6.85	8.11	6.09	12.7	1.41	-	✗
2025 Safenlp 2024	179	UNSAT	7.33	8.02	6.62	11.7	1.61	-	17.9
2025 Safenlp 2024	180	UNSAT	7.18	8.21	15.8	25.3	14.9	-	18.1
2025 Safenlp 2024	181	SAT	6.69	8.02	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	182	UNSAT	6.32	7.94	6.38	12.0	1.07	16.6	17.7
2025 Safenlp 2024	183	SAT	6.55	7.97	6.15	12.2	1.21	-	✗
2025 Safenlp 2024	184	SAT	6.77	7.10	6.09	12.2	1.26	-	✗
2025 Safenlp 2024	185	UNSAT	7.04	8.09	19.6	14.3	4.95	-	17.8
2025 Safenlp 2024	186	UNSAT	6.28	7.86	6.35	12.0	1.07	16.7	17.9
2025 Safenlp 2024	187	SAT	6.75	7.56	6.12	12.2	1.24	15.0	18.1
2025 Safenlp 2024	188	UNSAT	6.39	7.94	6.48	12.5	1.07	16.5	19.0
2025 Safenlp 2024	189	SAT	6.80	7.98	6.09	12.2	1.24	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	190	UNSAT	7.58	9.89	-	-	-	-	17.9
2025 Safenlp 2024	191	UNSAT	6.25	7.87	6.35	12.0	1.07	17.1	17.8
2025 Safenlp 2024	192	SAT	6.83	8.07	6.13	12.5	1.43	-	✗
2025 Safenlp 2024	193	SAT	6.80	8.09	6.12	11.2	1.26	-	✗
2025 Safenlp 2024	194	UNSAT	6.23	7.88	6.45	12.5	1.07	16.8	17.6
2025 Safenlp 2024	195	SAT	6.77	5.97	6.12	12.2	1.24	15.0	18.2
2025 Safenlp 2024	196	UNSAT	7.01	8.01	7.12	13.3	1.44	-	17.9
2025 Safenlp 2024	197	SAT	6.82	8.97	6.13	12.2	1.27	-	✗
2025 Safenlp 2024	198	UNSAT	7.32	8.52	-	14.3	16.4	-	17.9
2025 Safenlp 2024	199	SAT	6.54	7.97	6.09	12.2	1.24	-	✗
2025 Safenlp 2024	200	SAT	6.82	7.97	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	201	SAT	6.78	8.92	6.10	12.2	1.26	-	✗
2025 Safenlp 2024	202	SAT	6.67	8.94	6.12	12.2	1.25	-	✗
2025 Safenlp 2024	203	SAT	6.72	5.95	6.07	12.2	1.26	14.9	18.1
2025 Safenlp 2024	204	UNSAT	7.17	8.03	8.99	13.5	2.27	-	17.7
2025 Safenlp 2024	205	UNSAT	6.30	7.86	6.41	11.9	1.08	16.6	18.2
2025 Safenlp 2024	206	SAT	6.65	5.98	6.05	11.2	1.22	15.2	17.7
2025 Safenlp 2024	207	SAT	6.54	7.94	6.16	12.2	1.25	-	✗
2025 Safenlp 2024	208	UNSAT	6.26	7.93	6.40	12.0	1.07	16.7	17.9
2025 Safenlp 2024	209	SAT	6.76	7.32	6.14	12.2	1.30	14.9	18.3
2025 Safenlp 2024	210	SAT	6.60	9.01	6.11	11.2	1.23	-	✗
2025 Safenlp 2024	211	SAT	6.66	8.01	6.12	12.2	1.26	-	✗
2025 Safenlp 2024	212	SAT	6.83	8.99	6.13	12.2	1.27	-	✗
2025 Safenlp 2024	213	UNSAT	7.24	8.12	10.9	15.3	3.21	-	18.0
2025 Safenlp 2024	214	SAT	6.79	8.93	6.09	12.2	1.26	-	✗
2025 Safenlp 2024	215	SAT	6.62	7.92	6.13	11.2	1.27	-	✗
2025 Safenlp 2024	216	UNSAT	6.29	7.97	6.39	11.9	1.09	16.6	17.4
2025 Safenlp 2024	217	SAT	6.53	5.93	6.06	12.2	1.22	15.0	17.9
2025 Safenlp 2024	218	UNSAT	7.25	8.01	6.92	12.4	1.46	-	17.9
2025 Safenlp 2024	219	SAT	6.87	8.02	6.13	11.7	1.61	-	-
2025 Safenlp 2024	220	SAT	6.58	7.98	6.14	12.2	1.25	-	✗
2025 Safenlp 2024	221	SAT	6.82	6.27	6.13	12.2	1.23	-	18.1
2025 Safenlp 2024	222	SAT	6.80	9.07	6.13	12.2	1.28	-	✗
2025 Safenlp 2024	223	SAT	6.53	5.98	6.04	12.2	1.22	15.2	17.7
2025 Safenlp 2024	224	UNSAT	6.32	7.88	6.36	11.9	1.08	16.7	18.1
2025 Safenlp 2024	225	SAT	6.79	8.94	6.10	12.8	1.24	-	✗
2025 Safenlp 2024	226	SAT	6.62	7.93	6.13	11.2	1.23	-	✗
2025 Safenlp 2024	227	UNSAT	6.29	7.96	6.39	11.9	1.07	16.5	17.7
2025 Safenlp 2024	228	SAT	6.78	5.93	6.06	12.3	1.24	14.9	18.2
2025 Safenlp 2024	229	UNSAT	6.33	7.98	6.43	11.9	1.08	16.5	17.8
2025 Safenlp 2024	230	SAT	6.82	7.99	6.14	12.3	1.26	-	✗
2025 Safenlp 2024	231	SAT	6.48	5.97	6.06	12.2	1.12	14.8	17.9
2025 Safenlp 2024	232	UNSAT	7.44	8.24	14.5	14.3	3.21	-	17.7
2025 Safenlp 2024	233	SAT	6.68	8.12	6.10	12.2	1.47	-	✗
2025 Safenlp 2024	234	UNSAT	8.86	15.9	-	-	-	-	17.9
2025 Safenlp 2024	235	SAT	6.79	8.07	6.15	12.2	1.24	-	✗
2025 Safenlp 2024	236	UNSAT	8.43	9.40	-	-	-	-	18.3
2025 Safenlp 2024	237	UNSAT	6.26	7.96	6.40	12.1	1.10	17.2	17.8
2025 Safenlp 2024	238	SAT	6.59	9.27	6.14	12.5	1.44	-	✗
2025 Safenlp 2024	239	UNSAT	6.27	7.86	6.46	12.4	1.07	16.9	17.9
2025 Safenlp 2024	240	UNSAT	6.37	7.97	6.43	12.8	1.07	16.5	17.9
2025 Safenlp 2024	241	UNSAT	6.29	7.98	6.38	11.9	1.07	16.4	17.9
2025 Safenlp 2024	242	UNSAT	6.29	7.89	6.37	11.9	1.07	16.9	17.6
2025 Safenlp 2024	243	SAT	6.82	7.95	6.14	12.2	1.25	-	✗
2025 Safenlp 2024	244	UNSAT	7.23	8.25	-	13.2	6.24	-	17.7
2025 Safenlp 2024	245	UNSAT	6.27	7.91	6.42	11.9	1.13	16.4	18.0
2025 Safenlp 2024	246	SAT	6.80	8.02	6.12	12.7	1.25	-	✗
2025 Safenlp 2024	247	SAT	6.57	7.98	6.12	12.2	1.21	-	✗
2025 Safenlp 2024	248	SAT	6.75	6.06	6.07	12.2	1.24	15.8	18.0
2025 Safenlp 2024	249	SAT	6.67	8.02	6.12	12.2	1.25	-	✗
2025 Safenlp 2024	250	SAT	6.78	7.96	6.10	11.2	1.22	-	-
2025 Safenlp 2024	251	UNSAT	8.80	11.9	-	-	-	-	18.2
2025 Safenlp 2024	252	SAT	6.81	8.08	6.13	12.2	1.23	-	✗
2025 Safenlp 2024	253	SAT	6.46	5.97	6.08	12.3	1.25	14.8	18.0
2025 Safenlp 2024	254	SAT	6.75	5.96	6.13	11.2	1.23	-	17.8
2025 Safenlp 2024	255	SAT	6.78	8.09	6.10	12.3	1.40	-	✗
2025 Safenlp 2024	256	SAT	6.59	6.10	6.14	12.2	1.24	-	17.8
2025 Safenlp 2024	257	UNSAT	6.30	7.93	6.42	11.9	1.08	16.6	17.9

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	258	SAT	6.80	6.00	6.07	12.3	1.24	14.8	18.4
2025 Safenlp 2024	259	UNSAT	8.39	12.7	-	-	-	-	18.1
2025 Safenlp 2024	260	UNSAT	7.25	8.02	9.39	13.3	2.07	-	17.6
2025 Safenlp 2024	261	SAT	6.84	8.98	6.13	13.3	1.25	-	✗
2025 Safenlp 2024	262	UNSAT	7.48	8.23	18.0	29.6	7.31	-	18.1
2025 Safenlp 2024	263	SAT	6.81	8.95	6.11	11.2	1.23	-	18.3
2025 Safenlp 2024	264	SAT	6.86	8.04	6.10	11.2	1.26	-	✗
2025 Safenlp 2024	265	UNSAT	7.81	9.14	-	-	-	-	17.8
2025 Safenlp 2024	266	UNSAT	7.68	-	-	-	-	-	18.1
2025 Safenlp 2024	267	SAT	6.57	9.22	6.12	12.2	1.27	-	✗
2025 Safenlp 2024	268	SAT	6.66	5.98	6.04	12.3	1.24	15.0	17.9
2025 Safenlp 2024	269	SAT	6.84	8.05	6.10	11.3	1.25	-	✗
2025 Safenlp 2024	270	UNSAT	7.40	8.24	11.8	14.8	2.92	-	18.0
2025 Safenlp 2024	271	UNSAT	10.3	24.3	-	-	-	-	18.2
2025 Safenlp 2024	272	UNSAT	9.68	40.8	-	-	-	-	18.2
2025 Safenlp 2024	273	UNSAT	6.31	7.89	6.42	11.9	1.09	16.5	17.6
2025 Safenlp 2024	274	UNSAT	7.25	7.92	6.84	13.0	1.26	-	17.8
2025 Safenlp 2024	275	UNSAT	6.35	7.99	6.42	11.9	1.08	17.0	17.8
2025 Safenlp 2024	276	SAT	6.71	5.98	6.09	12.2	1.13	15.0	17.7
2025 Safenlp 2024	277	UNSAT	7.11	8.02	9.40	13.0	2.44	-	18.2
2025 Safenlp 2024	278	UNSAT	7.35	8.19	14.1	-	3.62	-	17.7
2025 Safenlp 2024	279	SAT	6.85	5.97	6.09	12.3	1.25	15.0	17.8
2025 Safenlp 2024	280	UNSAT	8.87	28.6	-	-	-	-	18.0
2025 Safenlp 2024	281	SAT	6.78	7.98	6.11	13.0	1.25	-	✗
2025 Safenlp 2024	282	SAT	6.67	7.93	6.14	12.2	1.24	-	✗
2025 Safenlp 2024	283	SAT	6.65	8.11	6.11	12.2	1.30	-	✗
2025 Safenlp 2024	284	SAT	6.52	8.04	6.14	12.2	1.41	-	✗
2025 Safenlp 2024	285	UNSAT	6.26	7.93	6.37	11.9	1.09	16.5	17.8
2025 Safenlp 2024	286	UNSAT	7.38	8.01	6.88	12.4	1.27	-	-
2025 Safenlp 2024	287	SAT	6.86	8.12	6.12	13.0	1.28	-	✗
2025 Safenlp 2024	288	UNSAT	8.06	8.78	-	-	-	-	18.2
2025 Safenlp 2024	289	UNSAT	7.24	8.28	-	14.3	16.5	-	18.1
2025 Safenlp 2024	290	UNSAT	14.0	-	-	-	-	-	17.9
2025 Safenlp 2024	291	UNSAT	7.15	8.33	15.4	16.0	3.87	-	17.8
2025 Safenlp 2024	292	SAT	6.69	5.98	6.07	12.2	1.25	15.3	18.1
2025 Safenlp 2024	293	UNSAT	8.46	12.6	-	-	-	-	18.1
2025 Safenlp 2024	294	UNSAT	7.76	8.30	22.4	-	-	-	17.9
2025 Safenlp 2024	295	SAT	6.48	5.96	6.09	12.2	1.07	15.0	17.6
2025 Safenlp 2024	296	SAT	6.58	5.95	6.07	12.2	1.24	14.9	18.2
2025 Safenlp 2024	297	UNSAT	7.18	8.33	17.5	14.0	8.03	-	18.0
2025 Safenlp 2024	298	UNSAT	7.56	8.38	21.7	24.8	19.5	-	17.9
2025 Safenlp 2024	299	UNSAT	6.28	7.92	6.41	12.0	1.07	16.5	17.7
2025 Safenlp 2024	300	UNSAT	7.48	8.26	17.9	26.3	5.16	-	18.1
2025 Safenlp 2024	301	SAT	6.58	5.98	6.06	12.2	1.24	15.0	17.8
2025 Safenlp 2024	302	UNSAT	7.13	7.97	10.5	13.3	2.08	-	17.6
2025 Safenlp 2024	303	SAT	6.75	5.95	6.06	11.2	1.26	15.0	17.7
2025 Safenlp 2024	304	UNSAT	7.48	8.28	25.7	15.0	15.3	-	17.6
2025 Safenlp 2024	305	SAT	6.84	7.98	6.14	11.2	1.23	-	✗
2025 Safenlp 2024	306	SAT	6.79	5.97	6.05	12.2	1.24	14.9	18.3
2025 Safenlp 2024	307	SAT	6.73	5.94	6.04	12.2	1.26	15.0	-
2025 Safenlp 2024	308	SAT	6.84	9.16	6.08	13.8	1.62	-	✗
2025 Safenlp 2024	309	SAT	6.64	7.15	6.11	12.2	1.29	-	✗
2025 Safenlp 2024	310	SAT	6.86	7.90	6.11	12.1	1.25	14.9	18.4
2025 Safenlp 2024	311	UNSAT	6.30	7.96	6.39	12.0	1.07	16.6	17.7
2025 Safenlp 2024	312	SAT	6.81	9.02	6.16	13.5	1.42	-	✗
2025 Safenlp 2024	313	UNSAT	6.26	7.93	6.36	12.0	1.08	16.3	17.9
2025 Safenlp 2024	314	UNSAT	7.09	8.00	8.48	13.3	2.26	-	17.9
2025 Safenlp 2024	315	UNSAT	6.33	7.94	6.36	10.9	1.07	16.8	17.9
2025 Safenlp 2024	316	UNSAT	6.35	7.95	6.39	11.9	1.07	16.6	17.8
2025 Safenlp 2024	317	SAT	6.56	6.64	6.11	12.2	1.24	-	17.8
2025 Safenlp 2024	318	UNSAT	7.13	8.24	11.8	14.2	2.55	-	17.7
2025 Safenlp 2024	319	UNSAT	7.72	8.25	-	-	-	-	18.2
2025 Safenlp 2024	320	UNSAT	7.22	8.24	19.5	14.0	4.86	-	18.1
2025 Safenlp 2024	321	UNSAT	7.28	8.03	10.3	16.3	2.82	-	-
2025 Safenlp 2024	322	SAT	6.79	7.96	6.10	12.2	1.24	-	✗
2025 Safenlp 2024	323	SAT	6.77	8.95	6.11	11.3	1.25	-	✗
2025 Safenlp 2024	324	SAT	6.85	6.52	6.11	12.2	1.26	-	18.3
2025 Safenlp 2024	325	SAT	6.76	5.97	6.06	12.3	1.28	14.9	18.1

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	326	SAT	6.72	7.95	6.12	11.2	1.29	-	✗
2025 Safenlp 2024	327	SAT	6.60	9.01	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	328	UNSAT	6.31	7.94	6.36	12.0	1.07	16.6	17.6
2025 Safenlp 2024	329	SAT	6.79	6.08	6.12	12.3	1.23	15.1	17.9
2025 Safenlp 2024	330	UNSAT	8.36	11.4	-	-	-	-	17.9
2025 Safenlp 2024	331	SAT	6.57	7.99	6.11	12.2	1.25	15.0	17.8
2025 Safenlp 2024	332	SAT	6.54	6.14	6.07	11.3	1.24	-	18.8
2025 Safenlp 2024	333	UNSAT	6.28	7.95	6.41	11.9	1.08	16.5	-
