The Fourth International Verification of Neural Networks Competition (VNN-COMP 2023): Summary and Results

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Abstract

This report summarizes the fourth International Verification of Neural Networks Competition (VNN-COMP 2023), held as a part of the 6th Workshop on Formal Methods for ML-Enabled Autonomous Systems (FoMLAS) that was collocated with the 35th International Conference on Computer-Aided Verification (CAV). The goal of the competition is to provide an objective comparison of the state-of-the-art methods in neural network verification, in terms of scalability and speed. Along this line, we used standard formats (ONNX for neural networks and VNNLIB for specifications), standard hardware (all tools are run by the organizers on AWS), and tool parameters provided by the tool authors. This report summarizes the rules, benchmarks, participating tools, results, and lessons learned from this competition.

1 Total Score

Table 1: Overall Score

#	Tool	Score
1	α-β-CROWN	839.5
2	Marabou	642.4
3	PyRAT	550.7
4	NeuralSAT	535.7
5	nnenum	430.5
6	NNV	257.1
7	FastBATLLNN	100.0

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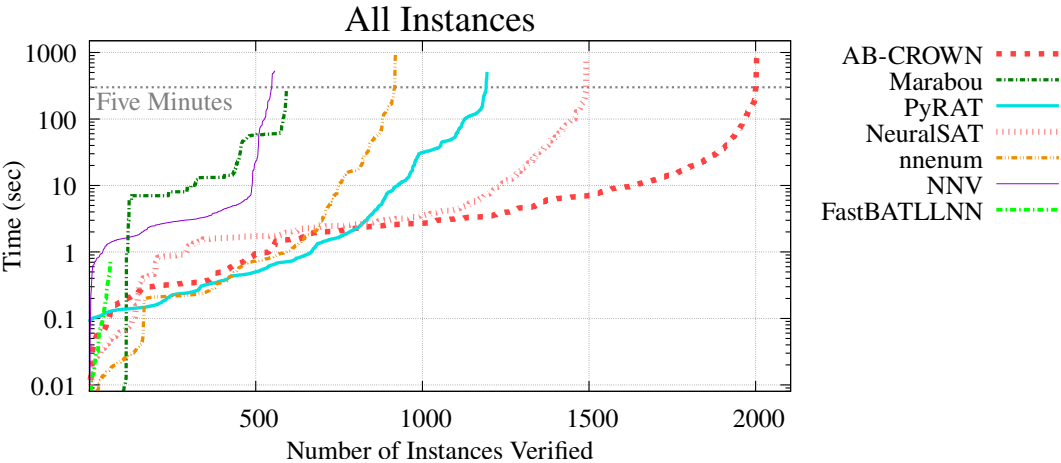
[¶]D. Shriver, `davidshriver@outlook.com`.

All Instances

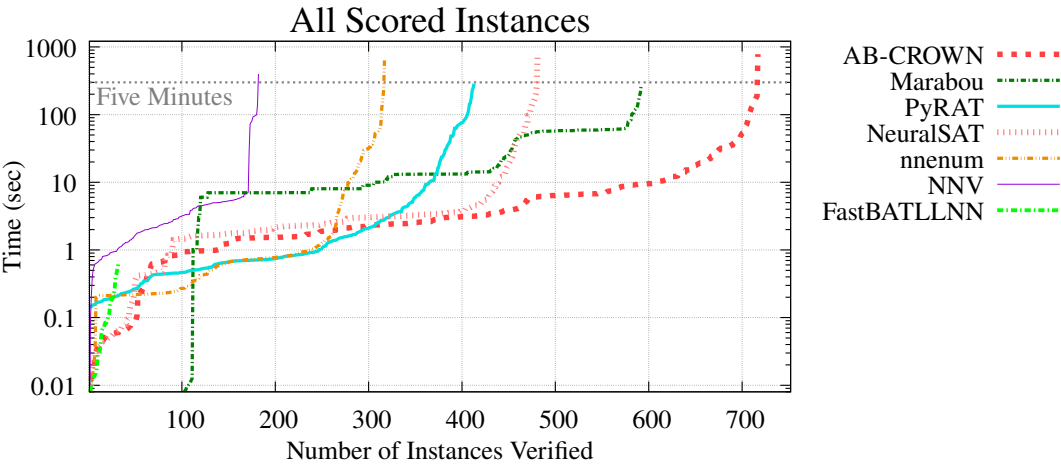Figure 1: Cactus Plot for All Instances.

All Scored Instances

Figure 2: Cactus Plot for All Scored Instances.

2 Scored Benchmarks

Table 2: Benchmark `2023-acasxu`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	nnenum	139	47	0	0	1860	100.0%
2	α-β-CROWN	139	47	0	0	1860	100.0%
3	NeuralSAT	138	46	0	0	1840	98.9%
4	PyRAT	137	45	0	0	1820	97.8%
5	Marabou	135	46	0	0	1810	97.3%
6	NNV	68	27	0	0	950	51.1%
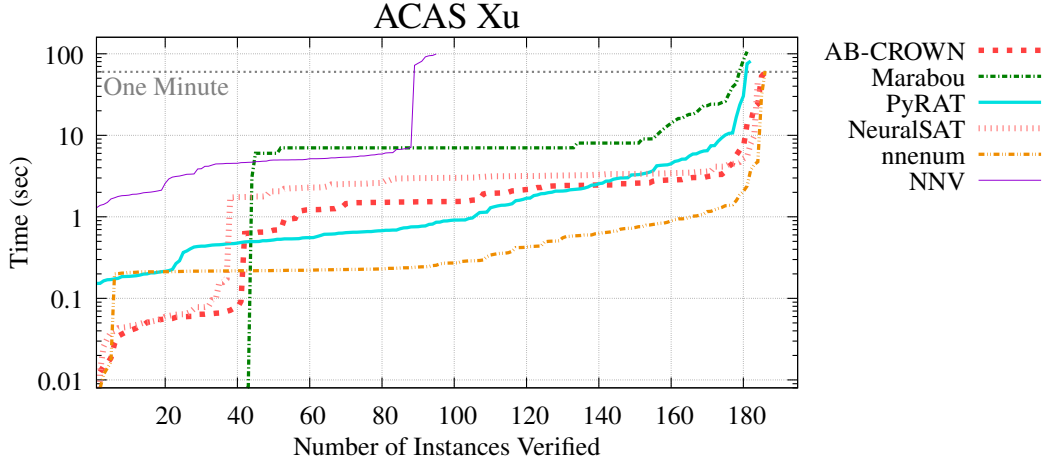
Figure 3: Cactus Plot for ACAS Xu.

Table 3: Benchmark `2023-cgan`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	8	13	0	0	210	100.0%
2	PyRAT	8	11	0	0	190	90.5%
3	nnenum	6	11	0	0	170	81.0%
4	NeuralSAT	3	11	0	0	140	66.7%
5	NNV	3	11	0	0	140	66.7%
6	Marabou	0	13	0	0	130	61.9%
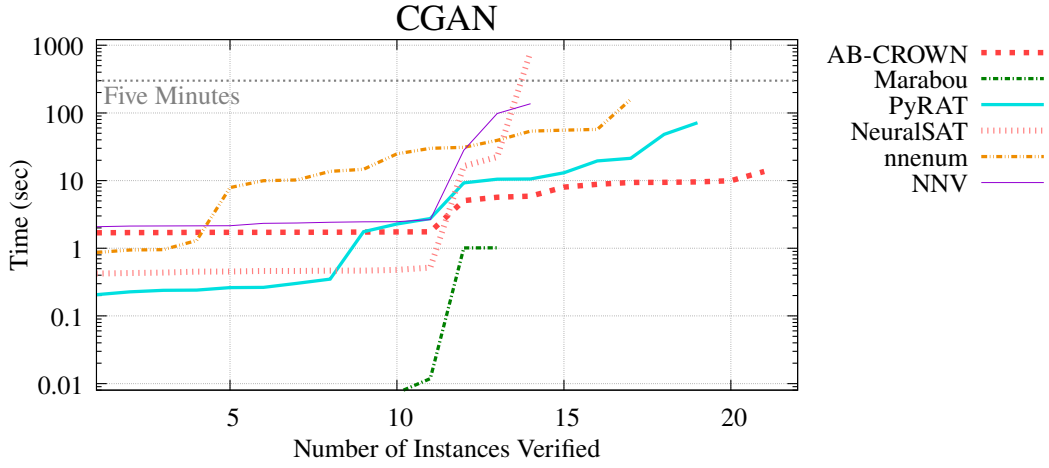
CGAN

Figure 4: Cactus Plot for CGAN.

Table 4: Benchmark `2023-collins-rul-cnn`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	nnenum	35	27	0	0	620	100.0%
2	NeuralSAT	35	27	0	0	620	100.0%
3	Marabou	35	27	0	0	620	100.0%
4	α-β-CROWN	35	27	0	0	620	100.0%
5	PyRAT	33	27	0	0	600	96.8%
6	NNV	23	27	0	0	500	80.6%

Collins Rul CNN

Figure 5: Cactus Plot for Collins Rul CNN.

Table 5: Benchmark `2023-dist-shift`

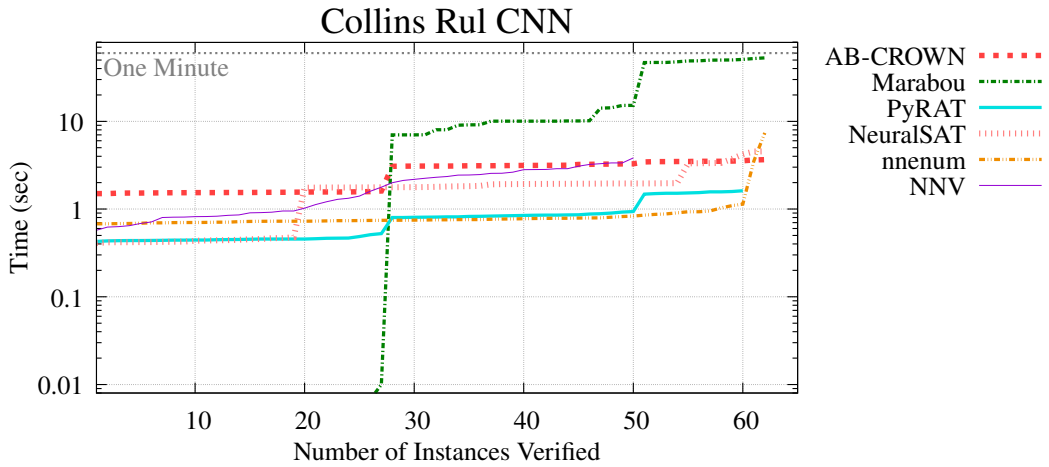| #	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	67	5	0	0	720	100.0%
2	PyRAT	66	5	0	0	710	98.6%
3	NeuralSAT	66	5	0	0	710	98.6%
4	Marabou	55	5	0	0	600	83.3%
5	NNV	0	4	0	0	40	5.6%
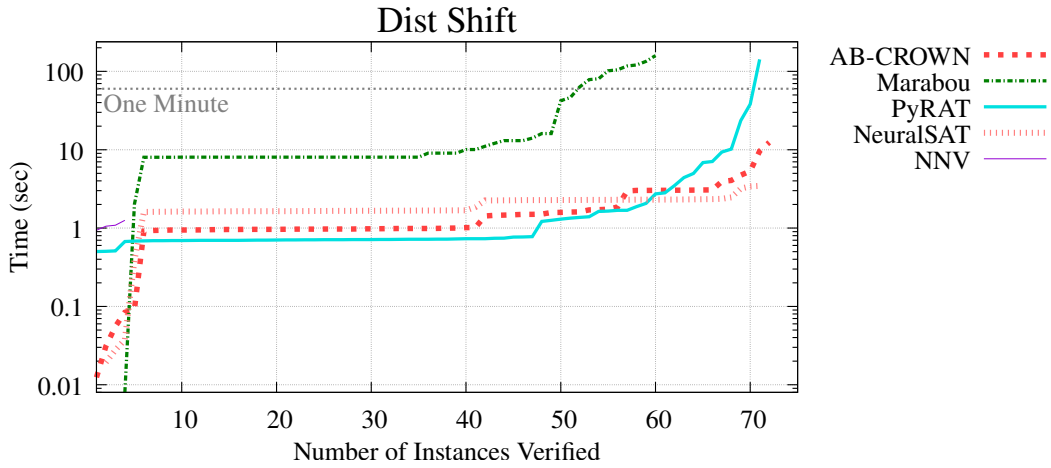
Figure 6: Cactus Plot for Dist Shift.