2025 Safenlp 2024	334	SAT	6.81	5.97	6.09	11.3	1.25	14.8	18.1
2025 Safenlp 2024	335	SAT	6.81	8.99	6.11	13.1	1.48	-	✗
2025 Safenlp 2024	336	UNSAT	6.23	7.94	6.39	11.9	1.07	16.5	19.1
2025 Safenlp 2024	337	UNSAT	9.27	32.5	-	-	-	-	18.1
2025 Safenlp 2024	338	UNSAT	7.15	8.37	15.9	18.2	4.56	-	18.0
2025 Safenlp 2024	339	UNSAT	6.28	7.92	6.37	11.0	1.07	16.6	17.6
2025 Safenlp 2024	340	UNSAT	7.40	8.12	11.2	14.5	2.33	-	18.0
2025 Safenlp 2024	341	UNSAT	7.41	8.06	7.57	12.9	2.10	-	17.8
2025 Safenlp 2024	342	UNSAT	7.08	8.04	10.5	13.6	2.98	-	-
2025 Safenlp 2024	343	SAT	6.78	9.01	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	344	UNSAT	6.30	7.92	6.37	11.0	1.08	16.3	17.8
2025 Safenlp 2024	345	UNSAT	7.47	8.21	18.0	15.8	3.71	-	17.7
2025 Safenlp 2024	346	SAT	6.78	8.10	6.12	12.0	1.64	-	✗
2025 Safenlp 2024	347	SAT	6.83	6.30	6.08	12.2	1.26	-	18.4
2025 Safenlp 2024	348	UNSAT	6.29	7.92	6.39	12.0	1.09	16.5	17.7
2025 Safenlp 2024	349	SAT	6.81	6.22	6.09	12.2	1.25	14.8	18.2
2025 Safenlp 2024	350	SAT	6.65	7.98	6.11	11.3	1.22	-	✗
2025 Safenlp 2024	351	SAT	6.65	8.03	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	352	UNSAT	7.37	8.02	9.80	13.8	1.76	-	17.8
2025 Safenlp 2024	353	UNSAT	12.6	-	-	-	-	-	18.2
2025 Safenlp 2024	354	UNSAT	6.30	8.05	6.38	12.0	1.13	16.3	17.6
2025 Safenlp 2024	355	UNSAT	7.55	8.41	-	-	-	-	18.0
2025 Safenlp 2024	356	UNSAT	7.40	8.16	12.3	21.5	3.87	-	18.1
2025 Safenlp 2024	357	SAT	6.61	7.99	6.06	12.2	1.24	-	✗
2025 Safenlp 2024	358	SAT	6.71	8.95	6.08	11.2	1.24	-	✗
2025 Safenlp 2024	359	UNSAT	6.47	7.91	6.36	12.0	1.08	16.5	17.6
2025 Safenlp 2024	360	SAT	6.81	8.04	6.10	12.3	1.24	-	✗
2025 Safenlp 2024	361	SAT	6.55	8.52	6.09	26.6	-	-	✗
2025 Safenlp 2024	362	SAT	6.83	8.98	6.07	12.2	1.25	-	✗
2025 Safenlp 2024	363	UNSAT	6.30	7.97	6.40	11.9	1.08	16.6	17.6
2025 Safenlp 2024	364	SAT	6.76	8.96	6.08	12.2	1.24	-	✗
2025 Safenlp 2024	365	SAT	6.47	5.98	6.05	12.3	1.25	15.1	18.0
2025 Safenlp 2024	366	UNSAT	7.21	7.99	7.39	12.8	1.98	-	17.8
2025 Safenlp 2024	367	UNSAT	7.28	8.05	6.60	12.7	1.26	-	17.8
2025 Safenlp 2024	368	SAT	6.84	8.14	6.12	13.0	1.45	-	✗
2025 Safenlp 2024	369	SAT	6.84	8.94	6.12	11.2	1.25	-	✗
2025 Safenlp 2024	370	SAT	6.83	8.04	6.09	13.0	2.40	-	✗
2025 Safenlp 2024	371	UNSAT	7.23	7.97	7.00	13.2	1.53	-	17.8
2025 Safenlp 2024	372	UNSAT	6.32	8.00	6.44	12.5	1.07	16.8	17.8
2025 Safenlp 2024	373	UNSAT	6.29	7.97	6.40	11.9	1.07	16.4	17.7
2025 Safenlp 2024	374	SAT	6.56	6.50	6.13	11.3	1.22	-	17.9
2025 Safenlp 2024	375	UNSAT	13.0	73.0	-	-	-	-	17.8
2025 Safenlp 2024	376	UNSAT	7.02	7.96	6.58	12.7	1.27	-	18.1
2025 Safenlp 2024	377	SAT	6.57	7.16	6.12	12.3	1.24	14.9	17.8
2025 Safenlp 2024	378	SAT	6.58	7.93	6.11	12.3	1.24	-	✗
2025 Safenlp 2024	379	SAT	6.77	5.98	6.05	12.2	1.26	15.1	18.1
2025 Safenlp 2024	380	UNSAT	6.32	7.94	6.38	11.0	1.06	16.5	18.0
2025 Safenlp 2024	381	SAT	6.82	8.18	6.14	12.2	1.25	-	✗
2025 Safenlp 2024	382	SAT	6.82	8.96	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	383	SAT	6.77	5.99	6.03	12.2	1.24	14.8	18.0
2025 Safenlp 2024	384	UNSAT	6.34	7.90	6.40	11.9	1.13	16.4	17.8
2025 Safenlp 2024	385	SAT	6.62	9.33	6.11	12.2	1.29	-	✗
2025 Safenlp 2024	386	SAT	6.82	6.05	6.11	11.2	1.25	-	✗
2025 Safenlp 2024	387	UNSAT	6.31	7.96	6.39	11.9	1.08	16.6	17.8
2025 Safenlp 2024	388	SAT	6.71	6.06	6.08	12.2	1.26	14.8	18.1
2025 Safenlp 2024	389	SAT	6.83	5.98	6.07	12.2	1.25	14.9	17.7
2025 Safenlp 2024	390	UNSAT	6.43	7.92	6.37	10.9	1.08	16.5	17.7
2025 Safenlp 2024	391	UNSAT	6.29	7.94	6.39	11.9	1.09	16.4	17.9
2025 Safenlp 2024	392	SAT	6.85	7.97	6.06	12.2	1.23	-	✗
2025 Safenlp 2024	393	SAT	6.52	8.96	6.11	12.3	1.24	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	394	SAT	6.83	9.01	6.10	11.2	1.26	-	✗
2025 Safenlp 2024	395	UNSAT	6.29	7.92	6.38	11.9	1.09	16.5	17.8
2025 Safenlp 2024	396	SAT	6.84	7.96	6.09	12.3	1.25	-	✗
2025 Safenlp 2024	397	SAT	6.68	6.02	6.01	12.2	1.27	14.8	18.3
2025 Safenlp 2024	398	SAT	6.82	6.05	6.11	12.2	1.25	-	18.0
2025 Safenlp 2024	399	UNSAT	6.29	7.92	6.39	12.0	1.12	17.0	17.9
2025 Safenlp 2024	400	SAT	6.82	9.11	6.12	12.2	1.92	-	✗
2025 Safenlp 2024	401	SAT	6.49	8.02	6.11	11.2	1.22	-	✗
2025 Safenlp 2024	402	SAT	6.80	6.71	6.10	12.3	1.23	-	✗
2025 Safenlp 2024	403	UNSAT	7.44	8.29	-	16.2	-	-	18.0
2025 Safenlp 2024	404	UNSAT	9.59	56.3	-	-	-	-	18.2
2025 Safenlp 2024	405	SAT	6.55	9.00	6.09	12.3	1.26	-	✗
2025 Safenlp 2024	406	SAT	6.80	5.95	6.04	12.2	1.23	15.0	18.1
2025 Safenlp 2024	407	UNSAT	7.12	7.99	10.9	15.0	2.61	-	17.9
2025 Safenlp 2024	408	UNSAT	7.69	8.25	25.2	23.8	8.82	-	17.7
2025 Safenlp 2024	409	SAT	6.70	9.01	6.12	12.7	1.57	-	✗
2025 Safenlp 2024	410	UNSAT	6.26	7.94	6.38	11.0	1.07	16.3	17.8
2025 Safenlp 2024	411	UNSAT	6.29	7.96	6.39	11.0	1.09	16.7	-
2025 Safenlp 2024	412	UNSAT	7.49	8.28	17.2	16.0	5.22	-	18.1
2025 Safenlp 2024	413	SAT	6.83	9.02	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	414	UNSAT	6.32	8.00	6.36	11.0	1.08	16.7	17.7
2025 Safenlp 2024	415	UNSAT	6.40	7.95	6.39	11.4	1.07	16.5	17.7
2025 Safenlp 2024	416	SAT	6.80	5.96	6.05	12.2	1.25	14.8	17.8
2025 Safenlp 2024	417	UNSAT	6.31	7.95	6.39	10.9	1.08	16.5	17.9
2025 Safenlp 2024	418	UNSAT	6.43	7.91	6.37	12.1	1.07	16.4	17.8
2025 Safenlp 2024	419	SAT	6.72	6.00	6.06	12.3	1.25	14.7	17.9
2025 Safenlp 2024	420	UNSAT	6.29	7.97	6.37	12.0	1.07	16.4	17.7
2025 Safenlp 2024	421	SAT	6.81	6.04	6.10	12.2	1.24	-	18.3
2025 Safenlp 2024	422	UNSAT	6.29	7.92	6.33	11.0	1.07	16.6	17.8
2025 Safenlp 2024	423	SAT	6.60	5.98	6.06	12.2	1.09	15.1	17.8
2025 Safenlp 2024	424	SAT	6.81	7.93	6.11	12.2	1.25	14.8	18.0
2025 Safenlp 2024	425	UNSAT	7.13	7.98	8.32	12.2	2.25	-	17.7
2025 Safenlp 2024	426	SAT	6.75	8.05	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	427	UNSAT	6.24	7.91	6.39	11.0	1.08	16.6	17.8
2025 Safenlp 2024	428	SAT	6.87	7.99	6.12	12.2	1.23	-	✗
2025 Safenlp 2024	429	UNSAT	7.87	9.23	-	-	-	-	17.9
2025 Safenlp 2024	430	SAT	6.75	8.01	6.08	12.2	1.23	-	✗
2025 Safenlp 2024	431	UNSAT	6.27	7.94	6.49	12.5	1.07	16.6	-
2025 Safenlp 2024	432	SAT	6.86	6.13	6.10	12.2	1.26	-	18.0
2025 Safenlp 2024	433	SAT	6.81	8.83	6.13	12.2	1.25	-	✗
2025 Safenlp 2024	434	SAT	6.55	7.99	6.11	12.3	1.25	-	✗
2025 Safenlp 2024	435	UNSAT	7.30	8.08	17.3	13.8	8.56	-	18.2
2025 Safenlp 2024	436	SAT	6.81	6.61	6.13	11.2	1.24	-	18.0
2025 Safenlp 2024	437	UNSAT	6.25	7.96	6.39	11.0	1.07	16.6	17.7
2025 Safenlp 2024	438	SAT	6.86	8.00	6.09	11.2	1.25	-	✗
2025 Safenlp 2024	439	SAT	6.56	8.01	6.07	14.7	-	-	✗
2025 Safenlp 2024	440	SAT	6.70	5.95	6.05	12.3	1.28	15.1	18.0
2025 Safenlp 2024	441	SAT	6.73	6.40	6.12	11.2	1.24	-	✗
2025 Safenlp 2024	442	UNSAT	6.35	7.94	6.37	12.0	1.07	16.7	18.0
2025 Safenlp 2024	443	SAT	6.83	7.96	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	444	UNSAT	6.31	7.91	6.40	12.0	1.08	16.5	-
2025 Safenlp 2024	445	UNSAT	7.07	7.93	7.23	13.5	1.46	-	18.0
2025 Safenlp 2024	446	SAT	6.56	8.96	6.11	12.2	1.29	-	✗
2025 Safenlp 2024	447	SAT	6.86	8.99	6.12	12.3	1.43	-	✗
2025 Safenlp 2024	448	SAT	6.85	5.98	6.13	12.2	1.23	14.9	18.0
2025 Safenlp 2024	449	SAT	6.76	8.94	6.10	12.3	1.28	-	✗
2025 Safenlp 2024	450	UNSAT	12.0	42.3	-	-	-	-	18.0
2025 Safenlp 2024	451	SAT	6.63	5.97	6.05	12.2	1.25	14.9	18.0
2025 Safenlp 2024	452	UNSAT	7.64	8.86	-	-	14.0	-	18.1
2025 Safenlp 2024	453	SAT	6.73	8.01	6.08	12.3	1.25	-	✗
2025 Safenlp 2024	454	UNSAT	15.7	25.7	-	-	-	-	18.0
2025 Safenlp 2024	455	SAT	6.84	8.00	6.10	12.2	1.29	-	✗
2025 Safenlp 2024	456	UNSAT	7.47	8.12	11.5	13.8	2.22	-	17.9
2025 Safenlp 2024	457	SAT	6.80	8.02	6.13	12.2	1.26	-	✗
2025 Safenlp 2024	458	SAT	6.82	5.95	6.02	11.3	1.23	15.1	18.2
2025 Safenlp 2024	459	UNSAT	7.17	8.53	-	26.2	-	-	17.7
2025 Safenlp 2024	460	SAT	6.77	5.95	6.09	12.2	1.25	15.3	17.9
2025 Safenlp 2024	461	SAT	6.93	8.04	6.11	11.2	1.26	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	462	SAT	6.80	5.95	6.05	12.2	1.23	15.0	18.0
2025 Safenlp 2024	463	SAT	6.84	8.89	6.10	12.2	1.22	-	✗
2025 Safenlp 2024	464	SAT	6.81	7.97	6.09	12.7	1.27	-	✗
2025 Safenlp 2024	465	SAT	6.70	6.69	6.10	12.2	1.22	14.8	18.0
2025 Safenlp 2024	466	SAT	6.83	8.02	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	467	SAT	6.79	8.10	6.09	12.7	1.42	-	✗
2025 Safenlp 2024	468	SAT	6.59	8.90	6.11	12.2	1.28	-	✗
2025 Safenlp 2024	469	SAT	6.72	5.98	6.06	12.2	1.23	15.1	-
2025 Safenlp 2024	470	UNSAT	7.31	8.00	9.09	13.8	2.24	-	17.9
2025 Safenlp 2024	471	SAT	6.79	6.45	6.09	11.2	1.28	-	18.5
2025 Safenlp 2024	472	SAT	6.87	7.98	6.08	12.2	1.24	-	✗
2025 Safenlp 2024	473	SAT	6.75	6.29	6.13	12.3	1.24	14.7	18.0
2025 Safenlp 2024	474	SAT	6.65	7.97	6.10	12.2	1.24	-	✗
2025 Safenlp 2024	475	UNSAT	7.37	8.20	13.0	14.3	2.42	-	18.0
2025 Safenlp 2024	476	SAT	6.78	8.97	6.10	11.2	1.29	-	18.2
2025 Safenlp 2024	477	UNSAT	6.32	7.88	6.38	11.9	1.07	16.6	17.7
2025 Safenlp 2024	478	SAT	6.85	7.17	6.09	11.2	1.25	-	✗
2025 Safenlp 2024	479	UNSAT	6.28	7.94	6.39	12.0	1.07	16.6	17.8
2025 Safenlp 2024	480	SAT	6.51	5.97	6.06	12.2	1.24	15.0	18.0
2025 Safenlp 2024	481	SAT	6.83	8.78	6.08	13.3	1.76	-	✗
2025 Safenlp 2024	482	SAT	6.60	7.99	6.11	12.2	1.26	-	✗
2025 Safenlp 2024	483	SAT	6.50	7.94	6.11	12.2	1.25	-	✗
2025 Safenlp 2024	484	SAT	6.49	5.96	6.04	12.2	1.09	15.0	17.9
2025 Safenlp 2024	485	UNSAT	7.24	8.10	9.13	13.3	2.10	-	17.9
2025 Safenlp 2024	486	SAT	6.84	7.94	6.07	12.2	1.27	-	✗
2025 Safenlp 2024	487	SAT	6.64	7.99	6.09	11.2	1.24	-	✗
2025 Safenlp 2024	488	SAT	6.71	5.95	6.07	12.2	1.24	14.9	18.1
2025 Safenlp 2024	489	SAT	6.88	7.20	6.11	12.2	1.25	-	✗
2025 Safenlp 2024	490	SAT	6.59	8.93	6.07	12.2	1.24	-	18.0
2025 Safenlp 2024	491	SAT	6.88	8.00	6.10	12.2	1.22	-	✗
2025 Safenlp 2024	492	SAT	6.83	9.27	6.09	12.7	1.27	-	✗
2025 Safenlp 2024	493	UNSAT	7.25	8.10	10.9	14.3	3.99	-	17.9
2025 Safenlp 2024	494	SAT	6.60	9.01	6.12	13.0	1.62	-	✗
2025 Safenlp 2024	495	SAT	6.83	9.00	6.07	11.2	1.24	-	✗
2025 Safenlp 2024	496	SAT	6.79	8.93	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	497	UNSAT	7.34	7.97	6.86	11.5	1.42	-	17.9
2025 Safenlp 2024	498	SAT	6.86	8.01	6.09	11.7	1.45	-	✗
2025 Safenlp 2024	499	UNSAT	6.27	7.93	6.41	12.0	1.07	16.3	17.8
2025 Safenlp 2024	500	SAT	6.80	9.01	6.09	11.2	1.27	-	✗
2025 Safenlp 2024	501	SAT	6.51	7.95	6.13	11.2	1.24	-	✗
2025 Safenlp 2024	502	SAT	6.79	6.00	6.06	12.2	1.30	15.2	18.5
2025 Safenlp 2024	503	UNSAT	7.66	8.31	21.0	-	-	-	18.0
2025 Safenlp 2024	504	SAT	6.52	5.93	6.03	11.2	1.29	14.9	17.9
2025 Safenlp 2024	505	UNSAT	6.30	7.87	6.47	12.4	1.07	16.8	17.9
2025 Safenlp 2024	506	UNSAT	6.33	7.84	6.34	11.0	1.07	16.4	18.0
2025 Safenlp 2024	507	UNSAT	7.37	8.18	17.9	21.3	4.55	-	17.8
2025 Safenlp 2024	508	SAT	6.72	7.94	6.09	12.3	1.24	14.9	18.4
2025 Safenlp 2024	509	SAT	6.84	8.96	6.07	11.2	1.24	-	✗
2025 Safenlp 2024	510	UNSAT	6.26	7.99	6.38	11.9	1.06	16.4	17.9
2025 Safenlp 2024	511	UNSAT	6.28	7.91	6.35	11.9	1.07	16.6	17.8
2025 Safenlp 2024	512	UNSAT	7.73	8.34	18.7	18.1	3.90	-	18.2
2025 Safenlp 2024	513	SAT	6.83	8.04	6.11	12.2	1.23	-	✗
2025 Safenlp 2024	514	SAT	6.83	8.01	6.11	11.7	1.23	-	✗
2025 Safenlp 2024	515	UNSAT	7.53	8.31	22.4	19.1	-	-	18.0
2025 Safenlp 2024	516	SAT	6.76	6.35	6.04	12.1	1.24	-	18.2
2025 Safenlp 2024	517	SAT	6.58	9.13	6.08	12.2	1.24	-	✗
2025 Safenlp 2024	518	SAT	6.81	6.02	6.07	11.2	1.25	-	17.7
2025 Safenlp 2024	519	SAT	6.71	9.00	6.06	11.2	1.23	-	✗
2025 Safenlp 2024	520	UNSAT	6.29	7.92	6.37	12.0	1.07	16.3	17.7
2025 Safenlp 2024	521	SAT	6.71	6.03	6.04	12.2	1.25	14.9	18.1
2025 Safenlp 2024	522	UNSAT	7.65	8.44	24.7	22.1	17.5	-	18.1
2025 Safenlp 2024	523	UNSAT	8.04	9.33	-	-	-	-	17.9
2025 Safenlp 2024	524	UNSAT	6.33	7.91	6.33	12.0	1.07	16.7	17.7
2025 Safenlp 2024	525	SAT	6.80	8.01	6.09	12.2	1.24	15.2	-
2025 Safenlp 2024	526	SAT	6.54	6.01	6.01	12.2	1.24	14.9	18.1
2025 Safenlp 2024	527	SAT	6.73	8.01	6.11	12.2	1.25	-	✗
2025 Safenlp 2024	528	SAT	6.59	6.05	6.11	12.2	1.27	-	17.9
2025 Safenlp 2024	529	SAT	6.73	8.98	6.10	12.2	1.24	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	530	UNSAT	7.16	8.32	11.6	13.3	2.30	-	17.9
2025 Safenlp 2024	531	SAT	6.76	5.95	6.02	12.1	1.25	15.0	18.1
2025 Safenlp 2024	532	SAT	6.56	6.00	6.08	12.2	1.26	14.8	18.1
2025 Safenlp 2024	533	UNSAT	8.37	9.48	-	-	-	-	18.1
2025 Safenlp 2024	534	UNSAT	8.81	18.5	-	-	-	-	18.0
2025 Safenlp 2024	535	UNSAT	7.00	7.99	7.83	14.0	2.07	-	18.0
2025 Safenlp 2024	536	SAT	6.51	7.98	6.11	12.7	1.57	-	✗
2025 Safenlp 2024	537	UNSAT	7.88	11.1	-	-	-	-	18.3
2025 Safenlp 2024	538	SAT	6.58	6.03	6.09	12.2	1.25	15.0	18.5
2025 Safenlp 2024	539	UNSAT	11.9	26.1	-	-	-	-	18.1
2025 Safenlp 2024	540	SAT	6.77	5.98	6.05	12.2	1.27	14.9	18.2
2025 Safenlp 2024	541	SAT	6.77	5.93	6.05	11.2	1.24	14.7	18.2
2025 Safenlp 2024	542	UNSAT	6.28	7.93	6.37	11.9	1.09	16.7	17.9
2025 Safenlp 2024	543	UNSAT	7.43	8.31	-	16.0	15.2	-	17.7
2025 Safenlp 2024	544	SAT	6.66	8.03	6.12	12.3	1.28	-	✗
2025 Safenlp 2024	545	UNSAT	7.18	8.10	15.2	14.8	3.85	-	18.0
2025 Safenlp 2024	546	SAT	6.86	8.94	6.08	12.2	1.25	-	✗
2025 Safenlp 2024	547	SAT	6.77	5.98	6.04	12.3	1.07	14.8	18.0
2025 Safenlp 2024	548	SAT	6.78	8.97	6.11	12.3	1.23	-	✗
2025 Safenlp 2024	549	SAT	6.82	6.46	6.06	11.2	1.23	15.4	18.2
2025 Safenlp 2024	550	SAT	6.74	8.00	6.07	11.8	1.26	-	✗
2025 Safenlp 2024	551	SAT	6.76	8.00	6.09	12.1	1.24	-	✗
2025 Safenlp 2024	552	SAT	6.74	5.93	6.01	12.2	1.22	14.9	18.4
2025 Safenlp 2024	553	SAT	6.81	7.97	6.09	12.2	1.24	-	✗
2025 Safenlp 2024	554	SAT	6.63	6.48	6.10	11.3	1.24	-	18.2
2025 Safenlp 2024	555	SAT	6.84	8.16	6.07	12.3	1.25	-	✗
2025 Safenlp 2024	556	UNSAT	8.26	9.00	-	-	-	-	18.1
2025 Safenlp 2024	557	UNSAT	7.25	8.04	8.59	13.1	1.95	-	18.0
2025 Safenlp 2024	558	UNSAT	6.29	7.94	6.34	11.0	1.08	16.5	17.8
2025 Safenlp 2024	559	SAT	6.81	9.14	6.11	12.2	1.48	-	✗
2025 Safenlp 2024	560	SAT	6.67	8.01	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	561	SAT	6.77	5.97	6.07	12.3	1.24	15.1	18.0
2025 Safenlp 2024	562	UNSAT	6.28	7.94	6.48	12.5	1.08	16.7	17.8
2025 Safenlp 2024	563	UNSAT	6.29	7.99	6.34	11.9	1.07	16.5	17.9
2025 Safenlp 2024	564	SAT	6.55	8.04	6.10	11.7	1.48	-	✗
2025 Safenlp 2024	565	UNSAT	8.02	8.69	-	-	-	-	18.2
2025 Safenlp 2024	566	UNSAT	6.26	7.93	6.38	12.0	1.07	16.3	17.7
2025 Safenlp 2024	567	UNSAT	7.36	8.33	22.7	-	16.7	-	18.3
2025 Safenlp 2024	568	UNSAT	6.29	7.99	6.38	12.0	1.07	16.7	17.8
2025 Safenlp 2024	569	UNSAT	6.31	7.93	6.33	12.0	1.07	16.6	17.8
2025 Safenlp 2024	570	SAT	6.58	7.98	6.09	11.5	1.26	-	✗
2025 Safenlp 2024	571	SAT	6.80	8.96	6.11	12.2	1.24	-	✗
2025 Safenlp 2024	572	SAT	6.82	7.99	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	573	SAT	6.85	7.08	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	574	UNSAT	8.14	8.71	-	-	-	-	18.3
2025 Safenlp 2024	575	SAT	6.62	5.96	6.07	12.3	1.25	15.0	18.2
2025 Safenlp 2024	576	SAT	6.66	8.03	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	577	SAT	6.62	8.91	6.10	11.2	1.26	-	✗
2025 Safenlp 2024	578	UNSAT	8.43	9.20	-	-	-	-	17.9
2025 Safenlp 2024	579	SAT	6.86	9.03	6.08	13.0	1.43	-	✗
2025 Safenlp 2024	580	SAT	6.79	6.01	6.08	12.2	1.25	-	-
2025 Safenlp 2024	581	UNSAT	6.29	7.97	6.37	12.0	1.10	16.9	17.8
2025 Safenlp 2024	582	UNSAT	7.14	8.01	10.1	13.3	2.37	-	17.7
2025 Safenlp 2024	583	UNSAT	7.23	8.29	16.7	16.5	3.52	-	17.9
2025 Safenlp 2024	584	UNSAT	7.54	8.60	-	17.3	-	-	17.7
2025 Safenlp 2024	585	SAT	6.72	7.97	6.07	12.3	1.23	-	✗
2025 Safenlp 2024	586	UNSAT	7.17	8.04	7.66	13.8	2.05	-	17.8
2025 Safenlp 2024	587	SAT	6.79	8.03	6.10	12.3	1.24	-	✗
2025 Safenlp 2024	588	UNSAT	9.05	29.0	-	-	-	-	18.2
2025 Safenlp 2024	589	UNSAT	7.65	8.31	-	-	-	-	17.9
2025 Safenlp 2024	590	SAT	6.83	7.99	6.06	13.0	1.25	-	✗
2025 Safenlp 2024	591	UNSAT	8.42	8.82	-	-	-	-	18.3
2025 Safenlp 2024	592	SAT	6.47	5.98	6.08	12.2	1.07	14.7	17.8
2025 Safenlp 2024	593	UNSAT	6.27	8.00	6.38	12.0	1.08	16.3	17.6
2025 Safenlp 2024	594	SAT	6.78	8.98	6.12	11.7	1.43	-	✗
2025 Safenlp 2024	595	SAT	6.70	8.94	6.11	12.2	1.25	-	✗
2025 Safenlp 2024	596	SAT	6.79	7.91	6.11	12.2	1.23	-	✗
2025 Safenlp 2024	597	SAT	6.55	7.99	6.06	11.2	1.23	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	598	UNSAT	7.55	8.68	25.3	-	19.5	-	18.2
2025 Safenlp 2024	599	UNSAT	7.23	8.07	13.0	16.0	3.40	-	18.1
2025 Safenlp 2024	600	SAT	6.54	8.99	6.06	12.2	1.24	-	✗
2025 Safenlp 2024	601	UNSAT	7.18	7.91	7.11	13.0	1.64	-	17.9
2025 Safenlp 2024	602	SAT	6.80	8.88	6.11	12.3	1.24	-	✗
2025 Safenlp 2024	603	UNSAT	7.25	8.02	12.1	13.8	3.08	-	-
2025 Safenlp 2024	604	UNSAT	12.4	-	-	-	-	-	17.9
2025 Safenlp 2024	605	UNSAT	7.39	9.64	-	-	18.0	-	17.8
2025 Safenlp 2024	606	UNSAT	6.28	7.98	6.39	12.0	1.08	16.5	17.9
2025 Safenlp 2024	607	UNSAT	7.01	7.95	6.93	13.0	1.55	-	17.6
2025 Safenlp 2024	608	SAT	6.76	5.99	6.05	12.2	1.28	15.0	19.3
2025 Safenlp 2024	609	SAT	6.72	8.99	6.10	13.0	1.44	-	✗
2025 Safenlp 2024	610	SAT	6.78	9.40	6.12	15.5	2.32	-	✗
2025 Safenlp 2024	611	SAT	6.64	9.01	6.10	13.0	2.15	-	✗
2025 Safenlp 2024	612	UNSAT	7.24	8.14	18.5	18.5	4.58	-	17.8
2025 Safenlp 2024	613	SAT	6.81	7.97	6.08	12.1	1.27	14.9	18.2
2025 Safenlp 2024	614	SAT	6.70	5.97	6.09	11.2	1.25	15.3	18.2
2025 Safenlp 2024	615	SAT	6.81	8.01	6.11	12.2	1.27	-	✗
2025 Safenlp 2024	616	SAT	6.85	8.98	6.10	12.9	1.76	-	✗
2025 Safenlp 2024	617	SAT	6.77	6.25	6.11	12.2	1.23	-	-
2025 Safenlp 2024	618	SAT	6.55	6.01	6.05	11.2	1.25	15.3	18.1
2025 Safenlp 2024	619	SAT	6.81	8.98	6.13	12.3	1.24	-	✗
2025 Safenlp 2024	620	SAT	6.83	7.95	6.08	12.1	1.24	-	✗
2025 Safenlp 2024	621	SAT	6.84	8.86	6.10	11.3	1.25	-	✗
2025 Safenlp 2024	622	UNSAT	7.27	8.00	7.13	12.7	1.81	-	17.7
2025 Safenlp 2024	623	SAT	6.83	8.93	6.09	12.2	1.28	-	✗
2025 Safenlp 2024	624	UNSAT	7.14	7.99	6.69	11.7	1.27	-	17.8
2025 Safenlp 2024	625	SAT	6.79	8.14	6.12	11.7	1.25	-	✗
2025 Safenlp 2024	626	SAT	6.59	9.01	6.08	12.2	1.24	-	✗
2025 Safenlp 2024	627	SAT	6.56	5.96	6.07	11.2	1.25	15.5	18.1
2025 Safenlp 2024	628	SAT	6.68	8.97	6.10	12.2	1.23	-	-
2025 Safenlp 2024	629	SAT	6.69	5.92	6.04	12.2	1.26	15.1	17.9
2025 Safenlp 2024	630	SAT	6.80	9.25	6.11	13.0	1.30	-	✗
2025 Safenlp 2024	631	SAT	6.87	8.03	6.09	12.2	1.22	-	✗
2025 Safenlp 2024	632	UNSAT	8.77	9.48	-	-	-	-	18.2
2025 Safenlp 2024	633	SAT	6.56	9.00	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	634	SAT	6.77	7.97	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	635	UNSAT	6.29	7.91	6.39	11.9	1.09	16.3	-
2025 Safenlp 2024	636	SAT	6.85	8.06	6.10	11.7	1.24	-	✗
2025 Safenlp 2024	637	SAT	6.81	8.91	6.10	11.1	1.24	-	✗
2025 Safenlp 2024	638	SAT	6.69	8.02	6.08	12.7	1.24	-	✗
2025 Safenlp 2024	639	UNSAT	6.30	7.87	6.43	11.9	1.07	16.2	17.6
2025 Safenlp 2024	640	UNSAT	7.32	8.04	9.66	14.7	2.43	-	17.6
2025 Safenlp 2024	641	UNSAT	8.90	10.9	-	-	-	-	17.7
2025 Safenlp 2024	642	SAT	6.81	5.95	6.04	12.2	1.23	14.9	17.9
2025 Safenlp 2024	643	UNSAT	6.29	7.86	6.45	12.5	1.07	16.5	17.8
2025 Safenlp 2024	644	SAT	6.76	9.00	6.11	11.3	1.23	-	✗
2025 Safenlp 2024	645	UNSAT	7.22	8.07	12.2	14.5	2.76	-	17.9