Table 6: Benchmark `2023-ml4acopf`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	18	1	0	0	190	100.0%

Table 7: Benchmark `2023-nn4sys`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	192	0	0	2	1620	100.0%
2	NeuralSAT	81	0	0	2	510	31.5%
3	Marabou	33	0	0	1	180	11.1%
4	PyRAT	38	0	0	2	80	4.9%
5	nnenum	20	0	0	2	-100	0%
6	NNV	0	2	0	8	-1180	0%
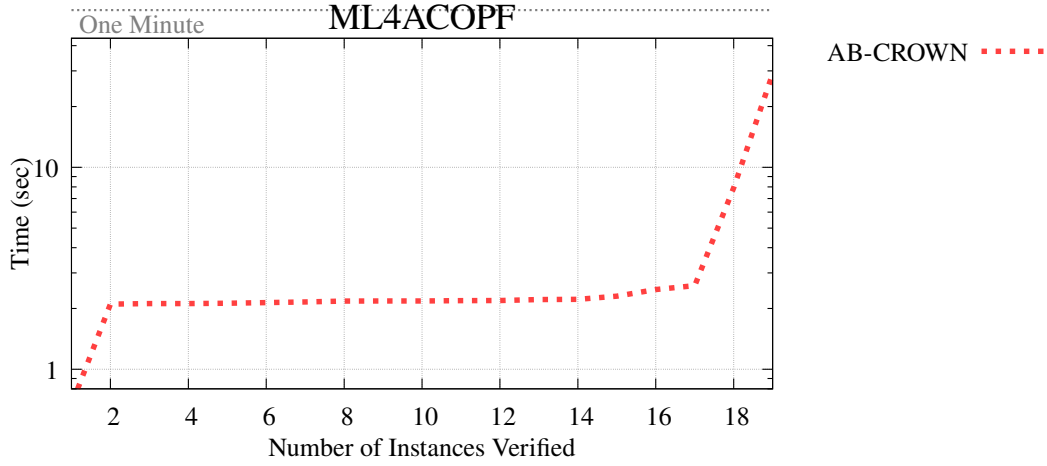
Figure 7: Cactus Plot for ML4ACOPF.
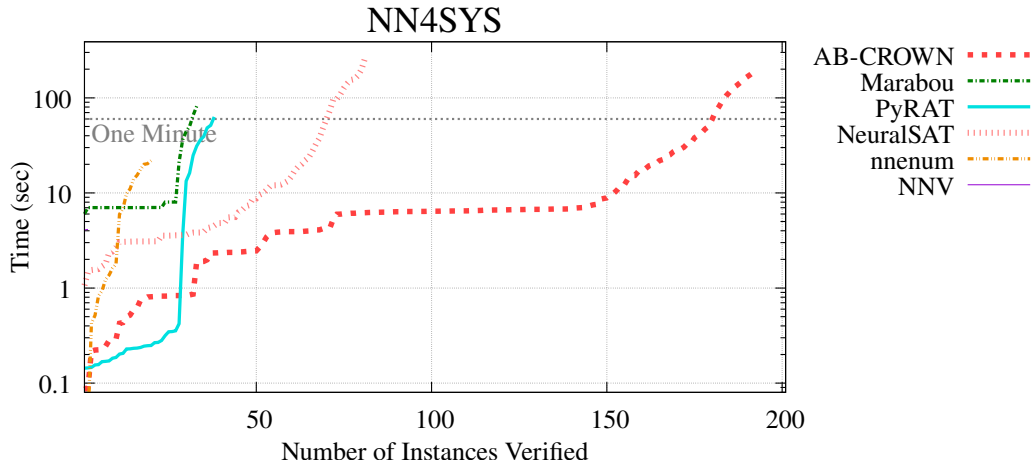
Figure 8: Cactus Plot for NN4SYS.

Table 8: Benchmark `2023-tllverifybench`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	NeuralSAT	15	17	0	0	320	100.0%
2	FastBATLLNN	15	17	0	0	320	100.0%
3	α-β-CROWN	15	17	0	0	320	100.0%
4	PyRAT	10	12	0	0	220	68.8%
5	Marabou	5	17	0	0	220	68.8%
6	nnenum	2	16	0	0	180	56.2%
7	NNV	1	16	0	0	170	53.1%

TLL Verify Bench (2023)
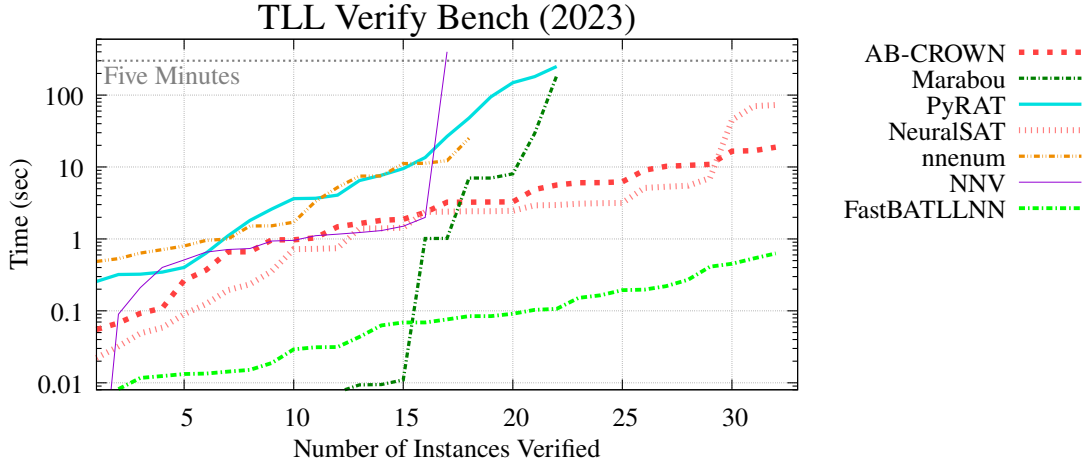
Figure 9: Cactus Plot for TLL Verify Bench (2023).

Table 9: Benchmark `2023-traffic-signs-recognition`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	Marabou	0	18	0	1	30	100.0%
2	PyRAT	0	7	0	1	-80	0%
3	NeuralSAT	0	31	0	4	-290	0%
4	α-β-CROWN	0	39	0	3	-60	0%

Traffic Signs Recognition
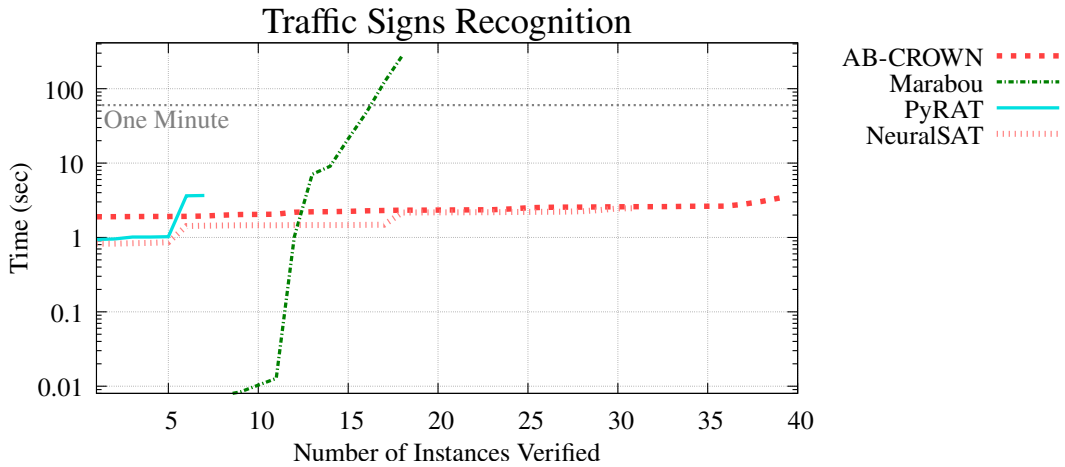
Figure 10: Cactus Plot for Traffic Signs Recognition.

Table 10: Benchmark `2023-vggnet16`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	15	0	0	0	150	100.0%
2	nnenum	14	0	0	0	140	93.3%
3	PyRAT	13	1	0	0	140	93.3%
4	NeuralSAT	5	1	0	0	60	40.0%
5	Marabou	2	1	0	0	30	20.0%
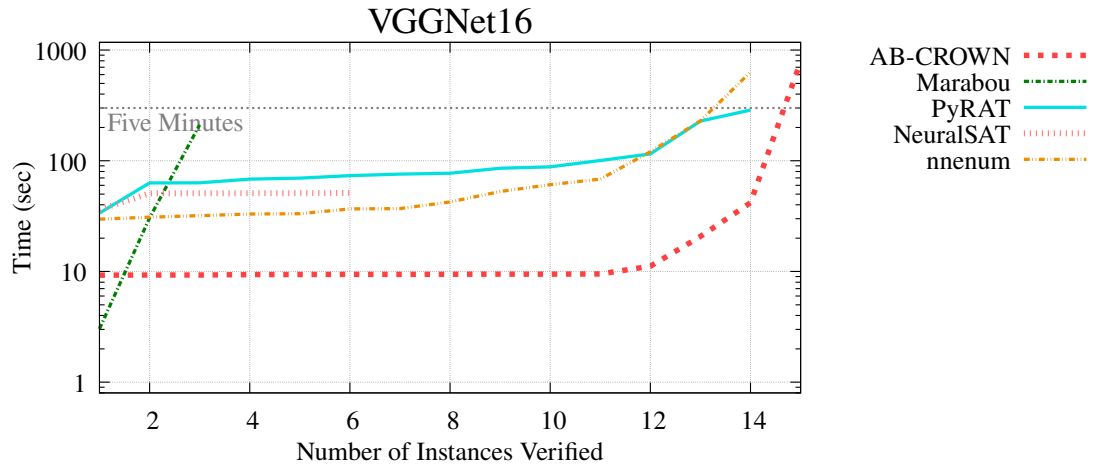
Figure 11: Cactus Plot for VGGNet16.