2025 Safenlp 2024	646	SAT	6.83	8.02	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	647	SAT	6.84	8.02	6.12	12.2	1.23	-	✗
2025 Safenlp 2024	648	SAT	6.85	9.75	6.11	✗	1.24	-	✗
2025 Safenlp 2024	649	SAT	6.80	8.93	6.10	12.3	1.22	-	✗
2025 Safenlp 2024	650	SAT	6.79	8.96	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	651	SAT	6.79	8.99	6.09	12.2	1.28	-	✗
2025 Safenlp 2024	652	SAT	6.83	6.41	6.10	12.2	1.28	-	✗
2025 Safenlp 2024	653	UNSAT	6.31	7.93	6.38	11.9	1.06	16.5	17.8
2025 Safenlp 2024	654	SAT	6.84	6.15	6.04	12.2	1.28	-	18.3
2025 Safenlp 2024	655	SAT	6.83	7.94	6.10	11.2	1.27	-	✗
2025 Safenlp 2024	656	SAT	6.54	7.97	6.08	12.3	1.27	-	17.8
2025 Safenlp 2024	657	SAT	6.64	8.00	6.05	11.2	1.27	-	✗
2025 Safenlp 2024	658	SAT	6.78	5.97	6.09	11.2	1.25	14.8	18.1
2025 Safenlp 2024	659	UNSAT	6.29	7.99	6.39	12.0	1.07	16.6	-
2025 Safenlp 2024	660	SAT	6.76	8.99	6.10	12.2	1.27	-	✗
2025 Safenlp 2024	661	SAT	6.77	8.96	6.11	11.2	1.23	-	✗
2025 Safenlp 2024	662	UNSAT	7.13	8.00	8.92	12.0	2.06	-	17.9
2025 Safenlp 2024	663	UNSAT	6.29	7.93	6.37	12.0	1.08	16.6	17.9
2025 Safenlp 2024	664	UNSAT	7.35	8.05	8.94	12.6	2.10	-	18.1
2025 Safenlp 2024	665	SAT	6.80	7.97	6.09	12.2	1.29	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	666	SAT	6.65	5.96	6.07	12.2	1.10	15.1	17.9
2025 Safenlp 2024	667	UNSAT	6.26	7.92	6.40	12.0	1.12	16.7	17.7
2025 Safenlp 2024	668	UNSAT	7.22	8.08	8.67	12.5	2.10	-	17.9
2025 Safenlp 2024	669	UNSAT	6.29	7.95	6.35	11.9	1.08	16.5	17.8
2025 Safenlp 2024	670	UNSAT	7.10	8.28	18.0	14.2	10.1	-	18.0
2025 Safenlp 2024	671	UNSAT	7.10	8.08	12.3	12.3	2.46	-	17.8
2025 Safenlp 2024	672	SAT	6.71	7.96	6.11	12.2	1.24	-	✗
2025 Safenlp 2024	673	SAT	6.65	6.30	6.14	12.3	1.24	-	18.2
2025 Safenlp 2024	674	UNSAT	7.14	8.18	16.0	13.8	3.73	-	17.6
2025 Safenlp 2024	675	UNSAT	8.98	32.1	-	-	-	-	18.0
2025 Safenlp 2024	676	UNSAT	7.20	8.00	6.64	11.7	1.70	-	18.0
2025 Safenlp 2024	677	SAT	6.78	6.18	6.06	11.2	1.24	-	✗
2025 Safenlp 2024	678	SAT	6.80	8.05	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	679	SAT	6.79	6.32	6.10	12.2	1.24	-	17.9
2025 Safenlp 2024	680	SAT	6.37	5.97	6.00	12.2	1.07	15.2	17.8
2025 Safenlp 2024	681	SAT	6.83	6.57	6.06	12.2	1.26	-	18.0
2025 Safenlp 2024	682	SAT	6.86	8.03	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	683	SAT	6.61	8.01	6.08	12.2	1.25	-	✗
2025 Safenlp 2024	684	SAT	6.84	5.96	6.07	12.2	1.23	14.9	18.0
2025 Safenlp 2024	685	SAT	6.79	8.01	6.09	12.3	1.24	-	✗
2025 Safenlp 2024	686	SAT	6.84	8.58	6.09	29.3	-	-	✗
2025 Safenlp 2024	687	UNSAT	6.31	7.99	6.34	12.0	1.13	16.5	17.9
2025 Safenlp 2024	688	SAT	6.72	6.02	6.07	12.2	1.26	15.0	18.1
2025 Safenlp 2024	689	SAT	6.59	8.98	6.12	11.2	1.23	-	✗
2025 Safenlp 2024	690	UNSAT	8.00	51.4	-	-	-	-	17.8
2025 Safenlp 2024	691	UNSAT	7.44	8.13	13.6	20.0	7.89	-	17.8
2025 Safenlp 2024	692	SAT	6.84	8.98	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	693	SAT	6.77	9.01	6.11	12.2	1.24	-	✗
2025 Safenlp 2024	694	UNSAT	7.18	8.06	8.17	14.8	2.43	-	17.7
2025 Safenlp 2024	695	SAT	6.77	8.01	6.09	12.2	1.24	-	✗
2025 Safenlp 2024	696	SAT	6.80	5.93	6.07	11.2	1.28	15.2	18.0
2025 Safenlp 2024	697	SAT	6.77	5.95	6.08	12.2	1.24	14.8	17.8
2025 Safenlp 2024	698	SAT	6.50	8.27	6.08	12.7	1.44	-	✗
2025 Safenlp 2024	699	SAT	6.73	8.04	6.11	12.3	1.23	-	-
2025 Safenlp 2024	700	SAT	6.77	8.55	6.10	14.3	1.98	-	✗
2025 Safenlp 2024	701	UNSAT	7.25	8.06	9.06	13.2	2.33	-	17.8
2025 Safenlp 2024	702	UNSAT	7.22	7.96	6.82	11.8	1.52	-	17.7
2025 Safenlp 2024	703	SAT	6.81	5.95	6.08	11.3	1.12	14.8	17.8
2025 Safenlp 2024	704	SAT	6.84	9.02	6.12	-	-	-	✗
2025 Safenlp 2024	705	UNSAT	7.30	8.13	19.9	15.0	3.44	-	17.7
2025 Safenlp 2024	706	SAT	6.85	9.05	6.10	12.2	1.28	-	✗
2025 Safenlp 2024	707	SAT	6.58	8.08	6.12	12.2	1.30	-	✗
2025 Safenlp 2024	708	SAT	6.59	7.98	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	709	UNSAT	8.36	8.92	-	-	-	-	17.9
2025 Safenlp 2024	710	SAT	6.77	7.97	6.13	12.2	1.24	-	✗
2025 Safenlp 2024	711	UNSAT	7.10	8.29	20.1	14.2	5.75	-	17.9
2025 Safenlp 2024	712	UNSAT	8.09	42.1	-	-	-	-	17.8
2025 Safenlp 2024	713	SAT	6.80	8.04	6.10	12.0	1.23	-	✗
2025 Safenlp 2024	714	SAT	6.75	8.02	6.09	12.2	1.30	-	✗
2025 Safenlp 2024	715	UNSAT	7.24	8.09	9.76	14.5	2.10	-	17.7
2025 Safenlp 2024	716	SAT	6.79	8.97	6.10	12.3	1.29	-	✗
2025 Safenlp 2024	717	SAT	6.82	8.10	6.07	12.2	1.28	-	✗
2025 Safenlp 2024	718	UNSAT	6.27	7.99	6.39	12.0	1.07	16.8	17.9
2025 Safenlp 2024	719	SAT	6.78	7.87	6.12	11.2	1.24	14.8	18.2
2025 Safenlp 2024	720	SAT	6.75	9.31	6.11	12.8	1.61	-	✗
2025 Safenlp 2024	721	SAT	6.63	8.90	6.09	12.2	1.26	-	✗
2025 Safenlp 2024	722	SAT	6.77	9.02	6.12	12.2	1.31	-	✗
2025 Safenlp 2024	723	UNSAT	9.17	25.7	-	-	-	-	18.1
2025 Safenlp 2024	724	SAT	6.66	8.94	6.12	11.2	1.25	-	✗
2025 Safenlp 2024	725	SAT	6.69	5.98	6.08	12.2	1.24	14.9	18.3
2025 Safenlp 2024	726	SAT	6.78	5.94	6.04	12.2	1.24	14.8	17.8
2025 Safenlp 2024	727	UNSAT	7.53	11.3	-	-	-	-	17.7
2025 Safenlp 2024	728	SAT	6.81	5.97	6.10	12.2	1.24	15.3	18.3
2025 Safenlp 2024	729	SAT	6.61	8.98	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	730	SAT	6.56	6.00	6.05	11.2	1.24	14.9	18.2
2025 Safenlp 2024	731	SAT	6.56	6.01	6.08	12.2	1.26	14.8	17.9
2025 Safenlp 2024	732	UNSAT	7.30	8.16	12.3	14.8	2.41	-	17.7
2025 Safenlp 2024	733	UNSAT	7.26	8.05	11.5	15.0	2.78	-	17.9

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	734	UNSAT	7.15	7.92	6.85	12.7	1.34	-	18.0
2025 Safenlp 2024	735	SAT	6.82	8.00	6.12	12.3	1.21	-	✗
2025 Safenlp 2024	736	SAT	6.83	8.05	6.16	12.2	1.27	-	✗
2025 Safenlp 2024	737	SAT	6.81	8.98	6.10	11.7	1.42	-	✗
2025 Safenlp 2024	738	UNSAT	6.32	7.94	6.38	12.0	1.07	16.6	18.0
2025 Safenlp 2024	739	SAT	6.64	8.02	6.09	12.3	1.23	-	✗
2025 Safenlp 2024	740	SAT	6.70	9.02	6.10	12.2	1.26	-	✗
2025 Safenlp 2024	741	SAT	6.83	8.98	6.13	12.2	1.23	-	✗
2025 Safenlp 2024	742	UNSAT	7.67	8.40	23.8	21.8	-	-	18.0
2025 Safenlp 2024	743	SAT	6.72	5.95	6.06	11.3	1.25	15.1	17.9
2025 Safenlp 2024	744	SAT	6.64	8.01	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	745	SAT	6.77	6.02	6.09	12.2	1.22	-	17.9
2025 Safenlp 2024	746	UNSAT	13.7	24.4	-	-	-	-	18.2
2025 Safenlp 2024	747	SAT	6.81	5.96	6.04	12.2	1.26	15.4	17.9
2025 Safenlp 2024	748	SAT	6.60	8.98	6.09	11.2	1.23	-	✗
2025 Safenlp 2024	749	SAT	6.50	6.07	6.14	11.2	1.22	15.0	17.8
2025 Safenlp 2024	750	SAT	6.54	5.98	6.07	12.2	1.25	14.9	18.3
2025 Safenlp 2024	751	SAT	6.79	6.04	6.05	11.3	1.23	15.0	17.9
2025 Safenlp 2024	752	SAT	6.88	7.98	6.10	11.2	1.23	-	-
2025 Safenlp 2024	753	UNSAT	7.04	8.02	10.4	13.1	2.18	-	17.8
2025 Safenlp 2024	754	SAT	6.71	8.96	6.11	12.2	1.24	-	✗
2025 Safenlp 2024	755	SAT	6.76	7.96	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	756	SAT	6.83	7.12	6.09	11.2	1.25	-	✗
2025 Safenlp 2024	757	UNSAT	6.29	7.97	6.39	11.9	1.13	16.5	17.7
2025 Safenlp 2024	758	UNSAT	6.31	7.94	6.35	12.0	1.07	16.5	-
2025 Safenlp 2024	759	SAT	6.80	6.50	6.09	11.2	1.23	-	✗
2025 Safenlp 2024	760	SAT	6.85	7.98	6.10	11.3	1.24	-	✗
2025 Safenlp 2024	761	UNSAT	6.31	7.94	6.38	12.5	1.08	16.4	17.7
2025 Safenlp 2024	762	UNSAT	7.45	8.27	-	18.5	18.2	-	17.8
2025 Safenlp 2024	763	UNSAT	7.02	7.96	6.63	12.4	1.33	-	17.9
2025 Safenlp 2024	764	UNSAT	7.34	8.18	-	14.8	5.04	-	17.9
2025 Safenlp 2024	765	UNSAT	7.12	8.00	10.3	13.5	3.55	-	17.9
2025 Safenlp 2024	766	UNSAT	6.28	7.96	6.44	11.4	1.09	16.7	17.9
2025 Safenlp 2024	767	UNSAT	7.03	7.99	6.54	12.5	1.30	-	17.8
2025 Safenlp 2024	768	SAT	6.83	6.79	6.09	12.2	1.24	-	✗
2025 Safenlp 2024	769	SAT	6.82	8.15	6.09	13.6	1.45	-	✗
2025 Safenlp 2024	770	SAT	6.74	7.99	6.10	12.2	1.25	14.8	18.4
2025 Safenlp 2024	771	SAT	6.62	5.98	6.12	12.2	1.24	-	17.9
2025 Safenlp 2024	772	UNSAT	7.35	8.02	7.95	12.7	2.01	-	17.6
2025 Safenlp 2024	773	SAT	6.66	7.96	6.08	12.2	1.23	-	✗
2025 Safenlp 2024	774	UNSAT	8.75	13.9	-	-	-	-	17.7
2025 Safenlp 2024	775	UNSAT	7.03	8.02	7.04	12.7	1.28	-	17.8
2025 Safenlp 2024	776	UNSAT	6.28	7.90	6.37	12.0	1.07	16.5	18.5
2025 Safenlp 2024	777	SAT	6.79	7.96	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	778	SAT	6.52	8.00	6.08	12.2	1.28	-	✗
2025 Safenlp 2024	779	SAT	6.54	8.11	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	780	SAT	6.87	6.54	6.08	12.2	1.27	-	✗
2025 Safenlp 2024	781	UNSAT	7.79	8.37	-	-	15.9	-	17.8
2025 Safenlp 2024	782	UNSAT	7.07	8.03	13.0	12.8	3.15	-	17.5
2025 Safenlp 2024	783	UNSAT	6.28	7.96	6.38	11.9	1.07	16.6	19.1
2025 Safenlp 2024	784	UNSAT	6.33	7.93	6.33	11.9	1.08	16.7	-
2025 Safenlp 2024	785	SAT	6.85	8.99	6.12	11.7	1.27	-	✗
2025 Safenlp 2024	786	SAT	6.83	8.96	6.08	12.2	1.24	-	✗
2025 Safenlp 2024	787	UNSAT	6.29	7.86	6.36	11.0	1.08	16.4	17.3
2025 Safenlp 2024	788	SAT	6.79	6.03	6.10	12.2	1.24	14.8	18.1
2025 Safenlp 2024	789	UNSAT	6.27	7.91	6.49	12.5	1.07	16.7	17.5
2025 Safenlp 2024	790	UNSAT	7.70	19.7	-	-	-	-	19.4
2025 Safenlp 2024	791	UNSAT	7.10	8.13	15.9	19.8	3.56	-	17.3
2025 Safenlp 2024	792	SAT	6.85	8.93	6.08	12.2	1.25	-	✗
2025 Safenlp 2024	793	UNSAT	6.25	7.97	6.37	12.0	1.07	16.6	17.6
2025 Safenlp 2024	794	UNSAT	6.30	7.95	6.37	12.0	1.07	16.4	17.6
2025 Safenlp 2024	795	UNSAT	6.25	7.95	6.39	12.0	1.08	16.6	17.8
2025 Safenlp 2024	796	SAT	6.60	6.02	6.12	11.2	1.24	14.8	17.7
2025 Safenlp 2024	797	SAT	6.82	5.99	6.05	12.2	1.24	14.9	19.5
2025 Safenlp 2024	798	UNSAT	7.24	8.16	17.1	14.8	4.22	-	17.8
2025 Safenlp 2024	799	SAT	6.78	6.31	6.10	12.2	1.29	15.1	17.8
2025 Safenlp 2024	800	UNSAT	6.24	7.99	6.41	12.5	1.07	16.8	17.5