Table 11: Benchmark `2023-vit`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	Marabou	200	0	0	0	2000	100.0%
2	α-β-CROWN	79	0	0	0	790	39.5%
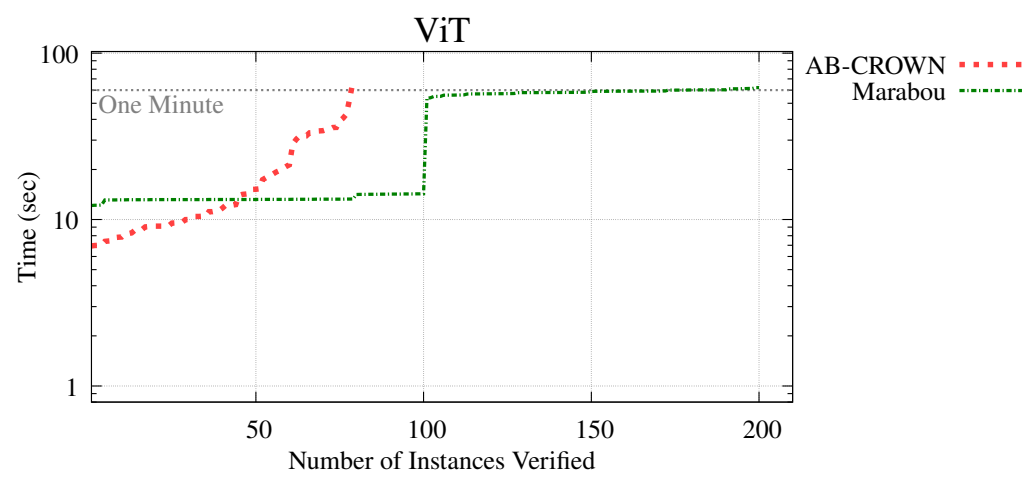
Figure 12: Cactus Plot for ViT.

3 Unscored Benchmarks

Table 12: Benchmark `2022-carvana-unet-2022`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	39	0	0	0	390	100.0%
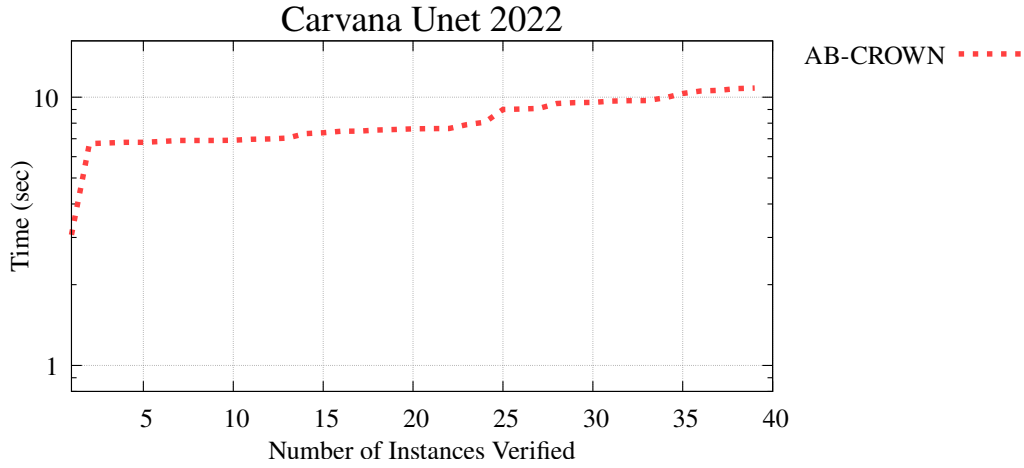
Figure 13: Cactus Plot for Carvana Unet 2022.

Table 13: Benchmark `2022-cifar100-tinyimagenet-resnet`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	69	3	0	0	720	100.0%
2	NeuralSAT	56	3	0	0	590	81.9%

CIFAR100 Tiny ImageNet ResNet
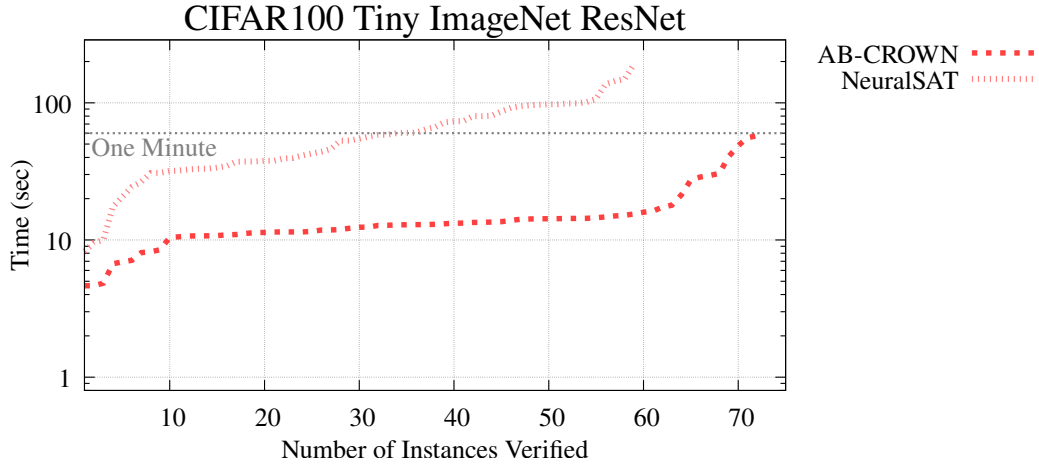
Figure 14: Cactus Plot for CIFAR100 Tiny ImageNet ResNet.

Table 14: Benchmark `2022-cifar2020`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	NeuralSAT	148	42	0	0	1900	100.0%
2	α-β-CROWN	148	41	0	0	1890	99.5%
3	PyRAT	96	39	0	0	1350	71.1%
4	nnenum	66	19	0	0	850	44.7%
5	NNV	32	6	0	0	380	20.0%
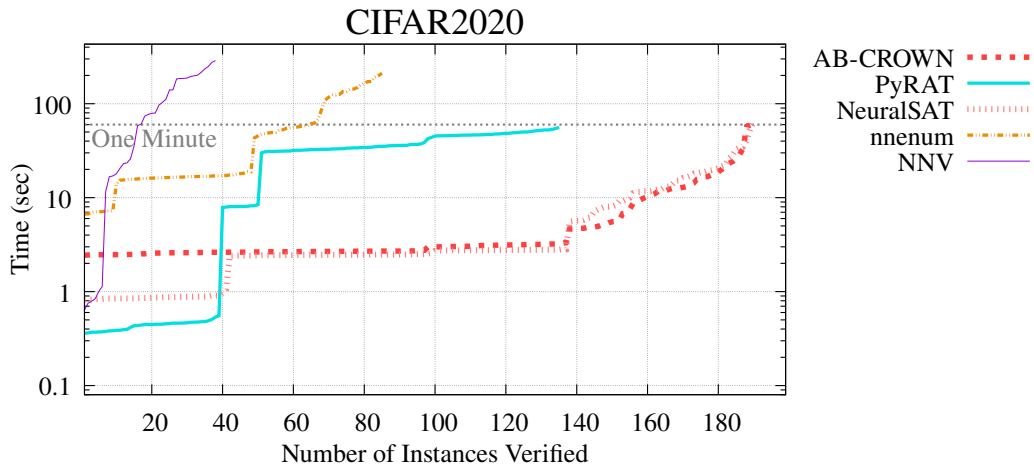
CIFAR2020

Figure 15: Cactus Plot for CIFAR2020.

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Table 15: Benchmark `2022-cifar-biasfield`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	68	1	0	0	690	100.0%
2	NeuralSAT	67	1	0	0	680	98.6%
3	PyRAT	51	1	0	0	520	75.4%
4	nnenum	18	0	0	0	180	26.1%
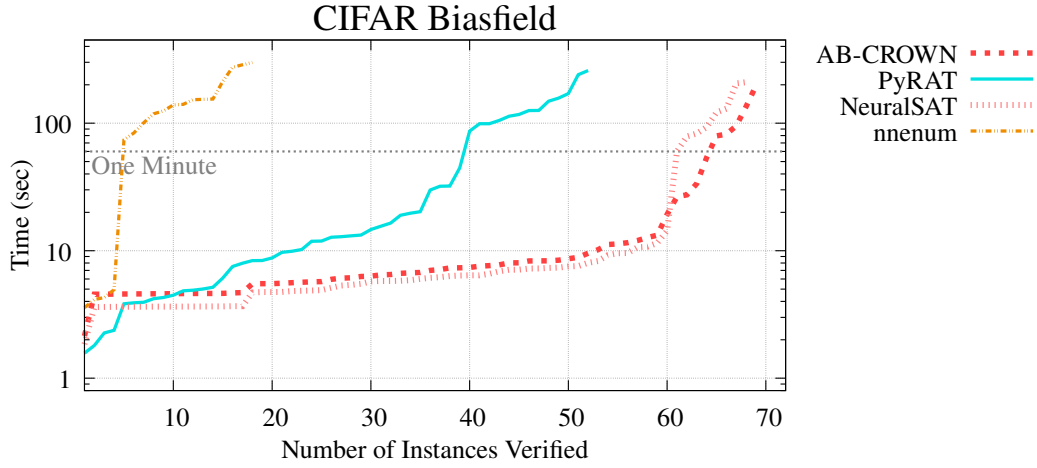
Figure 16: Cactus Plot for CIFAR Biasfield.

Table 16: Benchmark `2022-mnist-fc`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	68	18	0	0	860	100.0%
2	NeuralSAT	46	18	0	0	640	74.4%
3	nnenum	48	11	0	0	590	68.6%
4	PyRAT	35	16	0	0	510	59.3%
5	NNV	30	4	0	0	340	39.5%

Table 17: Benchmark `2022-nn4sys`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	150	0	0	2	1200	100.0%
2	NeuralSAT	76	0	0	2	460	38.3%
3	nnenum	20	0	0	2	-100	0%
4	PyRAT	12	0	0	2	-180	0%
5	NNV	0	2	0	8	-1180	0%
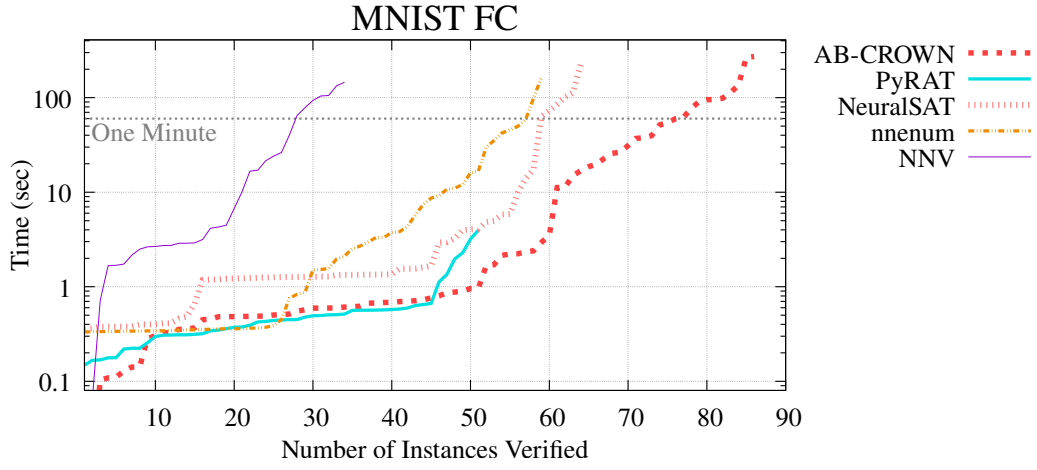
MNIST FC