2025 Safenlp 2024	801	SAT	6.69	5.95	6.04	12.2	1.24	15.0	17.8

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	802	SAT	6.84	7.96	6.08	11.3	1.24	-	✗
2025 Safenlp 2024	803	UNSAT	7.26	7.94	6.63	12.7	1.30	-	17.7
2025 Safenlp 2024	804	UNSAT	7.20	7.93	9.90	13.8	2.17	-	17.8
2025 Safenlp 2024	805	SAT	6.81	7.99	6.09	11.2	1.23	-	✗
2025 Safenlp 2024	806	SAT	6.85	8.01	6.08	12.2	1.25	-	✗
2025 Safenlp 2024	807	SAT	6.86	8.01	6.10	12.2	1.26	-	✗
2025 Safenlp 2024	808	SAT	6.83	5.99	6.06	12.3	1.07	15.0	17.6
2025 Safenlp 2024	809	UNSAT	6.31	7.96	6.36	11.0	1.07	16.4	-
2025 Safenlp 2024	810	UNSAT	7.04	8.06	9.54	13.3	2.06	-	17.5
2025 Safenlp 2024	811	UNSAT	7.96	-	-	-	-	-	17.7
2025 Safenlp 2024	812	SAT	6.81	6.02	6.05	11.2	1.24	14.9	-
2025 Safenlp 2024	813	SAT	6.69	7.95	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	814	SAT	6.78	5.98	6.01	11.3	1.07	15.0	17.6
2025 Safenlp 2024	815	SAT	6.80	5.95	6.11	12.2	1.24	15.1	17.8
2025 Safenlp 2024	816	SAT	6.50	5.95	6.03	12.2	1.10	14.9	17.7
2025 Safenlp 2024	817	SAT	6.60	9.09	6.09	15.3	-	-	✗
2025 Safenlp 2024	818	UNSAT	8.07	12.3	-	-	-	-	17.9
2025 Safenlp 2024	819	SAT	6.78	5.95	6.09	12.2	1.25	14.8	18.2
2025 Safenlp 2024	820	UNSAT	15.4	-	-	-	-	-	17.8
2025 Safenlp 2024	821	UNSAT	8.80	-	-	-	-	-	17.8
2025 Safenlp 2024	822	SAT	6.96	6.96	6.10	12.2	1.25	-	18.2
2025 Safenlp 2024	823	UNSAT	8.33	8.57	-	-	-	-	18.2
2025 Safenlp 2024	824	UNSAT	7.26	8.36	-	14.2	11.1	-	17.8
2025 Safenlp 2024	825	SAT	6.78	8.01	6.14	12.2	1.25	-	✗
2025 Safenlp 2024	826	SAT	6.77	6.00	6.08	12.2	1.25	15.1	-
2025 Safenlp 2024	827	SAT	6.79	8.99	6.11	12.9	-	-	✗
2025 Safenlp 2024	828	UNSAT	7.13	8.19	19.5	15.0	7.11	-	18.3
2025 Safenlp 2024	829	SAT	6.79	8.06	6.08	12.2	1.24	-	✗
2025 Safenlp 2024	830	SAT	6.66	5.94	6.04	12.3	1.29	14.9	17.9
2025 Safenlp 2024	831	UNSAT	7.85	8.47	-	-	-	-	17.9
2025 Safenlp 2024	832	SAT	6.62	6.08	6.07	12.2	1.27	-	-
2025 Safenlp 2024	833	UNSAT	6.28	7.90	6.37	12.0	1.10	16.6	17.6
2025 Safenlp 2024	834	SAT	6.82	7.97	6.12	11.2	1.23	-	✗
2025 Safenlp 2024	835	SAT	6.80	7.99	6.08	12.2	1.26	-	✗
2025 Safenlp 2024	836	UNSAT	6.24	7.92	6.35	11.0	1.08	16.6	17.8
2025 Safenlp 2024	837	SAT	6.71	9.22	6.12	-	-	-	✗
2025 Safenlp 2024	838	SAT	6.68	8.97	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	839	UNSAT	7.26	8.11	-	15.8	-	-	17.6
2025 Safenlp 2024	840	SAT	6.84	7.90	6.10	11.2	1.27	-	✗
2025 Safenlp 2024	841	SAT	6.80	8.02	6.09	11.2	1.23	-	✗
2025 Safenlp 2024	842	SAT	6.75	5.99	6.09	12.3	1.25	14.7	18.0
2025 Safenlp 2024	843	SAT	6.69	5.97	6.05	12.2	1.25	14.9	17.8
2025 Safenlp 2024	844	UNSAT	13.3	38.1	-	-	-	-	18.0
2025 Safenlp 2024	845	UNSAT	7.28	8.00	7.39	13.6	2.09	-	17.5
2025 Safenlp 2024	846	SAT	6.88	9.21	6.07	14.5	2.11	-	✗
2025 Safenlp 2024	847	SAT	6.57	5.97	6.10	11.2	1.22	15.3	17.7
2025 Safenlp 2024	848	SAT	6.71	7.97	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	849	UNSAT	7.70	8.44	21.8	-	-	-	17.8
2025 Safenlp 2024	850	SAT	6.85	8.87	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	851	SAT	6.60	7.96	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	852	UNSAT	7.40	8.12	11.5	14.0	2.76	-	17.5
2025 Safenlp 2024	853	SAT	6.89	6.57	6.09	12.2	1.22	-	17.9
2025 Safenlp 2024	854	SAT	6.67	8.01	6.08	12.2	1.22	-	✗
2025 Safenlp 2024	855	UNSAT	6.22	7.95	6.37	11.0	1.08	16.5	17.5
2025 Safenlp 2024	856	SAT	6.90	7.54	6.12	12.2	1.26	-	✗
2025 Safenlp 2024	857	UNSAT	7.21	7.98	7.01	12.8	1.75	-	17.7
2025 Safenlp 2024	858	UNSAT	11.9	34.8	-	-	-	-	17.8
2025 Safenlp 2024	859	SAT	6.80	9.27	6.12	13.2	1.60	-	✗
2025 Safenlp 2024	860	SAT	6.61	7.98	6.11	11.1	1.24	-	✗
2025 Safenlp 2024	861	UNSAT	7.55	8.65	-	-	20.3	-	17.7
2025 Safenlp 2024	862	UNSAT	7.18	8.17	22.8	26.5	4.09	-	17.7
2025 Safenlp 2024	863	SAT	6.82	7.78	6.11	11.2	1.26	14.9	18.2
2025 Safenlp 2024	864	UNSAT	7.39	8.07	9.97	13.7	2.18	-	-
2025 Safenlp 2024	865	SAT	6.68	5.97	6.07	12.2	1.23	-	-
2025 Safenlp 2024	866	SAT	6.65	8.03	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	867	UNSAT	6.32	7.92	6.37	12.0	1.12	16.4	17.5
2025 Safenlp 2024	868	UNSAT	6.38	7.97	6.44	12.7	1.08	16.7	17.6
2025 Safenlp 2024	869	UNSAT	7.28	8.23	24.2	-	3.06	-	17.8

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	870	SAT	6.74	8.00	6.11	11.2	1.25	-	✗
2025 Safenlp 2024	871	UNSAT	7.28	8.02	9.36	13.4	3.68	-	19.3
2025 Safenlp 2024	872	UNSAT	7.65	8.48	-	-	15.7	-	17.8
2025 Safenlp 2024	873	UNSAT	6.26	7.95	6.37	12.0	1.13	16.5	17.8
2025 Safenlp 2024	874	SAT	6.78	5.95	6.05	11.2	1.23	14.9	17.8
2025 Safenlp 2024	875	SAT	6.53	8.97	6.11	11.7	1.71	-	✗
2025 Safenlp 2024	876	UNSAT	6.27	7.96	6.34	10.9	1.08	16.7	17.6
2025 Safenlp 2024	877	SAT	6.76	7.88	6.14	12.2	1.25	-	✗
2025 Safenlp 2024	878	SAT	6.80	7.99	6.08	12.2	1.25	-	✗
2025 Safenlp 2024	879	SAT	6.83	5.94	6.07	12.2	1.22	14.8	17.7
2025 Safenlp 2024	880	UNSAT	6.27	7.89	6.35	12.0	1.09	16.3	17.5
2025 Safenlp 2024	881	SAT	6.61	5.99	6.04	12.2	1.25	14.9	17.9
2025 Safenlp 2024	882	SAT	6.85	8.00	6.11	12.2	1.24	-	✗
2025 Safenlp 2024	883	UNSAT	8.66	9.20	-	-	-	-	18.0
2025 Safenlp 2024	884	UNSAT	6.30	7.92	6.35	11.0	1.08	16.5	19.2
2025 Safenlp 2024	885	SAT	6.82	9.21	6.08	14.0	2.00	-	✗
2025 Safenlp 2024	886	SAT	6.87	8.00	6.14	11.8	1.24	-	✗
2025 Safenlp 2024	887	SAT	6.82	8.93	6.06	12.2	1.24	-	✗
2025 Safenlp 2024	888	SAT	6.84	8.00	6.08	12.3	1.32	-	✗
2025 Safenlp 2024	889	SAT	6.71	5.96	6.06	12.2	1.28	15.3	17.9
2025 Safenlp 2024	890	UNSAT	7.75	8.42	-	24.3	-	-	19.3
2025 Safenlp 2024	891	SAT	6.65	7.98	6.12	12.3	1.23	-	-
2025 Safenlp 2024	892	SAT	6.64	5.99	6.11	12.3	1.24	14.8	17.8
2025 Safenlp 2024	893	UNSAT	6.40	7.94	6.36	12.0	1.07	16.3	18.0
2025 Safenlp 2024	894	SAT	6.76	6.03	6.10	11.2	1.24	14.9	-
2025 Safenlp 2024	895	SAT	6.81	5.99	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	896	SAT	6.95	6.00	6.07	11.3	1.27	-	18.1
2025 Safenlp 2024	897	UNSAT	7.26	8.25	18.1	-	-	-	17.8
2025 Safenlp 2024	898	UNSAT	7.10	8.03	6.62	11.5	1.27	-	17.6
2025 Safenlp 2024	899	SAT	6.47	5.92	6.05	11.2	1.12	15.0	19.2
2025 Safenlp 2024	900	SAT	6.77	5.93	6.03	12.2	1.24	14.8	17.9
2025 Safenlp 2024	901	SAT	6.83	8.02	6.07	13.5	1.25	-	✗
2025 Safenlp 2024	902	SAT	6.80	8.00	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	903	SAT	6.79	5.96	6.12	11.2	1.25	15.1	18.1
2025 Safenlp 2024	904	UNSAT	13.1	-	-	-	-	-	17.5
2025 Safenlp 2024	905	UNSAT	6.28	8.05	6.39	11.9	1.07	16.4	17.4
2025 Safenlp 2024	906	SAT	6.57	6.10	6.09	12.2	1.30	-	17.8
2025 Safenlp 2024	907	SAT	6.79	5.96	6.04	12.1	1.09	14.9	17.7
2025 Safenlp 2024	908	UNSAT	6.44	7.89	6.50	11.8	1.07	16.6	17.5
2025 Safenlp 2024	909	UNSAT	8.29	9.31	-	-	-	-	17.7
2025 Safenlp 2024	910	UNSAT	7.26	8.07	15.5	13.6	3.77	-	17.6
2025 Safenlp 2024	911	SAT	6.64	8.98	6.09	11.2	1.23	-	✗
2025 Safenlp 2024	912	UNSAT	6.30	7.93	6.40	12.0	1.08	17.1	17.8
2025 Safenlp 2024	913	UNSAT	7.06	7.97	7.79	13.2	1.83	-	17.5
2025 Safenlp 2024	914	UNSAT	6.29	7.96	6.36	12.0	1.07	16.5	17.6
2025 Safenlp 2024	915	SAT	6.83	7.88	6.08	12.2	1.24	-	✗
2025 Safenlp 2024	916	SAT	6.71	5.98	6.03	12.2	1.23	14.8	19.2
2025 Safenlp 2024	917	SAT	6.84	8.01	6.11	12.2	1.24	-	-
2025 Safenlp 2024	918	SAT	6.77	8.95	6.09	11.2	1.26	-	✗
2025 Safenlp 2024	919	UNSAT	6.30	7.94	6.37	12.0	1.07	16.6	17.5
2025 Safenlp 2024	920	SAT	6.74	7.88	6.12	11.2	1.23	-	✗
2025 Safenlp 2024	921	UNSAT	6.26	7.93	6.38	11.9	1.07	16.7	19.2
2025 Safenlp 2024	922	SAT	6.67	8.96	6.08	11.2	1.25	-	✗
2025 Safenlp 2024	923	SAT	6.50	5.96	6.03	11.2	1.23	-	17.6
2025 Safenlp 2024	924	SAT	6.60	7.98	6.12	12.2	1.39	-	✗
2025 Safenlp 2024	925	UNSAT	7.90	11.7	-	-	-	-	17.8
2025 Safenlp 2024	926	SAT	6.58	8.01	6.09	11.2	1.26	-	✗
2025 Safenlp 2024	927	SAT	7.71	9.64	6.10	13.0	-	-	✗
2025 Safenlp 2024	928	SAT	6.71	5.98	6.05	12.3	1.25	14.9	17.9
2025 Safenlp 2024	929	SAT	6.73	8.89	6.09	12.2	1.22	-	✗
2025 Safenlp 2024	930	UNSAT	7.73	8.37	-	-	-	-	19.1
2025 Safenlp 2024	931	UNSAT	11.4	19.3	-	-	-	-	18.1
2025 Safenlp 2024	932	SAT	6.81	6.01	6.06	12.2	1.26	15.0	18.0
2025 Safenlp 2024	933	UNSAT	7.28	8.00	6.56	12.4	1.47	-	17.5
2025 Safenlp 2024	934	SAT	6.81	6.19	6.09	12.2	1.26	-	✗
2025 Safenlp 2024	935	SAT	6.80	5.99	6.05	12.2	1.27	14.9	18.0
2025 Safenlp 2024	936	UNSAT	8.38	9.47	-	-	-	-	17.7
2025 Safenlp 2024	937	SAT	6.87	6.34	6.09	12.2	1.23	-	17.8

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	938	UNSAT	6.30	7.89	6.36	12.0	1.08	16.6	17.4
2025 Safenlp 2024	939	SAT	6.76	6.01	6.06	11.2	1.31	15.0	17.9
2025 Safenlp 2024	940	UNSAT	6.25	7.96	6.37	11.0	1.07	16.8	17.4
2025 Safenlp 2024	941	UNSAT	9.49	27.0	-	-	-	-	17.8
2025 Safenlp 2024	942	SAT	6.81	8.02	6.09	12.7	1.25	-	✗
2025 Safenlp 2024	943	SAT	6.61	8.21	6.12	12.8	2.44	-	✗
2025 Safenlp 2024	944	UNSAT	7.49	8.91	-	-	-	-	17.8
2025 Safenlp 2024	945	SAT	6.81	-	6.09	12.2	1.30	-	✗
2025 Safenlp 2024	946	SAT	6.71	5.95	6.05	12.2	1.23	14.9	17.8
2025 Safenlp 2024	947	SAT	6.50	5.92	6.06	12.2	1.24	14.8	17.7
2025 Safenlp 2024	948	SAT	6.52	5.97	6.03	12.2	1.26	14.9	18.0
2025 Safenlp 2024	949	SAT	6.87	7.96	6.09	12.2	1.84	-	✗
2025 Safenlp 2024	950	SAT	6.83	9.03	6.12	12.5	1.24	-	✗
2025 Safenlp 2024	951	SAT	6.70	9.01	6.10	13.1	1.80	-	✗
2025 Safenlp 2024	952	SAT	6.68	8.17	6.08	13.5	2.23	-	✗
2025 Safenlp 2024	953	SAT	6.85	9.20	6.11	12.5	1.47	-	✗
2025 Safenlp 2024	954	UNSAT	7.37	8.08	10.5	13.3	2.09	-	17.5
2025 Safenlp 2024	955	UNSAT	7.19	8.01	7.08	12.0	1.93	-	17.5
2025 Safenlp 2024	956	UNSAT	6.24	7.99	6.35	11.9	1.07	16.3	19.0
2025 Safenlp 2024	957	SAT	6.84	7.97	6.14	12.2	1.26	-	✗
2025 Safenlp 2024	958	UNSAT	6.35	7.97	6.37	12.0	1.07	16.9	18.1
2025 Safenlp 2024	959	SAT	6.56	7.96	6.10	12.2	1.26	-	✗
2025 Safenlp 2024	960	SAT	6.61	6.36	6.13	12.2	1.23	-	-
2025 Safenlp 2024	961	UNSAT	6.32	7.94	6.40	12.0	1.07	16.5	17.7
2025 Safenlp 2024	962	UNSAT	6.23	7.93	6.39	11.0	1.07	16.5	17.6
2025 Safenlp 2024	963	SAT	6.81	8.20	6.12	12.7	1.24	-	✗
2025 Safenlp 2024	964	SAT	6.83	8.97	6.12	16.5	-	-	✗
2025 Safenlp 2024	965	UNSAT	6.31	7.96	6.38	12.0	1.08	16.7	17.6
2025 Safenlp 2024	966	SAT	6.53	7.99	6.09	12.2	1.27	-	✗
2025 Safenlp 2024	967	SAT	6.86	8.12	6.09	12.2	1.24	-	✗
2025 Safenlp 2024	968	UNSAT	7.62	8.33	-	-	-	-	17.8
2025 Safenlp 2024	969	UNSAT	7.09	8.05	7.11	13.5	1.77	-	17.7
2025 Safenlp 2024	970	SAT	6.81	8.03	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	971	SAT	6.90	8.07	6.08	12.2	1.25	-	-
2025 Safenlp 2024	972	SAT	6.88	7.93	6.11	11.5	1.25	-	✗
2025 Safenlp 2024	973	SAT	6.80	7.21	6.09	12.2	1.25	-	17.6
2025 Safenlp 2024	974	SAT	6.63	7.89	6.13	11.2	1.26	14.7	18.1
2025 Safenlp 2024	975	SAT	6.81	8.97	6.11	12.3	1.28	-	✗
2025 Safenlp 2024	976	UNSAT	7.30	8.02	10.1	13.5	2.24	-	18.2
2025 Safenlp 2024	977	UNSAT	7.41	8.11	14.6	16.5	3.01	-	17.7
2025 Safenlp 2024	978	SAT	6.82	8.94	6.11	12.1	1.24	-	✗
2025 Safenlp 2024	979	SAT	6.87	8.00	6.08	11.2	1.24	-	✗
2025 Safenlp 2024	980	SAT	6.71	7.99	6.12	12.8	1.59	-	✗
2025 Safenlp 2024	981	SAT	6.75	9.09	6.10	11.2	1.43	-	✗
2025 Safenlp 2024	982	SAT	6.74	7.80	6.09	12.2	1.23	-	✗
2025 Safenlp 2024	983	UNSAT	6.32	7.91	6.35	12.0	1.08	16.7	17.6
2025 Safenlp 2024	984	UNSAT	6.31	7.95	6.39	12.0	1.10	16.3	17.5
2025 Safenlp 2024	985	SAT	6.74	8.98	6.09	12.2	1.31	-	✗
2025 Safenlp 2024	986	SAT	6.62	8.00	6.11	11.7	1.24	-	✗
2025 Safenlp 2024	987	SAT	6.52	8.98	6.09	12.2	1.28	-	-
2025 Safenlp 2024	988	SAT	6.56	8.00	6.11	12.2	1.25	-	✗
2025 Safenlp 2024	989	UNSAT	7.26	7.98	7.80	13.3	2.27	-	17.7
2025 Safenlp 2024	990	SAT	7.03	8.99	6.08	12.3	1.23	-	✗
2025 Safenlp 2024	991	SAT	6.81	9.02	6.10	12.2	1.25	-	✗
2025 Safenlp 2024	992	UNSAT	7.27	8.03	9.21	14.3	1.78	-	-
2025 Safenlp 2024	993	SAT	6.50	5.96	6.06	12.2	1.23	15.0	17.6
2025 Safenlp 2024	994	UNSAT	6.31	7.90	6.37	12.0	1.08	16.7	17.6
2025 Safenlp 2024	995	SAT	6.83	8.00	6.11	12.7	1.43	-	✗
2025 Safenlp 2024	996	UNSAT	6.28	7.98	6.39	11.9	1.09	16.4	17.6
2025 Safenlp 2024	997	SAT	6.59	9.07	6.11	12.4	1.76	-	✗
2025 Safenlp 2024	998	SAT	6.81	8.09	6.11	12.2	1.24	-	✗
2025 Safenlp 2024	999	SAT	6.65	8.00	6.14	12.7	1.29	-	✗
2025 Safenlp 2024	1000	SAT	6.47	5.96	6.08	12.2	1.27	14.9	19.2
2025 Safenlp 2024	1001	UNSAT	6.27	7.93	6.36	11.0	1.13	16.7	17.7
2025 Safenlp 2024	1002	SAT	6.65	8.94	6.11	11.6	1.26	-	✗
2025 Safenlp 2024	1003	SAT	6.68	8.04	6.11	12.2	1.27	-	✗
2025 Safenlp 2024	1004	UNSAT	6.34	7.95	6.39	12.0	1.08	16.6	17.5
2025 Safenlp 2024	1005	SAT	6.62	8.95	6.11	12.4	1.23	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	1006	SAT	6.68	8.11	6.09	12.9	1.98	-	✗
2025 Safenlp 2024	1007	SAT	6.82	8.92	6.10	12.2	1.31	-	✗
2025 Safenlp 2024	1008	SAT	6.74	8.03	6.11	12.7	1.24	-	-
2025 Safenlp 2024	1009	SAT	6.84	8.90	6.09	11.2	1.27	-	17.8
2025 Safenlp 2024	1010	UNSAT	6.36	7.89	6.39	11.9	1.07	16.5	17.6
2025 Safenlp 2024	1011	UNSAT	7.19	8.27	-	16.5	19.3	-	17.8
2025 Safenlp 2024	1012	SAT	6.80	8.96	6.11	12.2	1.22	-	✗
2025 Safenlp 2024	1013	SAT	6.80	7.99	6.10	12.2	1.26	-	✗
2025 Safenlp 2024	1014	SAT	6.82	7.95	6.09	12.2	1.24	-	✗
2025 Safenlp 2024	1015	UNSAT	7.36	8.04	17.4	14.3	13.8	-	17.8
2025 Safenlp 2024	1016	SAT	6.64	7.96	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	1017	SAT	6.71	7.30	6.06	11.2	1.23	-	✗
2025 Safenlp 2024	1018	SAT	6.80	6.27	6.08	12.3	1.27	-	18.0
2025 Safenlp 2024	1019	SAT	6.84	7.97	6.06	12.2	1.24	-	✗
2025 Safenlp 2024	1020	UNSAT	7.39	8.02	7.73	13.8	2.16	-	17.6
2025 Safenlp 2024	1021	SAT	6.57	9.03	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	1022	SAT	6.68	8.01	6.09	13.0	1.26	-	✗
2025 Safenlp 2024	1023	UNSAT	7.25	8.04	6.66	12.7	1.28	-	17.7
2025 Safenlp 2024	1024	SAT	6.55	5.95	6.06	12.2	1.23	15.1	17.8
2025 Safenlp 2024	1025	UNSAT	7.09	8.00	6.60	12.7	1.28	-	19.5
2025 Safenlp 2024	1026	UNSAT	7.20	8.27	13.1	14.2	2.94	-	17.8
2025 Safenlp 2024	1027	SAT	6.76	7.98	6.09	11.3	1.25	-	✗
2025 Safenlp 2024	1028	SAT	6.78	7.94	6.11	11.2	1.25	-	✗
2025 Safenlp 2024	1029	SAT	6.77	6.02	6.16	11.1	1.28	15.1	17.9
2025 Safenlp 2024	1030	UNSAT	7.12	7.97	6.65	12.5	1.29	-	17.6
2025 Safenlp 2024	1031	UNSAT	7.02	7.99	7.19	13.0	1.89	-	17.4
2025 Safenlp 2024	1032	SAT	6.68	8.96	6.10	12.2	1.23	-	✗
2025 Safenlp 2024	1033	SAT	6.59	8.99	6.12	12.2	1.24	-	-
2025 Safenlp 2024	1034	UNSAT	6.27	7.88	6.36	11.9	1.08	16.9	19.5
2025 Safenlp 2024	1035	UNSAT	7.45	8.57	-	29.1	14.3	-	17.7
2025 Safenlp 2024	1036	UNSAT	6.30	7.90	6.38	10.9	1.08	16.6	17.8
2025 Safenlp 2024	1037	UNSAT	6.24	7.92	6.38	12.0	1.07	16.4	17.5
2025 Safenlp 2024	1038	UNSAT	7.62	9.76	-	-	-	-	19.2
2025 Safenlp 2024	1039	SAT	6.65	8.02	6.09	11.2	1.27	-	✗
2025 Safenlp 2024	1040	SAT	6.65	8.96	6.07	12.5	1.37	-	✗
2025 Safenlp 2024	1041	SAT	6.78	8.97	6.08	12.2	1.24	14.8	17.8
2025 Safenlp 2024	1042	SAT	6.70	5.95	6.04	12.2	1.25	14.8	17.9
2025 Safenlp 2024	1043	SAT	6.84	9.01	6.14	12.2	1.22	-	✗
2025 Safenlp 2024	1044	UNSAT	7.05	7.99	8.54	12.8	1.96	-	17.5
2025 Safenlp 2024	1045	SAT	6.78	8.90	6.06	12.3	1.24	-	✗
2025 Safenlp 2024	1046	UNSAT	7.32	8.02	6.87	12.9	1.74	-	17.6
2025 Safenlp 2024	1047	SAT	6.75	6.50	6.10	12.3	1.24	-	19.3
2025 Safenlp 2024	1048	UNSAT	7.74	8.96	-	-	-	-	17.6
2025 Safenlp 2024	1049	SAT	6.75	5.96	6.08	12.2	1.24	-	17.8
2025 Safenlp 2024	1050	SAT	6.82	7.98	6.10	11.2	1.23	-	✗
2025 Safenlp 2024	1051	SAT	6.81	7.14	6.11	11.3	1.25	-	17.9
2025 Safenlp 2024	1052	SAT	6.78	6.10	6.12	12.3	1.25	-	18.0
2025 Safenlp 2024	1053	UNSAT	6.27	7.93	6.37	11.0	1.07	16.4	17.6
2025 Safenlp 2024	1054	SAT	6.76	7.97	6.09	12.2	1.26	14.8	18.2
2025 Safenlp 2024	1055	SAT	6.62	6.06	6.08	12.2	1.26	14.9	17.9
2025 Safenlp 2024	1056	SAT	6.61	6.06	6.11	11.3	1.24	-	17.8
2025 Safenlp 2024	1057	SAT	6.78	8.93	6.10	13.5	1.42	-	✗
2025 Safenlp 2024	1058	UNSAT	7.19	8.28	20.3	21.0	19.4	-	18.4
2025 Safenlp 2024	1059	SAT	6.71	7.99	6.10	12.2	1.28	-	✗
2025 Safenlp 2024	1060	SAT	6.58	9.00	6.10	12.3	1.23	-	✗
2025 Safenlp 2024	1061	SAT	6.74	9.20	6.07	12.5	1.70	-	✗
2025 Safenlp 2024	1062	SAT	6.83	7.98	6.10	12.3	1.24	-	✗
2025 Safenlp 2024	1063	UNSAT	6.29	7.99	6.37	10.9	1.07	16.7	17.5
2025 Safenlp 2024	1064	SAT	6.79	7.93	6.06	12.2	1.25	-	✗
2025 Safenlp 2024	1065	UNSAT	7.30	7.98	7.15	12.7	1.51	-	17.6
2025 Safenlp 2024	1066	SAT	6.67	8.92	6.12	12.2	1.24	-	✗
2025 Safenlp 2024	1067	SAT	6.48	6.24	6.08	12.2	1.23	-	17.7
2025 Safenlp 2024	1068	UNSAT	6.27	7.93	6.36	10.9	1.07	16.5	17.8
2025 Safenlp 2024	1069	SAT	6.82	8.01	6.09	11.2	1.22	-	✗
2025 Safenlp 2024	1070	SAT	6.67	6.11	6.02	12.2	1.26	15.0	17.8
2025 Safenlp 2024	1071	UNSAT	7.74	8.53	-	-	-	-	17.9
2025 Safenlp 2024	1072	SAT	6.77	5.95	6.05	12.2	1.25	15.2	17.8
2025 Safenlp 2024	1073	SAT	6.79	8.13	6.11	12.2	1.25	-	✗

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Safenlp 2024	1074	SAT	6.78	5.93	6.02	12.2	1.26	15.0	18.3
2025 Safenlp 2024	1075	SAT	6.79	8.99	6.07	11.2	1.25	-	✗
2025 Safenlp 2024	1076	SAT	6.60	8.95	6.09	12.2	1.25	-	✗
2025 Safenlp 2024	1077	SAT	6.65	6.03	6.10	12.2	1.24	-	18.3
2025 Safenlp 2024	1078	UNSAT	6.95	7.88	6.76	12.7	1.38	-	17.6
2025 Safenlp 2024	1079	SAT	6.77	8.84	6.10	12.1	1.23	-	✗
2025 Sat Relu	0	SAT	6.09	8.74	6.13	12.2	1.12	-	-
2025 Sat Relu	1	UNSAT	6.76	16.3	-	12.0	-	-	-
2025 Sat Relu	2	SAT	6.07	8.62	6.18	12.1	2.50	14.6	✗
2025 Sat Relu	3	UNSAT	6.60	16.4	-	13.5	-	-	-
2025 Sat Relu	4	SAT	6.10	8.68	6.22	12.2	-	-	✗
2025 Sat Relu	5	UNSAT	6.69	16.4	-	13.5	-	-	-
2025 Sat Relu	6	SAT	5.99	8.57	6.14	12.7	1.10	14.6	17.5
2025 Sat Relu	7	UNSAT	6.53	16.2	23.2	13.2	1.74	-	-
2025 Sat Relu	8	SAT	6.09	8.84	6.29	11.2	-	-	✗
2025 Sat Relu	9	UNSAT	6.64	16.5	-	12.5	-	-	-
2025 Sat Relu	10	SAT	6.04	8.65	6.14	12.7	1.07	-	✗
2025 Sat Relu	11	UNSAT	6.46	16.2	7.61	12.7	1.11	96.9	-
2025 Sat Relu	12	SAT	6.08	8.69	6.15	12.7	1.08	-	✗
2025 Sat Relu	13	UNSAT	6.71	16.2	7.52	12.8	1.11	97.4	-
2025 Sat Relu	14	SAT	6.09	8.64	6.35	12.2	-	-	✗
2025 Sat Relu	15	UNSAT	6.80	16.5	-	13.0	-	-	-
2025 Sat Relu	16	SAT	6.07	8.71	6.18	11.2	2.32	-	✗
2025 Sat Relu	17	UNSAT	6.58	16.4	-	13.5	-	-	-
2025 Sat Relu	18	SAT	5.99	8.56	6.16	11.7	1.10	14.6	19.3
2025 Sat Relu	19	UNSAT	6.59	16.3	-	13.0	-	-	-
2025 Sat Relu	20	SAT	6.05	8.69	6.20	12.2	4.21	14.4	23.3
2025 Sat Relu	21	UNSAT	6.62	16.4	-	13.0	-	-	-
2025 Sat Relu	22	SAT	6.07	8.64	6.23	12.3	2.94	-	✗
2025 Sat Relu	23	UNSAT	6.63	16.4	-	13.5	-	-	-
2025 Sat Relu	24	SAT	6.10	8.69	6.12	12.7	1.09	-	✗
2025 Sat Relu	25	UNSAT	6.78	16.4	-	12.1	11.0	-	-
2025 Sat Relu	26	SAT	6.08	8.57	6.19	12.2	-	-	✗
2025 Sat Relu	27	UNSAT	6.68	16.5	-	13.3	-	-	-
2025 Sat Relu	28	SAT	6.06	12.4	6.30	12.2	-	-	✗
2025 Sat Relu	29	UNSAT	6.72	16.5	-	13.7	-	-	-
2025 Sat Relu	30	SAT	6.03	8.70	6.10	12.2	1.09	14.7	21.2
2025 Sat Relu	31	UNSAT	6.52	16.4	-	13.0	-	-	-
2025 Sat Relu	32	SAT	6.10	8.70	6.20	12.2	-	-	-
2025 Sat Relu	33	UNSAT	6.64	16.5	-	12.6	-	-	-
2025 Sat Relu	34	SAT	6.11	8.74	6.16	12.2	1.90	-	✗
2025 Sat Relu	35	UNSAT	6.65	16.5	-	13.2	-	-	-
2025 Sat Relu	36	SAT	6.04	12.3	6.18	12.7	1.57	15.2	✗
2025 Sat Relu	37	UNSAT	6.91	16.5	-	13.3	-	-	-
2025 Sat Relu	38	SAT	6.00	8.70	6.15	12.2	1.14	14.7	21.7