Figure 17: Cactus Plot for MNIST FC.
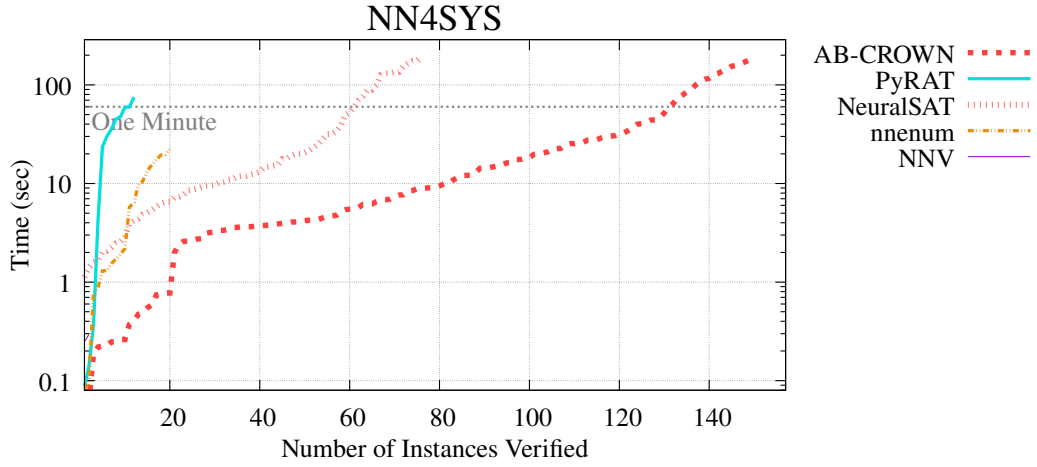
NN4SYS

Figure 18: Cactus Plot for NN4SYS.

Table 18: Benchmark `2022-oval21`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	25	1	0	0	260	100.0%
2	NeuralSAT	19	1	0	0	200	76.9%
3	nnenum	3	1	0	0	40	15.4%
4	NNV	4	0	0	0	40	15.4%
5	PyRAT	1	1	0	0	20	7.7%
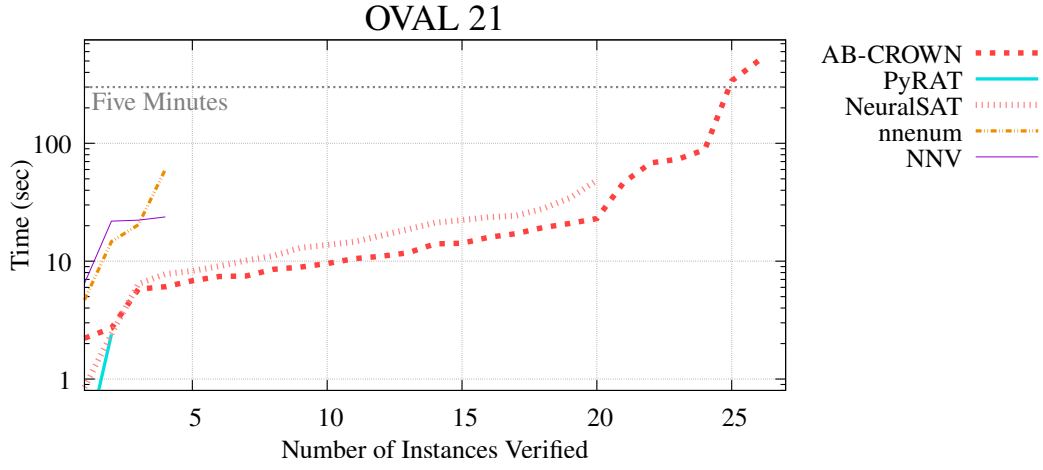
Figure 19: Cactus Plot for OVAL 21.

Table 19: Benchmark `2022-reach-prob-density`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	nnenum	22	14	0	0	360	100.0%
2	α-β-CROWN	22	14	0	0	360	100.0%
3	NeuralSAT	22	12	0	0	340	94.4%
4	PyRAT	17	7	0	0	240	66.7%
5	NNV	9	0	0	0	90	25.0%
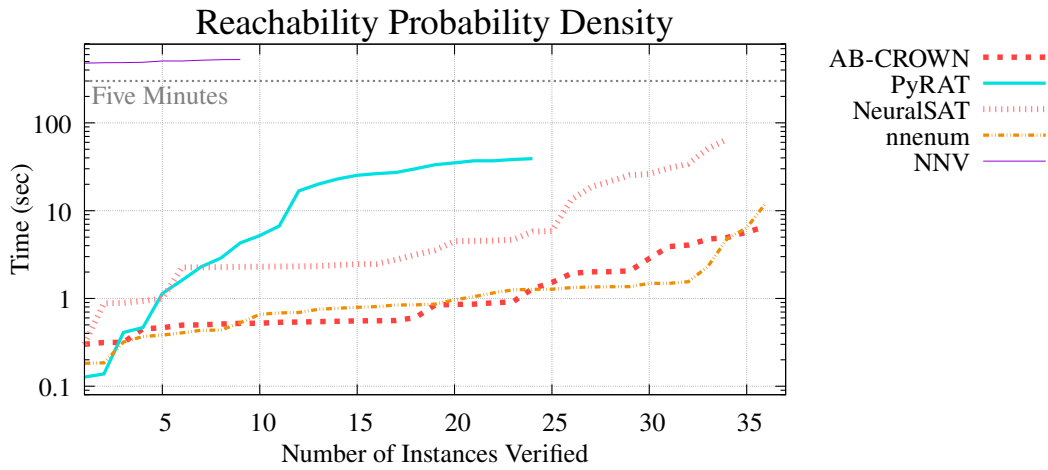
Figure 20: Cactus Plot for Reachability Probability Density.

Table 20: Benchmark `2022-rl-benchmarks`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	NeuralSAT	193	103	0	0	2960	100.0%
2	α-β-CROWN	193	103	0	0	2960	100.0%
3	nnenum	191	103	0	0	2940	99.3%
4	NNV	177	90	0	0	2670	90.2%
5	PyRAT	191	96	0	3	2420	81.8%
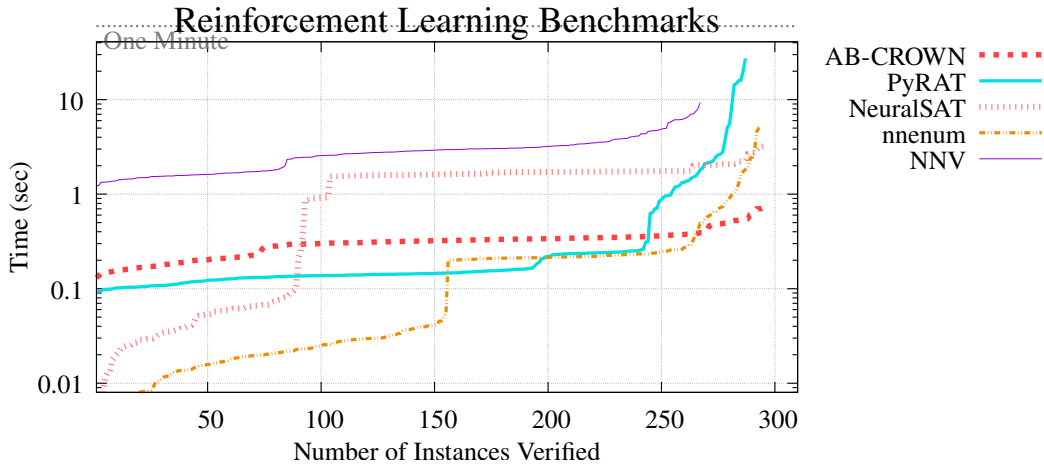
Figure 21: Cactus Plot for Reinforcement Learning Benchmarks.

Table 21: Benchmark `2022-sri-resnet-a`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	20	12	0	0	320	100.0%
2	NeuralSAT	18	12	0	0	300	93.8%
3	PyRAT	5	11	0	0	160	50.0%

Table 22: Benchmark `2022-sri-resnet-b`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	NeuralSAT	28	11	0	0	390	100.0%
2	α-β-CROWN	28	11	0	0	390	100.0%
3	PyRAT	13	11	0	0	240	61.5%
4	NNV	1	0	0	1	-140	0%
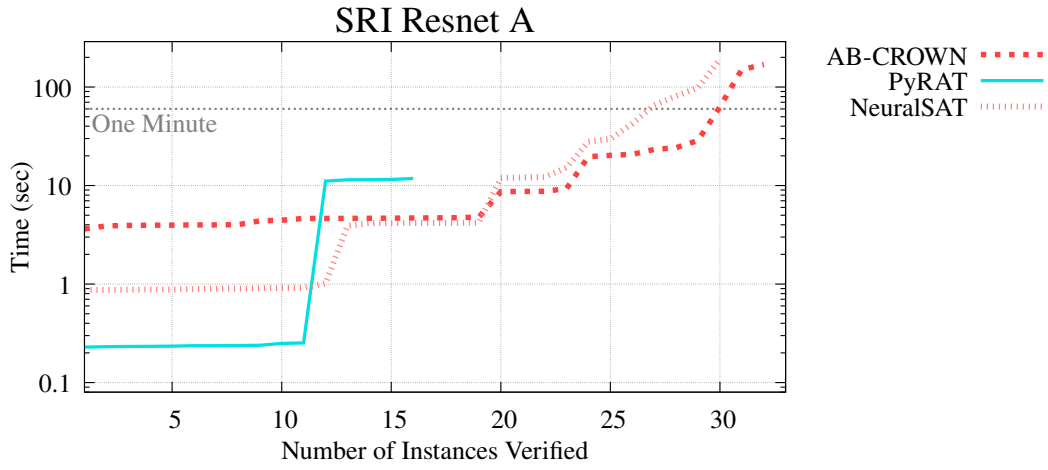
SRI Resnet A

Figure 22: Cactus Plot for SRI Resnet A.
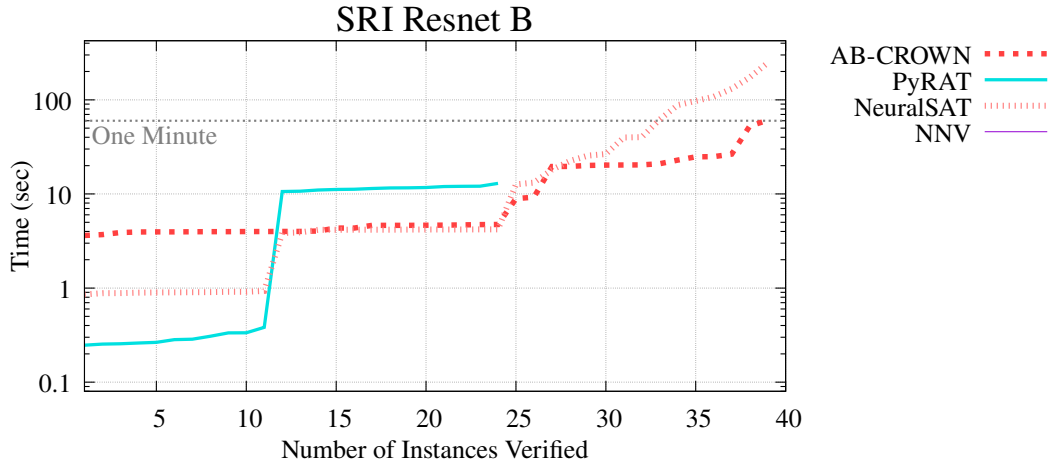
SRI Resnet B

Figure 23: Cactus Plot for SRI Resnet B.