2025 Sat Relu	39	UNSAT	6.70	16.7	-	13.0	-	-	-
2025 Sat Relu	40	SAT	6.06	8.84	6.15	12.2	2.03	-	✗
2025 Sat Relu	41	UNSAT	6.60	16.4	-	13.2	-	-	-
2025 Sat Relu	42	SAT	6.07	8.88	6.21	11.7	4.12	-	✗
2025 Sat Relu	43	UNSAT	6.61	16.5	-	13.5	-	-	-
2025 Sat Relu	44	SAT	6.06	8.67	6.14	12.7	1.07	-	✗
2025 Sat Relu	45	UNSAT	6.46	16.2	8.25	13.0	1.36	-	-
2025 Sat Relu	46	SAT	6.06	8.72	6.18	12.3	-	-	-
2025 Sat Relu	47	UNSAT	6.65	16.4	-	13.6	-	-	-
2025 Sat Relu	48	SAT	6.02	8.86	6.20	11.7	-	14.3	26.5
2025 Sat Relu	49	UNSAT	6.92	16.4	-	13.4	-	-	-
2025 Sat Relu	50	SAT	6.05	8.73	6.17	12.2	1.80	14.9	✗
2025 Sat Relu	51	UNSAT	6.63	16.5	-	13.3	-	-	-
2025 Sat Relu	52	SAT	6.09	8.67	6.11	12.3	1.08	-	✗
2025 Sat Relu	53	UNSAT	6.45	16.2	6.81	12.7	1.25	-	-
2025 Sat Relu	54	SAT	6.07	8.58	6.14	12.2	1.11	-	✗
2025 Sat Relu	55	UNSAT	6.47	16.2	7.31	12.7	1.20	-	-
2025 Sat Relu	56	SAT	6.03	8.70	6.25	12.2	4.49	14.7	22.2
2025 Sat Relu	57	UNSAT	6.63	16.4	-	12.3	-	-	-
2025 Sat Relu	58	SAT	6.06	8.73	6.26	12.3	-	-	✗
2025 Sat Relu	59	UNSAT	6.68	16.5	-	13.5	-	-	-
2025 Sat Relu	60	SAT	6.08	8.56	6.16	12.3	1.22	-	✗
2025 Sat Relu	61	UNSAT	6.84	16.5	-	12.3	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Sat Relu	62	SAT	6.07	8.73	6.36	12.2	-	-	✗
2025 Sat Relu	63	UNSAT	6.78	16.6	-	13.8	-	-	-
2025 Sat Relu	64	SAT	6.11	8.61	6.36	12.2	-	-	✗
2025 Sat Relu	65	UNSAT	6.74	16.5	-	12.8	-	-	-
2025 Sat Relu	66	SAT	6.08	8.62	6.23	11.2	-	-	✗
2025 Sat Relu	67	UNSAT	6.61	16.4	-	13.6	-	-	-
2025 Sat Relu	68	SAT	6.03	8.71	6.13	12.2	1.08	14.2	✗
2025 Sat Relu	69	UNSAT	6.48	16.2	19.5	13.0	-	-	-
2025 Sat Relu	70	SAT	6.05	8.70	6.15	11.2	1.30	-	✗
2025 Sat Relu	71	UNSAT	6.70	16.4	-	13.3	-	-	-
2025 Sat Relu	72	SAT	6.07	8.70	6.19	12.2	-	-	✗
2025 Sat Relu	73	UNSAT	6.90	16.4	-	13.3	-	-	-
2025 Sat Relu	74	SAT	6.06	8.64	6.15	12.2	1.09	-	-
2025 Sat Relu	75	UNSAT	6.52	16.2	56.9	13.3	2.22	-	-
2025 Sat Relu	76	SAT	6.06	8.57	6.18	12.2	1.14	14.7	-
2025 Sat Relu	77	UNSAT	6.59	16.5	-	13.0	-	-	-
2025 Sat Relu	78	SAT	6.01	8.70	6.24	11.2	4.96	-	✗
2025 Sat Relu	79	UNSAT	6.62	16.4	-	13.8	-	-	-
2025 Sat Relu	80	SAT	6.12	8.68	6.17	12.2	1.75	-	✗
2025 Sat Relu	81	UNSAT	6.63	16.4	-	13.3	-	-	-
2025 Sat Relu	82	SAT	6.12	8.66	6.19	12.2	1.39	-	✗
2025 Sat Relu	83	UNSAT	6.60	16.6	-	13.3	-	-	-
2025 Sat Relu	84	SAT	6.08	12.5	6.31	11.2	-	-	✗
2025 Sat Relu	85	UNSAT	6.99	16.6	-	13.8	-	-	-
2025 Sat Relu	86	SAT	6.09	8.79	6.18	12.2	2.95	14.7	✗
2025 Sat Relu	87	UNSAT	6.61	16.4	-	12.4	-	-	-
2025 Sat Relu	88	SAT	6.05	8.68	6.18	12.2	10.6	14.9	30.1
2025 Sat Relu	89	UNSAT	6.70	16.5	-	13.3	-	-	-
2025 Sat Relu	90	SAT	6.09	8.66	6.23	11.3	3.43	-	✗
2025 Sat Relu	91	UNSAT	6.60	16.5	-	12.5	-	-	-
2025 Sat Relu	92	SAT	6.05	8.72	6.15	12.2	1.40	-	-
2025 Sat Relu	93	UNSAT	6.63	16.4	-	13.3	-	-	-
2025 Sat Relu	94	SAT	6.07	8.68	6.15	11.2	1.07	-	-
2025 Sat Relu	95	UNSAT	6.45	16.2	32.6	13.0	4.31	-	-
2025 Sat Relu	96	SAT	6.03	8.73	6.20	12.3	-	14.5	24.6
2025 Sat Relu	97	UNSAT	6.88	16.4	-	13.6	-	-	-
2025 Sat Relu	98	SAT	6.03	8.73	6.19	11.3	1.30	15.0	27.9
2025 Sat Relu	99	UNSAT	6.74	17.2	-	13.3	-	-	-
2025 Soundnessbench	0	SAT	106	✗	-	-	-	-	-
2025 Soundnessbench	1	SAT	99.1	9.69	-	-	-	-	-
2025 Soundnessbench	2	SAT	50.4	9.46	-	-	-	-	-
2025 Soundnessbench	3	SAT	50.4	9.25	-	-	-	-	-
2025 Soundnessbench	4	SAT	66.7	16.2	-	-	-	-	-
2025 Soundnessbench	5	SAT	105	✗	-	-	-	-	-
2025 Soundnessbench	6	SAT	106	✗	-	-	-	-	-
2025 Soundnessbench	7	SAT	37.8	9.82	-	-	-	-	-
2025 Soundnessbench	8	SAT	116	✗	-	✗	-	-	-
2025 Soundnessbench	9	SAT	104	10.1	-	-	-	-	-
2025 Soundnessbench	10	SAT	118	10.1	-	-	-	-	-
2025 Soundnessbench	11	SAT	49.0	9.34	-	-	-	-	-
2025 Soundnessbench	12	SAT	109	-	-	✗	-	-	-
2025 Soundnessbench	13	SAT	121	✗	-	-	-	-	-
2025 Soundnessbench	14	SAT	98.1	-	-	✗	-	-	-
2025 Soundnessbench	15	SAT	96.3	✗	-	-	-	-	-
2025 Soundnessbench	16	SAT	59.8	9.78	-	✗	-	-	-
2025 Soundnessbench	17	SAT	101	✗	-	-	-	-	-
2025 Soundnessbench	18	SAT	30.1	9.50	-	-	-	-	-
2025 Soundnessbench	19	SAT	34.3	-	-	-	-	-	-
2025 Soundnessbench	20	SAT	60.4	✗	-	-	-	-	-
2025 Soundnessbench	21	SAT	68.6	9.30	-	-	-	-	-
2025 Soundnessbench	22	SAT	125	9.30	-	-	-	-	-
2025 Soundnessbench	23	SAT	37.7	9.16	-	-	-	-	-
2025 Soundnessbench	24	SAT	108	9.64	-	-	-	-	-
2025 Soundnessbench	25	SAT	32.0	9.25	-	-	-	-	-
2025 Soundnessbench	26	SAT	107	11.1	-	✗	-	-	-
2025 Soundnessbench	27	SAT	77.3	11.0	-	✗	-	-	-
2025 Soundnessbench	28	SAT	53.9	9.19	-	-	-	-	-
2025 Soundnessbench	29	SAT	80.8	-	-	✗	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Soundnessbench	30	SAT	118	11.1	-	✗	-	-	-
2025 Soundnessbench	31	SAT	52.5	✗	-	✗	-	-	-
2025 Soundnessbench	32	SAT	29.7	9.42	-	-	-	-	-
2025 Soundnessbench	33	SAT	31.0	9.35	-	✗	-	-	-
2025 Soundnessbench	34	UNSAT	42.7	9.66	-	-	-	-	-
2025 Soundnessbench	35	SAT	82.3	9.52	-	-	-	-	-
2025 Soundnessbench	36	SAT	44.8	9.53	-	-	-	-	-
2025 Soundnessbench	37	SAT	96.8	-	-	✗	-	-	-
2025 Soundnessbench	38	SAT	118	✗	-	-	-	-	-
2025 Soundnessbench	39	SAT	70.3	11.2	-	✗	-	-	-
2025 Soundnessbench	40	SAT	72.9	9.37	-	✗	-	-	-
2025 Soundnessbench	41	SAT	38.3	9.36	-	-	-	-	-
2025 Soundnessbench	42	SAT	118	✗	-	-	-	-	-
2025 Soundnessbench	43	SAT	55.3	10.3	-	-	-	-	-
2025 Soundnessbench	44	SAT	121	✗	-	✗	-	-	-
2025 Soundnessbench	45	SAT	98.7	10.1	-	✗	-	-	-
2025 Soundnessbench	46	SAT	95.5	-	-	✗	-	-	-
2025 Soundnessbench	47	SAT	48.8	9.62	-	-	-	-	-
2025 Soundnessbench	48	SAT	82.8	-	-	✗	-	-	-
2025 Soundnessbench	49	SAT	101	-	-	✗	-	-	-
2025 Tinyimagenet 2024	0	UNSAT	14.8	54.9	70.5	-	-	-	-
2025 Tinyimagenet 2024	1	SAT	7.78	15.9	8.87	-	-	-	-
2025 Tinyimagenet 2024	2	UNSAT	25.5	-	-	-	-	-	-
2025 Tinyimagenet 2024	3	SAT	7.77	15.8	9.01	-	-	-	-
2025 Tinyimagenet 2024	4	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	5	UNSAT	15.3	39.5	18.9	-	-	-	-
2025 Tinyimagenet 2024	6	SAT	7.67	14.7	8.83	14.8	-	23.4	-
2025 Tinyimagenet 2024	7	SAT	7.85	16.1	9.07	-	-	-	-
2025 Tinyimagenet 2024	8	UNSAT	19.5	70.8	-	-	-	-	-
2025 Tinyimagenet 2024	9	UNSAT	9.87	31.5	14.0	-	-	-	-
2025 Tinyimagenet 2024	10	SAT	7.74	15.8	8.87	-	-	-	-
2025 Tinyimagenet 2024	11	UNSAT	15.8	45.0	102	-	-	-	-
2025 Tinyimagenet 2024	12	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	13	UNSAT	9.78	27.2	13.8	-	-	-	-
2025 Tinyimagenet 2024	14	UNSAT	10.2	28.4	14.6	-	-	-	-
2025 Tinyimagenet 2024	15	UNSAT	16.3	79.1	-	-	-	-	-
2025 Tinyimagenet 2024	16	UNSAT	17.9	-	-	-	-	-	-
2025 Tinyimagenet 2024	17	UNSAT	15.3	41.6	19.1	-	-	-	-
2025 Tinyimagenet 2024	18	UNSAT	14.3	65.3	18.1	-	-	-	-
2025 Tinyimagenet 2024	19	UNSAT	17.6	88.2	-	-	-	-	-
2025 Tinyimagenet 2024	20	UNSAT	21.7	-	-	-	-	-	-
2025 Tinyimagenet 2024	21	UNSAT	31.8	-	-	-	-	-	-
2025 Tinyimagenet 2024	22	UNSAT	36.7	-	-	-	-	-	-
2025 Tinyimagenet 2024	23	SAT	7.85	15.6	8.91	14.8	-	-	-
2025 Tinyimagenet 2024	24	UNSAT	17.8	70.2	-	-	-	-	-
2025 Tinyimagenet 2024	25	UNSAT	21.1	56.2	-	-	-	-	-
2025 Tinyimagenet 2024	26	UNSAT	34.4	-	-	-	-	-	-
2025 Tinyimagenet 2024	27	UNSAT	10.4	29.0	14.7	-	-	-	-
2025 Tinyimagenet 2024	28	UNSAT	20.6	61.6	-	-	-	-	-
2025 Tinyimagenet 2024	29	SAT	7.83	16.0	8.97	-	-	-	-
2025 Tinyimagenet 2024	30	UNSAT	14.7	52.4	45.0	-	-	-	-
2025 Tinyimagenet 2024	31	UNSAT	18.5	59.9	-	-	-	-	-
2025 Tinyimagenet 2024	32	SAT	7.77	15.8	9.07	-	-	-	-
2025 Tinyimagenet 2024	33	UNSAT	10.2	28.1	16.3	-	-	-	-
2025 Tinyimagenet 2024	34	UNSAT	58.5	-	-	-	-	-	-
2025 Tinyimagenet 2024	35	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	36	UNSAT	10.6	28.9	14.9	-	-	-	-
2025 Tinyimagenet 2024	37	UNSAT	21.2	78.4	-	-	-	-	-
2025 Tinyimagenet 2024	38	SAT	7.73	15.7	8.89	14.8	-	-	-
2025 Tinyimagenet 2024	39	UNSAT	19.7	59.4	-	-	-	-	-
2025 Tinyimagenet 2024	40	UNSAT	9.88	28.1	15.1	-	-	-	-
2025 Tinyimagenet 2024	41	UNSAT	23.0	71.4	-	-	-	-	-
2025 Tinyimagenet 2024	42	UNSAT	15.5	46.5	82.8	-	-	-	-
2025 Tinyimagenet 2024	43	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	44	UNSAT	9.74	27.1	13.0	-	-	-	-
2025 Tinyimagenet 2024	45	UNSAT	24.7	63.4	-	-	-	-	-
2025 Tinyimagenet 2024	46	SAT	7.76	16.0	9.06	-	-	-	-
2025 Tinyimagenet 2024	47	UNSAT	16.0	58.1	32.9	-	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Tinyimagenet 2024	48	UNSAT	17.4	48.5	-	-	-	-	-
2025 Tinyimagenet 2024	49	UNSAT	9.75	29.2	16.4	-	-	-	-
2025 Tinyimagenet 2024	50	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	51	UNSAT	16.8	101	-	-	-	-	-
2025 Tinyimagenet 2024	52	UNSAT	11.0	30.2	15.4	-	-	-	-
2025 Tinyimagenet 2024	53	SAT	7.72	15.6	8.96	-	-	-	-
2025 Tinyimagenet 2024	54	SAT	7.73	16.0	9.06	-	-	-	-
2025 Tinyimagenet 2024	55	UNSAT	17.8	48.7	75.5	-	-	-	-
2025 Tinyimagenet 2024	56	UNSAT	102	-	-	-	-	-	-
2025 Tinyimagenet 2024	57	UNSAT	14.5	43.0	30.0	-	-	-	-
2025 Tinyimagenet 2024	58	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	59	UNSAT	15.5	41.7	52.1	-	-	-	-
2025 Tinyimagenet 2024	60	SAT	7.81	15.6	8.97	-	-	-	-
2025 Tinyimagenet 2024	61	UNSAT	11.1	31.4	23.0	-	-	-	-
2025 Tinyimagenet 2024	62	SAT	7.70	15.7	8.92	14.8	-	-	-
2025 Tinyimagenet 2024	63	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	64	UNSAT	15.7	46.0	47.9	-	-	-	-
2025 Tinyimagenet 2024	65	SAT	7.72	15.9	8.99	-	-	-	-
2025 Tinyimagenet 2024	66	UNSAT	16.0	62.6	-	-	-	-	-
2025 Tinyimagenet 2024	67	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	68	UNSAT	7.53	24.4	13.7	-	-	-	-
2025 Tinyimagenet 2024	69	SAT	7.75	15.9	9.06	-	-	-	-