Table 23: Benchmark `2022-tllverifybench`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	NeuralSAT	11	21	0	0	320	100.0%
2	FastBATLLNN	11	21	0	0	320	100.0%
3	α-β-CROWN	11	21	0	0	320	100.0%
4	PyRAT	9	17	0	0	260	81.2%
5	nnenum	1	21	0	0	220	68.8%
6	NNV	0	21	0	0	210	65.6%

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TLL Verify Bench (2022)
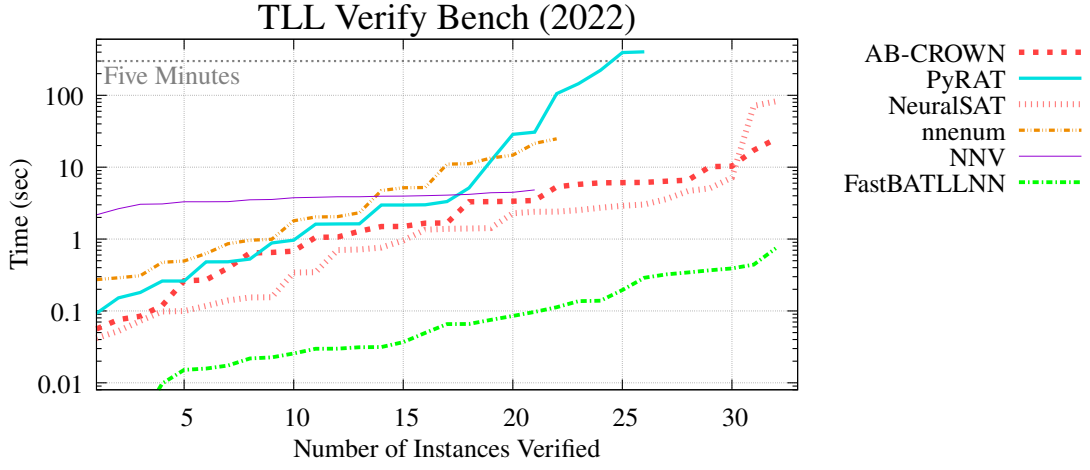
Figure 24: Cactus Plot for TLL Verify Bench (2022).

Table 24: Benchmark `2022-vggnet16-2022`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	14	1	0	0	150	100.0%
2	nnenum	11	1	0	0	120	80.0%
3	PyRAT	9	1	0	0	100	66.7%
4	NeuralSAT	5	1	0	0	60	40.0%
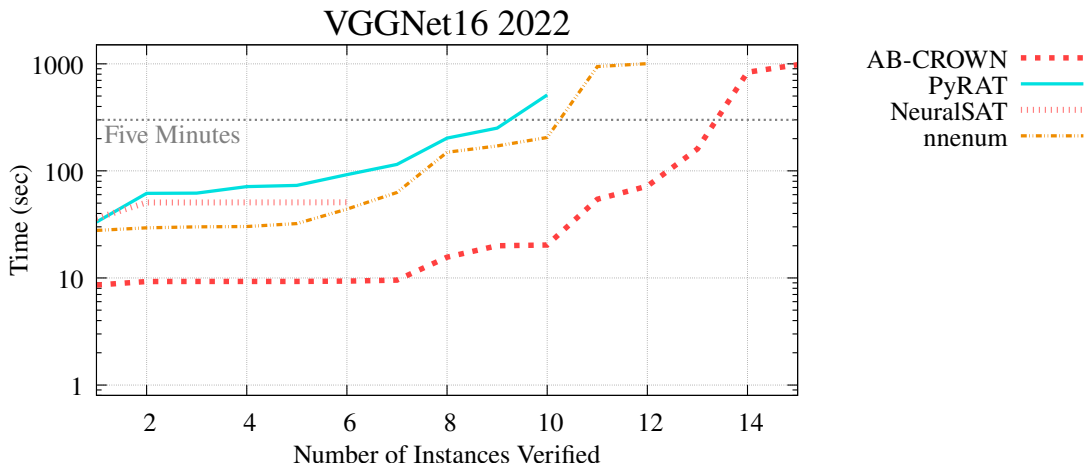
VGGNet16 2022

Figure 25: Cactus Plot for VGGNet16 2022.

Table 25: Benchmark `2023-cctsdb-yolo`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	11	28	0	0	390	100.0%

CCTSDb YOLO

AB-CROWN ·····

Time (sec)

Number of Instances Verified
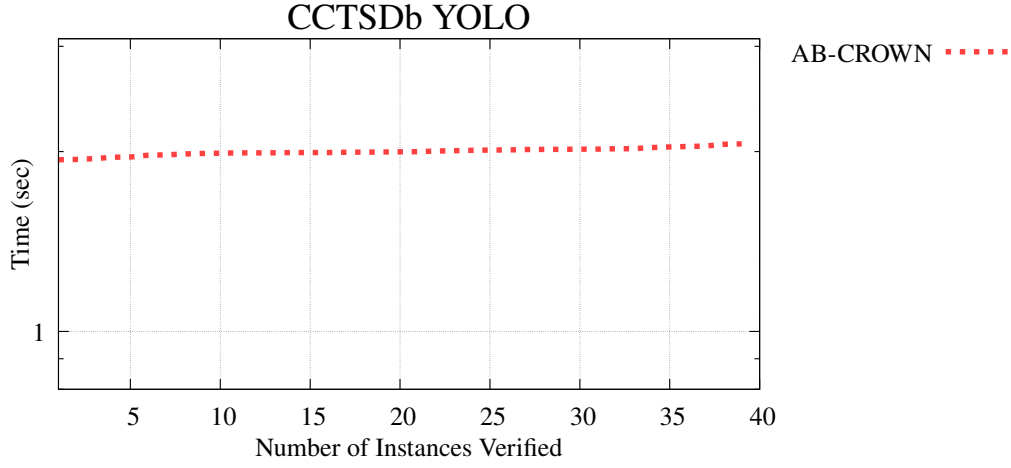
Figure 26: Cactus Plot for CCTSDb YOLO.

Table 26: Benchmark `2023-collins-yolo-robustness`

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

Collins YOLO Robustness

AB-CROWN ·····
PyRAT ——

Time (sec)

Number of Instances Verified
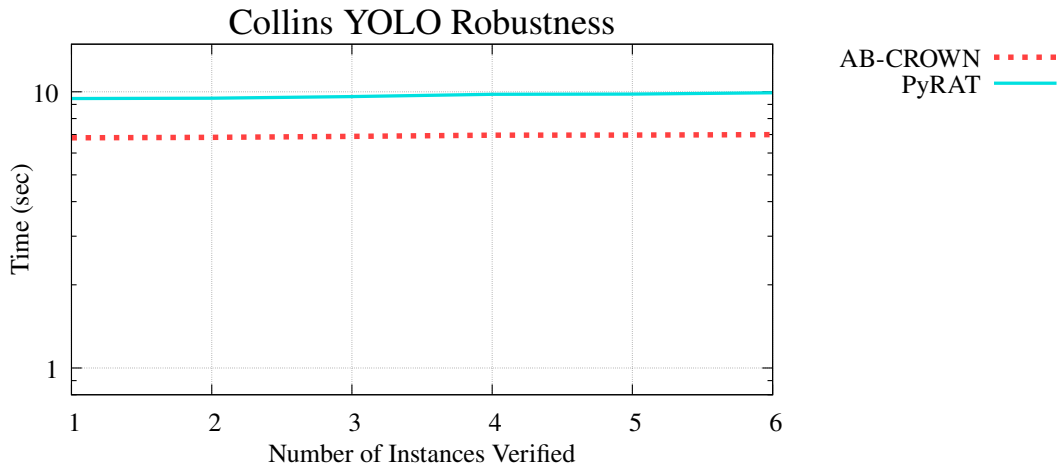
Figure 27: Cactus Plot for Collins YOLO Robustness.

Table 27: Benchmark `2023-metaroom`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	94	5	0	0	990	100.0%
2	NeuralSAT	92	5	0	0	970	98.0%
3	PyRAT	93	2	0	0	950	96.0%
4	nnenum	51	2	0	0	530	53.5%
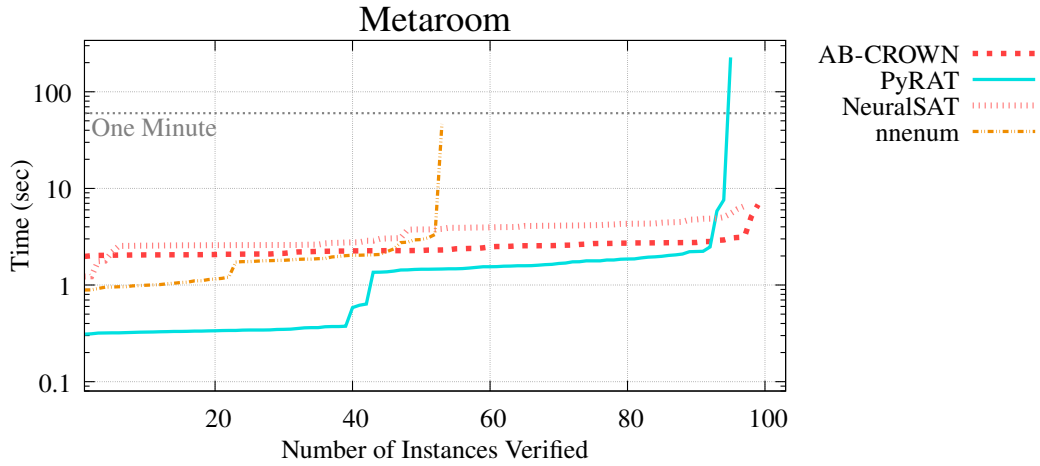
Figure 28: Cactus Plot for Metaroom.

Table 28: Benchmark `2023-yolo`

#	Tool	Verified	Falsified	Fastest	Penalty	Score	Percent
1	α-β-CROWN	63	0	0	0	630	100.0%
2	PyRAT	41	0	0	0	410	65.1%
3	NNV	0	0	0	41	-6150	0%
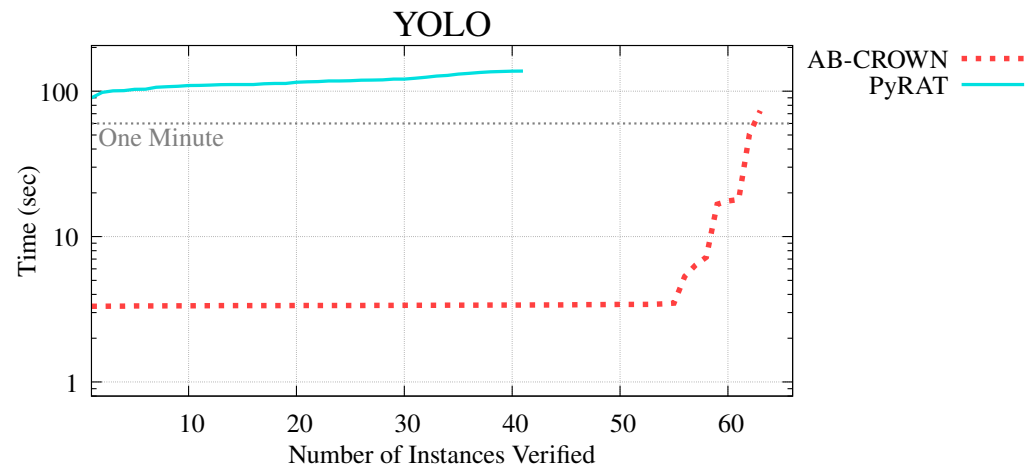
Figure 29: Cactus Plot for YOLO.

4 Stats

Table 29: Overhead

#	Tool	Seconds
1	FastBATLLNN	0.3
2	nnenum	0.9
3	Marabou	1.1
4	PyRAT	3.4
5	NeuralSAT	3.6
6	α-β-CROWN	5.7
7	NNV	15.9

Table 30: Num Benchmarks Participated

#	Tool	Count
1	α-β-CROWN	10
2	Marabou	9
3	PyRAT	8
4	NeuralSAT	8
5	nnenum	6
6	NNV	6
7	FastBATLLNN	1

Table 31: Num Instances Verified

#	Tool	Count
1	α-β-CROWN	717
2	Marabou	592
3	NeuralSAT	481
4	PyRAT	413
5	nnenum	317
6	NNV	182
7	FastBATLLNN	32

Table 32: Num SAT

#	Tool	Count
1	α-β-CROWN	149
2	NeuralSAT	138
3	Marabou	127
4	PyRAT	108
5	nnenum	101
6	NNV	87
7	FastBATLLNN	17

Table 33: Num UNSAT

#	Tool	Count
1	α-β-CROWN	568
2	Marabou	465
3	NeuralSAT	343
4	PyRAT	305
5	nnenum	216
6	NNV	95
7	FastBATLLNN	15

Table 34: Incorrect Results (or Missing CE)