2025 Tinyimagenet 2024	70	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	71	UNSAT	10.4	29.2	15.6	-	-	-	-
2025 Tinyimagenet 2024	72	UNSAT	25.6	85.1	-	-	-	-	-
2025 Tinyimagenet 2024	73	SAT	7.76	16.2	8.92	-	-	-	-
2025 Tinyimagenet 2024	74	UNSAT	10.8	29.7	16.7	-	-	-	-
2025 Tinyimagenet 2024	75	UNSAT	16.3	40.6	21.2	-	-	-	-
2025 Tinyimagenet 2024	76	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	77	SAT	7.76	15.7	9.02	-	-	-	-
2025 Tinyimagenet 2024	78	UNSAT	17.6	55.6	-	-	-	-	-
2025 Tinyimagenet 2024	79	UNSAT	9.96	27.5	15.1	-	-	-	-
2025 Tinyimagenet 2024	80	UNSAT	22.5	92.5	-	-	-	-	-
2025 Tinyimagenet 2024	81	UNSAT	10.5	32.1	14.1	-	-	-	-
2025 Tinyimagenet 2024	82	UNSAT	16.1	45.3	21.9	-	-	-	-
2025 Tinyimagenet 2024	83	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	84	UNSAT	9.85	28.0	16.8	-	-	-	-
2025 Tinyimagenet 2024	85	SAT	7.77	15.8	8.96	-	-	-	-
2025 Tinyimagenet 2024	86	UNSAT	16.1	43.8	27.0	-	-	-	-
2025 Tinyimagenet 2024	87	SAT	7.76	15.7	8.95	-	-	-	-
2025 Tinyimagenet 2024	88	UNSAT	16.9	52.3	-	-	-	-	-
2025 Tinyimagenet 2024	89	UNSAT	17.7	51.7	-	-	-	-	-
2025 Tinyimagenet 2024	90	SAT	7.83	15.5	9.07	-	-	-	-
2025 Tinyimagenet 2024	91	UNSAT	16.6	95.6	-	-	-	-	-
2025 Tinyimagenet 2024	92	UNSAT	60.8	-	-	-	-	-	-
2025 Tinyimagenet 2024	93	SAT	7.69	28.9	-	-	-	-	-
2025 Tinyimagenet 2024	94	UNSAT	21.2	-	-	-	-	-	-
2025 Tinyimagenet 2024	95	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	96	UNSAT	15.3	46.9	30.2	-	-	-	-
2025 Tinyimagenet 2024	97	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	98	UNSAT	23.3	-	-	-	-	-	-
2025 Tinyimagenet 2024	99	UNSAT	9.97	28.0	13.4	-	-	-	-
2025 Tinyimagenet 2024	100	UNSAT	18.1	71.2	-	-	-	-	-
2025 Tinyimagenet 2024	101	UNSAT	21.4	69.1	-	-	-	-	-
2025 Tinyimagenet 2024	102	UNSAT	15.7	55.0	-	-	-	-	-
2025 Tinyimagenet 2024	103	SAT	7.88	15.9	8.93	14.9	-	-	-
2025 Tinyimagenet 2024	104	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	105	UNSAT	21.9	-	-	-	-	-	-
2025 Tinyimagenet 2024	106	UNSAT	15.0	42.8	38.0	-	-	-	-
2025 Tinyimagenet 2024	107	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	108	SAT	7.76	16.2	9.06	-	-	-	-
2025 Tinyimagenet 2024	109	UNSAT	18.7	53.1	-	-	-	-	-
2025 Tinyimagenet 2024	110	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	111	UNSAT	10.5	29.5	16.0	-	-	-	-
2025 Tinyimagenet 2024	112	UNSAT	16.8	46.2	-	-	-	-	-
2025 Tinyimagenet 2024	113	UNSAT	15.7	43.2	39.5	-	-	-	-
2025 Tinyimagenet 2024	114	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	115	UNSAT	16.5	49.9	21.0	-	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Tinyimagenet 2024	116	SAT	7.75	15.7	8.89	-	-	-	-
2025 Tinyimagenet 2024	117	UNSAT	16.2	40.9	75.5	-	-	-	-
2025 Tinyimagenet 2024	118	UNSAT	15.6	65.3	46.1	-	-	-	-
2025 Tinyimagenet 2024	119	UNSAT	16.4	52.9	-	-	-	-	-
2025 Tinyimagenet 2024	120	SAT	7.76	16.1	-	-	-	-	-
2025 Tinyimagenet 2024	121	UNSAT	11.2	31.3	22.4	-	-	-	-
2025 Tinyimagenet 2024	122	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	123	UNSAT	16.3	78.5	32.2	-	-	-	-
2025 Tinyimagenet 2024	124	UNSAT	10.1	27.8	15.1	-	-	-	-
2025 Tinyimagenet 2024	125	SAT	7.82	15.8	8.95	-	-	-	-
2025 Tinyimagenet 2024	126	UNSAT	14.4	35.5	26.8	-	-	-	-
2025 Tinyimagenet 2024	127	UNSAT	18.2	54.0	-	-	-	-	-
2025 Tinyimagenet 2024	128	UNSAT	19.1	76.2	-	-	-	-	-
2025 Tinyimagenet 2024	129	UNSAT	16.1	43.5	108	-	-	-	-
2025 Tinyimagenet 2024	130	UNSAT	17.1	70.9	-	-	-	-	-
2025 Tinyimagenet 2024	131	UNSAT	84.6	-	-	-	-	-	-
2025 Tinyimagenet 2024	132	UNSAT	16.9	51.6	55.2	-	-	-	-
2025 Tinyimagenet 2024	133	UNSAT	22.2	86.4	-	-	-	-	-
2025 Tinyimagenet 2024	134	UNSAT	20.9	65.1	-	-	-	-	-
2025 Tinyimagenet 2024	135	UNSAT	15.6	67.1	-	-	-	-	-
2025 Tinyimagenet 2024	136	UNSAT	15.5	40.7	21.7	-	-	-	-
2025 Tinyimagenet 2024	137	UNSAT	14.8	51.6	37.5	-	-	-	-
2025 Tinyimagenet 2024	138	UNSAT	17.2	69.8	-	-	-	-	-
2025 Tinyimagenet 2024	139	UNSAT	19.6	-	-	-	-	-	-
2025 Tinyimagenet 2024	140	UNSAT	16.5	59.8	28.2	-	-	-	-
2025 Tinyimagenet 2024	141	UNSAT	17.5	103	-	-	-	-	-
2025 Tinyimagenet 2024	142	UNSAT	19.1	-	-	-	-	-	-
2025 Tinyimagenet 2024	143	SAT	7.82	✗	-	-	-	-	-
2025 Tinyimagenet 2024	144	UNSAT	16.9	58.1	-	-	-	-	-
2025 Tinyimagenet 2024	145	UNSAT	28.8	89.7	-	-	-	-	-
2025 Tinyimagenet 2024	146	SAT	7.76	15.9	8.99	-	-	-	-
2025 Tinyimagenet 2024	147	UNSAT	25.1	-	-	-	-	-	-
2025 Tinyimagenet 2024	148	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	149	UNSAT	18.6	56.0	-	-	-	-	-
2025 Tinyimagenet 2024	150	SAT	7.76	17.5	9.14	-	-	-	-
2025 Tinyimagenet 2024	151	UNSAT	15.3	65.8	41.2	-	-	-	-
2025 Tinyimagenet 2024	152	UNSAT	31.0	-	-	-	-	-	-
2025 Tinyimagenet 2024	153	SAT	7.81	16.0	9.33	-	-	-	-
2025 Tinyimagenet 2024	154	UNSAT	16.9	70.7	-	-	-	-	-
2025 Tinyimagenet 2024	155	SAT	7.78	15.5	8.92	-	-	-	-
2025 Tinyimagenet 2024	156	UNSAT	19.9	95.7	-	-	-	-	-
2025 Tinyimagenet 2024	157	UNSAT	14.6	45.1	19.7	-	-	-	-
2025 Tinyimagenet 2024	158	UNSAT	17.5	59.3	-	-	-	-	-
2025 Tinyimagenet 2024	159	UNSAT	7.65	24.5	14.9	-	-	-	-
2025 Tinyimagenet 2024	160	UNSAT	9.95	27.5	14.4	-	-	-	-
2025 Tinyimagenet 2024	161	SAT	7.78	15.6	8.91	-	-	-	-
2025 Tinyimagenet 2024	162	UNSAT	16.3	46.6	41.9	-	-	-	-
2025 Tinyimagenet 2024	163	UNSAT	10.7	34.3	15.8	-	-	-	-
2025 Tinyimagenet 2024	164	SAT	7.81	16.1	8.95	-	-	-	-
2025 Tinyimagenet 2024	165	UNSAT	16.3	70.4	43.9	-	-	-	-
2025 Tinyimagenet 2024	166	UNSAT	16.1	58.5	41.6	-	-	-	-
2025 Tinyimagenet 2024	167	UNSAT	29.5	-	-	-	-	-	-
2025 Tinyimagenet 2024	168	UNSAT	15.0	42.6	39.9	-	-	-	-
2025 Tinyimagenet 2024	169	UNSAT	16.8	46.2	-	-	-	-	-
2025 Tinyimagenet 2024	170	UNSAT	10.8	29.9	15.2	-	-	-	-
2025 Tinyimagenet 2024	171	UNSAT	21.2	54.5	-	-	-	-	-
2025 Tinyimagenet 2024	172	UNSAT	10.0	30.5	13.7	-	-	-	-
2025 Tinyimagenet 2024	173	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	174	UNSAT	17.3	49.7	-	-	-	-	-
2025 Tinyimagenet 2024	175	UNSAT	22.1	64.8	-	-	-	-	-
2025 Tinyimagenet 2024	176	UNSAT	17.2	79.2	-	-	-	-	-
2025 Tinyimagenet 2024	177	UNSAT	10.0	28.1	13.4	-	-	-	-
2025 Tinyimagenet 2024	178	UNSAT	17.6	75.0	-	-	-	-	-
2025 Tinyimagenet 2024	179	UNSAT	18.3	97.6	-	-	-	-	-
2025 Tinyimagenet 2024	180	UNSAT	18.7	-	-	-	-	-	-
2025 Tinyimagenet 2024	181	SAT	7.69	15.7	8.91	-	-	-	-
2025 Tinyimagenet 2024	182	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	183	UNSAT	38.5	-	-	-	-	-	-

Table 71: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	NSAT	PyRAT	CORA	NNen	NNV	SB
2025 Tinyimagenet 2024	184	UNSAT	20.3	-	-	-	-	-	-
2025 Tinyimagenet 2024	185	UNSAT	7.59	24.4	13.9	-	-	-	-
2025 Tinyimagenet 2024	186	UNSAT	15.6	65.0	46.8	-	-	-	-
2025 Tinyimagenet 2024	187	UNSAT	24.1	63.3	-	-	-	-	-
2025 Tinyimagenet 2024	188	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	189	SAT	7.79	15.7	9.05	-	-	-	-
2025 Tinyimagenet 2024	190	UNSAT	9.92	27.5	14.9	-	-	-	-
2025 Tinyimagenet 2024	191	UNSAT	16.7	48.5	77.4	-	-	-	-
2025 Tinyimagenet 2024	192	SAT	7.80	15.9	8.92	-	-	-	-
2025 Tinyimagenet 2024	193	SAT	7.75	16.4	9.12	-	-	-	-
2025 Tinyimagenet 2024	194	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	195	UNSAT	16.7	71.6	57.5	-	-	-	-
2025 Tinyimagenet 2024	196	UNSAT	14.6	38.8	30.5	-	-	-	-
2025 Tinyimagenet 2024	197	UNSAT	7.62	24.6	14.3	-	-	-	-
2025 Tinyimagenet 2024	198	?	-	-	-	-	-	-	-
2025 Tinyimagenet 2024	199	?	-	-	-	-	-	-	-
2025 Tllverifybench 2023	0	UNSAT	7.20	26.7	8.40	14.3	-	-	2.83
2025 Tllverifybench 2023	1	UNSAT	7.23	26.8	8.04	13.8	-	-	2.81
2025 Tllverifybench 2023	2	UNSAT	7.19	26.6	6.33	13.6	1.88	-	2.82
2025 Tllverifybench 2023	3	SAT	6.26	5.97	6.07	12.2	1.14	16.2	2.83
2025 Tllverifybench 2023	4	UNSAT	7.40	26.7	10.5	13.8	-	-	2.93
2025 Tllverifybench 2023	5	SAT	6.23	6.01	7.75	12.7	1.19	16.5	2.94
2025 Tllverifybench 2023	6	UNSAT	7.51	26.9	12.3	14.0	-	-	3.00
2025 Tllverifybench 2023	7	UNSAT	7.70	26.9	30.9	13.6	-	-	2.96
2025 Tllverifybench 2023	8	UNSAT	8.21	27.2	55.6	15.7	-	-	3.24
2025 Tllverifybench 2023	9	UNSAT	8.53	27.4	81.8	16.8	-	-	3.29
2025 Tllverifybench 2023	10	SAT	6.27	6.06	7.90	13.2	2.00	17.0	3.24
2025 Tllverifybench 2023	11	SAT	6.27	6.08	7.86	12.5	1.41	17.1	3.26
2025 Tllverifybench 2023	12	UNSAT	8.60	27.3	15.6	15.5	-	-	3.76
2025 Tllverifybench 2023	13	SAT	6.36	6.24	7.97	12.4	1.85	17.2	3.79
2025 Tllverifybench 2023	14	UNSAT	8.47	27.3	28.0	17.2	-	-	4.04
2025 Tllverifybench 2023	15	UNSAT	8.82	27.4	77.3	18.8	-	-	3.99
2025 Tllverifybench 2023	16	UNSAT	10.1	28.4	146	60.8	-	-	4.36
2025 Tllverifybench 2023	17	SAT	6.39	6.66	8.40	12.2	3.30	17.8	4.28
2025 Tllverifybench 2023	18	UNSAT	9.87	28.0	40.3	57.1	-	-	4.27
2025 Tllverifybench 2023	19	SAT	6.37	6.62	8.40	12.8	4.54	18.0	4.46
2025 Tllverifybench 2023	20	SAT	6.73	7.36	9.05	13.7	6.23	18.3	5.62
2025 Tllverifybench 2023	21	SAT	6.75	7.38	9.21	44.1	10.9	18.5	5.68
2025 Tllverifybench 2023	22	UNSAT	11.0	28.8	59.9	64.4	-	-	5.60
2025 Tllverifybench 2023	23	SAT	6.76	7.35	9.03	13.7	6.22	18.3	6.03
2025 Tllverifybench 2023	24	UNSAT	12.2	30.0	59.9	78.1	-	-	8.79
2025 Tllverifybench 2023	25	SAT	7.12	8.63	10.2	14.5	12.1	18.8	7.81
2025 Tllverifybench 2023	26	SAT	7.11	8.61	10.6	13.8	14.3	19.1	8.85
2025 Tllverifybench 2023	27	SAT	7.13	8.66	11.6	14.5	11.6	19.3	9.02
2025 Tllverifybench 2023	28	SAT	7.68	10.7	12.5	13.9	25.2	20.4	10.9
2025 Tllverifybench 2023	29	SAT	7.62	10.7	12.1	15.7	23.0	20.2	11.4
2025 Tllverifybench 2023	30	SAT	7.74	10.6	12.3	15.0	24.1	20.3	11.7
2025 Tllverifybench 2023	31	SAT	7.75	10.7	12.1	14.7	22.9	20.2	12.0