#	Tool	Count
1	NNV	8
2	NeuralSAT	6
3	α-β-CROWN	5
4	PyRAT	3
5	nnenum	2
6	Marabou	2

5 Detailed Results

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Acasxu	0	UNSAT	2.47	7.02	1.39	3.23	0.43	-	-
2023 Acasxu	1	UNSAT	2.40	7.02	1.60	3.16	0.42	-	-
2023 Acasxu	2	UNSAT	2.46	7.02	2.32	3.23	0.60	-	-
2023 Acasxu	3	UNSAT	2.45	7.02	1.82	3.16	0.62	-	-
2023 Acasxu	4	UNSAT	2.36	7.02	1.29	3.15	0.49	-	-
2023 Acasxu	5	UNSAT	2.42	7.02	1.58	3.15	0.76	-	-
2023 Acasxu	6	UNSAT	2.29	7.02	1.38	3.18	0.50	-	-
2023 Acasxu	7	UNSAT	2.21	7.02	1.14	3.14	0.58	-	-
2023 Acasxu	8	UNSAT	2.14	7.02	0.92	3.13	0.50	-	-
2023 Acasxu	9	UNSAT	2.43	7.02	1.93	3.15	0.74	-	-
2023 Acasxu	10	UNSAT	2.55	8.03	2.56	3.29	0.94	-	-
2023 Acasxu	11	UNSAT	2.42	7.02	2.06	3.16	0.71	-	-
2023 Acasxu	12	UNSAT	2.45	7.02	1.85	3.20	0.63	-	-
2023 Acasxu	13	UNSAT	2.79	9.03	3.35	3.35	0.92	-	-
2023 Acasxu	14	UNSAT	2.61	8.03	2.95	3.37	0.81	-	-
2023 Acasxu	15	UNSAT	2.96	26.1	5.93	3.40	1.41	-	-
2023 Acasxu	16	UNSAT	3.03	18.1	5.88	3.43	1.22	-	-
2023 Acasxu	17	UNSAT	3.16	24.1	7.45	3.41	61.4	-	-
2023 Acasxu	18	UNSAT	2.43	7.02	2.07	3.16	0.64	-	-
2023 Acasxu	19	UNSAT	2.49	8.02	2.16	3.16	0.59	-	-
2023 Acasxu	20	UNSAT	2.39	7.02	2.06	3.21	0.72	-	-
2023 Acasxu	21	UNSAT	2.45	7.02	1.70	3.23	0.60	-	-
2023 Acasxu	22	UNSAT	2.59	8.03	2.75	3.35	0.84	-	-
2023 Acasxu	23	UNSAT	2.74	12.0	4.89	3.39	1.58	-	-
2023 Acasxu	24	UNSAT	2.83	19.1	5.11	3.40	1.30	-	-
2023 Acasxu	25	UNSAT	2.83	16.1	4.49	3.44	1.08	-	-
2023 Acasxu	26	UNSAT	3.59	39.2	6.42	3.56	0.98	-	-
2023 Acasxu	27	UNSAT	2.59	9.03	3.02	3.35	1.02	-	-
2023 Acasxu	28	UNSAT	2.37	7.02	2.20	3.17	0.76	-	-
2023 Acasxu	29	UNSAT	2.46	7.02	2.01	3.17	0.65	-	-
2023 Acasxu	30	UNSAT	2.43	8.03	1.98	3.23	0.59	-	-
2023 Acasxu	31	UNSAT	2.54	8.03	3.00	3.34	0.94	-	-
2023 Acasxu	32	UNSAT	2.99	23.1	6.47	3.48	1.86	-	-
2023 Acasxu	33	UNSAT	3.21	32.2	10.6	3.47	1.38	-	-
2023 Acasxu	34	UNSAT	3.04	23.1	5.55	3.43	1.16	-	-
2023 Acasxu	35	UNSAT	3.30	43.2	9.29	3.48	2.39	-	-
2023 Acasxu	36	UNSAT	2.43	7.02	1.92	3.17	0.60	-	-
2023 Acasxu	37	UNSAT	2.45	8.02	2.18	3.21	0.79	-	-
2023 Acasxu	38	UNSAT	2.46	7.02	1.64	3.18	0.67	-	-
2023 Acasxu	39	UNSAT	2.43	7.02	1.69	3.19	0.73	-	-
2023 Acasxu	40	UNSAT	2.61	8.02	2.59	3.29	0.82	-	-
2023 Acasxu	41	UNSAT	2.79	13.1	4.22	3.37	1.05	-	-
2023 Acasxu	42	UNSAT	2.81	11.0	4.28	3.37	1.03	-	-
2023 Acasxu	43	UNSAT	3.12	24.1	7.49	3.45	1.17	-	-
2023 Acasxu	44	UNSAT	2.86	16.1	6.23	3.36	1.37	-	-
2023 Acasxu	45	UNSAT	4.52	15.1	3.67	3.61	0.72	-	-
2023 Acasxu	46	SAT	0.06	<0.01	0.97	4.42	0.29	-	-
2023 Acasxu	47	SAT	1.96	3.02	10.1	4.71	0.67	-	-
2023 Acasxu	48	SAT	0.04	<0.01	0.44	4.14	0.34	-	-
2023 Acasxu	49	SAT	7.04	-	23.6	5.45	0.29	-	-
2023 Acasxu	50	SAT	4.15	<0.01	8.46	4.12	0.86	-	-
2023 Acasxu	51	UNSAT	2.86	18.1	4.35	3.36	0.79	-	-
2023 Acasxu	52	UNSAT	2.84	25.1	4.78	3.35	1.27	-	-
2023 Acasxu	53	UNSAT	3.03	21.1	4.32	3.36	0.90	-	-
2023 Acasxu	54	SAT	0.04	<0.01	0.53	0.07	0.24	-	-
2023 Acasxu	55	SAT	0.06	<0.01	0.45	0.05	0.22	3.16	-
2023 Acasxu	56	SAT	0.03	<0.01	0.54	0.05	0.22	1.98	-
2023 Acasxu	57	SAT	0.01	<0.01	0.19	0.10	0.22	-	-
2023 Acasxu	58	SAT	0.06	<0.01	0.49	0.08	0.22	3.13	-
2023 Acasxu	59	SAT	0.06	<0.01	0.37	0.07	0.22	1.89	-
2023 Acasxu	60	SAT	0.04	<0.01	0.49	0.06	0.21	1.90	-
2023 Acasxu	61	SAT	0.04	<0.01	0.43	0.06	0.22	2.13	-
2023 Acasxu	62	SAT	0.05	<0.01	0.55	0.08	0.36	-	-
2023 Acasxu	63	SAT	0.05	<0.01	0.45	0.06	0.22	2.58	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Acasxu	64	SAT	1.61	<0.01	2.25	4.13	0.23	-	-
2023 Acasxu	65	UNSAT	59.0	-	-	-	4.38	-	-
2023 Acasxu	66	SAT	0.05	<0.01	0.69	0.07	0.21	2.91	-
2023 Acasxu	67	SAT	0.07	<0.01	0.47	0.08	0.22	1.99	-
2023 Acasxu	68	SAT	0.07	<0.01	0.67	0.04	0.23	1.71	-
2023 Acasxu	69	SAT	0.06	<0.01	1.41	0.05	0.35	-	-
2023 Acasxu	70	SAT	0.02	<0.01	0.47	0.17	0.23	-	-
2023 Acasxu	71	SAT	0.06	<0.01	0.46	0.05	0.22	3.25	-
2023 Acasxu	72	SAT	0.06	<0.01	0.52	0.16	0.23	-	-
2023 Acasxu	73	UNSAT	52.8	-	-	47.4	4.73	-	-
2023 Acasxu	74	SAT	0.01	<0.01	0.48	0.05	0.22	3.33	-
2023 Acasxu	75	SAT	0.07	<0.01	0.64	0.05	0.27	2.01	-
2023 Acasxu	76	SAT	0.06	<0.01	0.19	0.08	0.22	-	-
2023 Acasxu	77	SAT	0.06	<0.01	0.51	0.05	0.23	3.33	-
2023 Acasxu	78	SAT	0.02	<0.01	0.41	0.04	0.22	1.66	-
2023 Acasxu	79	SAT	0.09	<0.01	0.45	0.04	0.22	2.08	-
2023 Acasxu	80	SAT	0.07	<0.01	0.66	4.12	0.23	-	-
2023 Acasxu	81	SAT	0.03	<0.01	0.43	0.06	0.22	-	-
2023 Acasxu	82	SAT	0.06	<0.01	0.61	0.03	0.22	-	-
2023 Acasxu	83	SAT	24.2	83.5	-	-	0.83	-	-
2023 Acasxu	84	SAT	<0.01	<0.01	0.56	0.10	0.22	-	-
2023 Acasxu	85	SAT	0.06	<0.01	0.47	0.05	0.21	3.08	-
2023 Acasxu	86	SAT	0.06	<0.01	0.44	0.03	0.23	1.83	-
2023 Acasxu	87	SAT	0.04	<0.01	0.44	0.05	0.22	1.38	-
2023 Acasxu	88	SAT	0.06	<0.01	0.54	0.16	0.22	1.78	-
2023 Acasxu	89	SAT	0.07	<0.01	0.27	0.04	0.22	1.50	-
2023 Acasxu	90	UNSAT	13.7	17.3	75.5	7.88	0.57	-	-
2023 Acasxu	91	UNSAT	2.18	9.03	3.28	3.26	0.55	-	-
2023 Acasxu	92	UNSAT	3.03	14.1	5.10	3.50	0.44	-	-
2023 Acasxu	93	UNSAT	1.49	7.02	0.71	3.01	0.24	6.70	-
2023 Acasxu	94	UNSAT	1.26	7.02	1.05	2.29	0.28	5.18	-
2023 Acasxu	95	UNSAT	0.69	6.01	0.21	1.73	0.20	4.81	-
2023 Acasxu	96	SAT	0.06	<0.01	0.15	0.06	0.21	1.82	-
2023 Acasxu	97	SAT	0.05	<0.01	0.17	0.04	0.22	1.93	-
2023 Acasxu	98	SAT	0.08	<0.01	0.16	<0.01	0.21	2.04	-
2023 Acasxu	99	UNSAT	2.40	8.03	2.46	3.25	0.43	-	-
2023 Acasxu	100	UNSAT	2.29	8.02	2.88	3.23	0.36	-	-
2023 Acasxu	101	UNSAT	2.12	8.02	2.45	3.15	0.42	-	-
2023 Acasxu	102	UNSAT	0.62	6.01	0.17	1.75	0.02	6.07	-
2023 Acasxu	103	UNSAT	1.53	7.02	0.61	2.51	0.22	5.37	-
2023 Acasxu	104	UNSAT	0.65	6.02	0.17	1.74	0.22	5.20	-
2023 Acasxu	105	UNSAT	0.64	6.01	0.23	1.80	0.22	5.58	-
2023 Acasxu	106	UNSAT	0.65	6.02	0.38	1.75	0.24	4.47	-
2023 Acasxu	107	UNSAT	0.66	6.01	0.18	1.78	0.01	3.87	-
2023 Acasxu	108	UNSAT	1.52	7.02	0.86	2.99	0.22	5.29	-
2023 Acasxu	109	UNSAT	1.63	8.03	1.45	3.12	0.51	-	-
2023 Acasxu	110	UNSAT	1.53	7.02	1.36	3.08	0.38	6.90	-
2023 Acasxu	111	UNSAT	1.99	7.02	0.73	3.00	0.26	99.1	-
2023 Acasxu	112	UNSAT	1.24	7.02	0.56	2.26	0.23	5.87	-
2023 Acasxu	113	UNSAT	1.57	7.02	0.82	2.99	0.24	91.7	-
2023 Acasxu	114	UNSAT	0.63	7.02	0.19	1.76	0.20	4.99	-
2023 Acasxu	115	UNSAT	1.19	7.02	0.53	2.29	0.22	5.23	-
2023 Acasxu	116	UNSAT	1.32	7.02	0.81	2.30	0.21	4.62	-
2023 Acasxu	117	UNSAT	2.10	8.04	2.09	2.79	0.24	94.6	-
2023 Acasxu	118	UNSAT	2.17	10.0	3.00	3.23	0.51	-	-
2023 Acasxu	119	UNSAT	2.55	8.03	2.14	3.22	0.59	-	-
2023 Acasxu	120	UNSAT	1.51	7.02	0.65	2.96	0.22	6.72	-
2023 Acasxu	121	UNSAT	0.96	7.02	0.19	2.06	0.21	4.54	-
2023 Acasxu	122	UNSAT	1.53	7.02	0.77	3.03	0.22	7.12	-
2023 Acasxu	123	UNSAT	1.49	7.02	0.62	3.00	0.22	4.94	-
2023 Acasxu	124	UNSAT	0.63	7.02	0.21	1.75	0.27	5.02	-
2023 Acasxu	125	UNSAT	1.95	7.02	0.76	2.99	0.23	5.06	-
2023 Acasxu	126	UNSAT	2.58	9.04	3.53	3.30	0.42	-	-
2023 Acasxu	127	UNSAT	2.01	7.02	1.33	2.79	0.25	5.65	-
2023 Acasxu	128	UNSAT	1.49	7.03	0.89	2.56	0.25	4.99	-
2023 Acasxu	129	UNSAT	1.45	7.02	0.50	2.53	0.21	4.68	-
2023 Acasxu	130	UNSAT	1.54	7.02	0.65	2.98	0.21	5.16	-
2023 Acasxu	131	UNSAT	1.25	7.02	0.74	2.24	0.23	5.39	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Acasxu	132	UNSAT	0.94	7.02	0.19	2.05	<0.01	3.89	-
2023 Acasxu	133	UNSAT	1.22	7.02	0.65	2.22	0.23	4.52	-
2023 Acasxu	134	UNSAT	1.54	7.02	0.29	2.97	<0.01	3.36	-
2023 Acasxu	135	UNSAT	3.32	8.03	10.7	3.54	0.44	-	-
2023 Acasxu	136	UNSAT	2.60	8.03	2.74	3.60	0.43	-	-
2023 Acasxu	137	UNSAT	2.08	8.03	3.27	3.34	0.36	-	-
2023 Acasxu	138	UNSAT	1.54	7.02	0.92	3.09	0.22	76.5	-
2023 Acasxu	139	UNSAT	1.32	7.02	1.14	2.37	0.35	-	-
2023 Acasxu	140	UNSAT	1.23	7.03	0.95	2.32	0.29	5.76	-
2023 Acasxu	141	SAT	0.06	<0.01	0.15	0.06	0.22	1.85	-
2023 Acasxu	142	SAT	0.05	<0.01	0.19	0.06	0.20	1.29	-
2023 Acasxu	143	SAT	0.08	<0.01	0.22	0.01	0.20	1.42	-
2023 Acasxu	144	UNSAT	1.54	7.02	0.89	3.01	0.27	-	-
2023 Acasxu	145	UNSAT	1.51	7.02	0.91	2.60	0.30	-	-
2023 Acasxu	146	UNSAT	1.23	7.02	0.90	2.28	0.22	5.40	-
2023 Acasxu	147	UNSAT	1.53	7.02	0.61	2.96	0.21	4.75	-
2023 Acasxu	148	UNSAT	1.55	7.02	0.66	2.59	0.24	5.17	-
2023 Acasxu	149	UNSAT	1.54	7.02	0.69	2.55	0.22	6.11	-
2023 Acasxu	150	UNSAT	1.47	7.02	0.50	2.50	0.22	4.97	-
2023 Acasxu	151	UNSAT	1.96	7.02	0.75	3.04	0.27	95.3	-
2023 Acasxu	152	UNSAT	0.69	6.01	0.20	1.78	0.01	4.31	-
2023 Acasxu	153	UNSAT	1.50	7.02	1.13	3.03	0.24	5.16	-
2023 Acasxu	154	UNSAT	1.54	7.03	0.91	2.61	0.29	4.77	-
2023 Acasxu	155	UNSAT	0.94	7.02	0.20	2.05	0.21	4.16	-
2023 Acasxu	156	UNSAT	1.22	7.03	0.57	2.21	0.21	4.53	-
2023 Acasxu	157	UNSAT	1.53	8.03	0.67	3.00	0.25	5.47	-
2023 Acasxu	158	UNSAT	1.95	7.03	0.67	3.01	0.22	6.12	-
2023 Acasxu	159	UNSAT	1.50	7.02	0.54	2.50	0.23	4.45	-
2023 Acasxu	160	UNSAT	1.55	7.02	0.86	2.59	0.29	72.1	-
2023 Acasxu	161	UNSAT	1.53	7.02	0.68	2.99	0.33	5.89	-
2023 Acasxu	162	UNSAT	0.69	7.02	0.21	1.78	0.21	4.17	-
2023 Acasxu	163	UNSAT	1.95	7.03	0.63	2.98	0.23	5.28	-
2023 Acasxu	164	UNSAT	1.50	7.02	0.77	2.55	0.23	4.97	-
2023 Acasxu	165	UNSAT	1.51	7.02	0.64	3.00	0.24	80.9	-
2023 Acasxu	166	UNSAT	1.52	7.02	0.51	2.54	0.22	6.81	-
2023 Acasxu	167	UNSAT	1.52	7.02	0.50	2.52	0.21	5.02	-
2023 Acasxu	168	UNSAT	1.26	7.02	0.75	2.28	0.21	5.45	-
2023 Acasxu	169	UNSAT	1.52	7.03	0.63	2.99	0.22	5.56	-
2023 Acasxu	170	UNSAT	1.50	7.03	0.54	2.54	0.22	4.82	-
2023 Acasxu	171	UNSAT	1.49	7.02	0.54	3.01	0.22	4.99	-
2023 Acasxu	172	UNSAT	1.53	7.02	0.50	2.92	0.21	4.49	-
2023 Acasxu	173	UNSAT	1.52	7.02	0.65	2.96	0.23	4.63	-
2023 Acasxu	174	UNSAT	1.17	7.02	0.51	2.24	0.23	4.52	-
2023 Acasxu	175	UNSAT	1.60	7.02	0.59	2.98	0.22	5.34	-
2023 Acasxu	176	UNSAT	0.65	7.02	0.22	1.75	0.23	4.66	-
2023 Acasxu	177	UNSAT	0.95	7.02	0.21	2.06	0.22	5.01	-
2023 Acasxu	178	UNSAT	1.50	7.02	0.68	2.54	0.22	5.73	-
2023 Acasxu	179	UNSAT	1.23	7.02	0.56	2.25	0.22	5.00	-
2023 Acasxu	180	UNSAT	22.1	-	81.4	9.82	0.95	-	-
2023 Acasxu	181	UNSAT	14.3	-	30.2	3.34	3.74	-	-
2023 Acasxu	182	SAT	1.90	62.7	-	5.16	30.6	-	-
2023 Acasxu	183	SAT	0.06	<0.01	3.30	4.46	0.27	-	-
2023 Acasxu	184	UNSAT	6.63	106	16.6	4.55	2.05	-	-
2023 Acasxu	185	UNSAT	5.68	24.1	3.43	3.57	0.64	-	-
2023 Cgan	0	SAT	1.73	<0.01	2.75	0.52	9.98	2.37	-
2023 Cgan	1	SAT	1.70	<0.01	0.35	0.47	31.1	2.42	-
2023 Cgan	2	SAT	1.72	<0.01	2.28	0.46	13.7	2.13	-
2023 Cgan	3	UNSAT	5.68	-	10.6	16.4	24.9	-	-
2023 Cgan	4	SAT	1.72	<0.01	1.76	0.45	10.2	2.14	-
2023 Cgan	5	UNSAT	8.02	-	13.1	810	53.8	-	-
2023 Cgan	6	SAT	1.70	<0.01	0.21	0.42	0.94	2.46	-
2023 Cgan	7	SAT	1.75	<0.01	0.30	0.45	14.7	2.08	-
2023 Cgan	8	UNSAT	13.6	-	71.6	-	159	-	-
2023 Cgan	9	UNSAT	8.80	-	21.4	-	39.4	98.1	-
2023 Cgan	10	SAT	1.69	0.01	0.26	0.46	0.95	2.47	-
2023 Cgan	11	SAT	1.74	<0.01	0.23	0.44	0.87	2.64	-
2023 Cgan	12	UNSAT	9.95	-	19.5	-	30.0	28.0	-
2023 Cgan	13	UNSAT	9.56	-	48.2	-	57.1	137	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Cgan	14	SAT	1.72	<0.01	0.24	0.47	1.30	2.15	-
2023 Cgan	15	SAT	1.75	<0.01	0.26	0.48	55.6	2.33	-
2023 Cgan	16	UNSAT	5.89	-	10.5	22.3	-	-	-
2023 Cgan	17	SAT	1.73	<0.01	0.24	0.43	7.89	2.15	-
2023 Cgan	18	UNSAT	5.07	-	9.25	-	-	-	-
2023 Cgan	19	SAT	9.44	1.01	-	-	-	-	-
2023 Cgan	20	SAT	9.39	1.01	-	-	-	-	-
2023 Collins Rul Cnn	0	SAT	1.50	0.01	0.43	0.47	0.71	3.83	-
2023 Collins Rul Cnn	1	SAT	1.53	<0.01	0.46	3.34	0.75	0.83	-
2023 Collins Rul Cnn	2	UNSAT	3.13	8.02	0.81	1.78	0.68	2.25	-
2023 Collins Rul Cnn	3	UNSAT	3.10	7.02	0.81	1.75	0.76	1.78	-
2023 Collins Rul Cnn	4	SAT	1.54	<0.01	0.46	3.32	0.68	0.57	-
2023 Collins Rul Cnn	5	UNSAT	3.14	9.13	0.80	1.96	0.75	2.47	-
2023 Collins Rul Cnn	6	SAT	1.50	<0.01	0.44	3.36	0.87	0.80	-
2023 Collins Rul Cnn	7	UNSAT	3.25	10.1	0.82	1.93	0.70	2.45	-
2023 Collins Rul Cnn	8	UNSAT	3.09	8.03	0.82	1.76	0.77	2.18	-
2023 Collins Rul Cnn	9	UNSAT	3.11	7.02	0.80	1.76	0.75	2.12	-
2023 Collins Rul Cnn	10	SAT	1.52	<0.01	0.44	0.44	0.69	0.62	-
2023 Collins Rul Cnn	11	SAT	1.54	<0.01	0.47	0.42	0.73	0.81	-
2023 Collins Rul Cnn	12	UNSAT	3.08	10.1	0.83	1.75	0.74	2.82	-
2023 Collins Rul Cnn	13	UNSAT	3.12	9.04	0.81	1.78	0.76	3.22	-
2023 Collins Rul Cnn	14	UNSAT	3.27	10.2	0.84	1.91	0.70	3.36	-
2023 Collins Rul Cnn	15	UNSAT	3.15	9.11	0.84	1.95	0.74	3.35	-
2023 Collins Rul Cnn	16	UNSAT	3.15	7.02	0.90	1.76	0.73	3.29	-
2023 Collins Rul Cnn	17	SAT	1.52	<0.01	0.51	4.55	0.71	1.33	-
2023 Collins Rul Cnn	18	UNSAT	3.09	7.02	0.81	1.77	0.70	2.00	-
2023 Collins Rul Cnn	19	SAT	1.57	<0.01	0.45	0.42	7.39	1.02	-
2023 Collins Rul Cnn	20	SAT	1.53	<0.01	0.44	0.44	0.77	0.65	-
2023 Collins Rul Cnn	21	SAT	1.53	<0.01	0.45	0.48	0.76	0.91	-
2023 Collins Rul Cnn	22	SAT	1.56	<0.01	0.44	0.45	0.73	1.21	-
2023 Collins Rul Cnn	23	SAT	1.55	<0.01	0.46	4.20	0.79	0.95	-
2023 Collins Rul Cnn	24	UNSAT	3.09	10.0	0.83	1.81	0.72	2.35	-
2023 Collins Rul Cnn	25	UNSAT	3.22	10.0	0.84	1.77	0.68	2.56	-
2023 Collins Rul Cnn	26	UNSAT	3.25	14.1	0.85	1.96	0.78	2.44	-
2023 Collins Rul Cnn	27	UNSAT	3.16	10.0	0.94	1.94	0.75	2.63	-
2023 Collins Rul Cnn	28	SAT	1.53	<0.01	0.44	3.73	0.73	0.68	-
2023 Collins Rul Cnn	29	SAT	1.55	<0.01	0.46	0.42	0.72	0.82	-
2023 Collins Rul Cnn	30	UNSAT	3.24	10.0	0.86	1.78	0.77	2.88	-
2023 Collins Rul Cnn	31	UNSAT	3.09	10.0	0.86	1.82	0.79	2.83	-
2023 Collins Rul Cnn	32	SAT	1.54	<0.01	0.43	0.42	0.83	1.60	-
2023 Collins Rul Cnn	33	SAT	1.57	<0.01	0.44	0.43	0.78	1.40	-
2023 Collins Rul Cnn	34	SAT	1.57	<0.01	0.53	3.32	0.73	1.29	-
2023 Collins Rul Cnn	35	UNSAT	3.12	14.3	0.85	1.82	0.70	2.88	-
2023 Collins Rul Cnn	36	UNSAT	3.28	15.2	0.88	1.92	0.93	2.81	-
2023 Collins Rul Cnn	37	UNSAT	3.14	15.2	0.85	1.96	0.73	3.08	-
2023 Collins Rul Cnn	38	UNSAT	3.07	10.0	0.92	1.77	0.68	2.30	-
2023 Collins Rul Cnn	39	SAT	1.57	<0.01	0.46	4.53	0.78	0.63	-
2023 Collins Rul Cnn	40	UNSAT	3.14	10.0	0.88	1.77	0.70	2.55	-
2023 Collins Rul Cnn	41	SAT	1.54	<0.01	0.44	0.42	0.78	0.81	-
2023 Collins Rul Cnn	42	SAT	1.55	<0.01	0.44	0.41	0.70	0.71	-
2023 Collins Rul Cnn	43	UNSAT	3.44	48.8	1.52	1.97	0.82	-	-
2023 Collins Rul Cnn	44	SAT	1.56	<0.01	0.44	0.42	1.09	0.82	-
2023 Collins Rul Cnn	45	UNSAT	3.47	51.9	1.51	1.79	0.74	-	-
2023 Collins Rul Cnn	46	SAT	1.57	<0.01	0.49	0.44	0.79	0.95	-
2023 Collins Rul Cnn	47	UNSAT	3.48	47.0	1.50	1.94	0.95	-	-
2023 Collins Rul Cnn	48	UNSAT	3.62	48.9	1.53	1.92	0.85	-	-
2023 Collins Rul Cnn	49	UNSAT	3.48	49.8	1.48	1.98	0.72	-	-
2023 Collins Rul Cnn	50	SAT	1.52	<0.01	0.45	0.47	0.75	1.12	-
2023 Collins Rul Cnn	51	SAT	1.55	<0.01	0.45	0.45	0.74	0.85	-
2023 Collins Rul Cnn	52	UNSAT	3.50	49.9	1.54	1.84	0.76	-	-
2023 Collins Rul Cnn	53	UNSAT	3.66	46.9	1.58	1.95	0.93	-	-
2023 Collins Rul Cnn	54	SAT	1.61	<0.01	0.46	0.45	3.51	0.92	-
2023 Collins Rul Cnn	55	UNSAT	3.50	52.9	1.57	1.93	0.81	-	-
2023 Collins Rul Cnn	56	UNSAT	3.55	50.8	1.57	1.96	1.03	-	-
2023 Collins Rul Cnn	57	SAT	1.54	<0.01	0.47	0.42	0.74	0.86	-
2023 Collins Rul Cnn	58	SAT	1.58	<0.01	0.46	0.44	0.88	0.91	-
2023 Collins Rul Cnn	59	UNSAT	3.49	47.8	-	1.93	0.90	-	-
2023 Collins Rul Cnn	60	UNSAT	3.50	50.0	-	1.96	1.14	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Collins Rul Cnn	61	UNSAT	3.52	46.7	1.62	1.95	0.79	-	-
2023 Dist Shift	0	UNSAT	0.93	10.0	0.72	1.85	-	-	-
2023 Dist Shift	1	UNSAT	1.50	-	0.74	2.25	-	-	-
2023 Dist Shift	2	UNSAT	0.97	13.1	0.73	1.61	-	-	-
2023 Dist Shift	3	UNSAT	1.01	63.4	6.85	1.68	-	-	-
2023 Dist Shift	4	UNSAT	3.07	78.6	3.48	2.34	-	-	-
2023 Dist Shift	5	UNSAT	0.98	8.03	0.71	1.67	-	-	-
2023 Dist Shift	6	UNSAT	4.73	-	9.33	2.47	-	-	-
2023 Dist Shift	7	SAT	0.06	<0.01	0.50	0.02	-	1.09	-
2023 Dist Shift	8	UNSAT	3.03	-	1.65	2.27	-	-	-
2023 Dist Shift	9	UNSAT	3.03	-	4.98	2.31	-	-	-
2023 Dist Shift	10	UNSAT	1.02	13.1	0.70	1.66	-	-	-
2023 Dist Shift	11	UNSAT	0.97	8.03	0.71	1.63	-	-	-
2023 Dist Shift	12	UNSAT	1.58	102	0.70	2.29	-	-	-
2023 Dist Shift	13	UNSAT	0.96	8.03	0.67	1.69	-	-	-
2023 Dist Shift	14	UNSAT	3.05	8.03	1.26	2.33	-	-	-
2023 Dist Shift	15	UNSAT	1.47	9.04	1.68	2.30	-	-	-
2023 Dist Shift	16	UNSAT	0.96	8.02	0.71	1.64	-	-	-
2023 Dist Shift	17	UNSAT	0.97	8.03	0.71	1.61	-	-	-
2023 Dist Shift	18	UNSAT	0.99	8.02	0.73	1.64	-	-	-
2023 Dist Shift	19	UNSAT	0.98	8.03	0.72	1.66	-	-	-
2023 Dist Shift	20	UNSAT	1.59	117	1.30	2.26	-	-	-
2023 Dist Shift	21	UNSAT	0.94	8.03	0.70	1.63	-	-	-
2023 Dist Shift	22	SAT	0.01	<0.01	1.21	<0.01	-	1.25	-
2023 Dist Shift	23	UNSAT	0.96	8.02	0.78	1.63	-	-	-
2023 Dist Shift	24	UNSAT	1.00	8.03	0.69	1.65	-	-	-
2023 Dist Shift	25	UNSAT	0.96	8.03	0.73	1.66	-	-	-
2023 Dist Shift	26	UNSAT	3.93	-	1.63	2.32	-	-	-
2023 Dist Shift	27	UNSAT	12.4	-	-	-	-	-	-
2023 Dist Shift	28	UNSAT	0.96	8.03	0.69	1.61	-	-	-
2023 Dist Shift	29	UNSAT	1.71	105	0.72	2.25	-	-	-
2023 Dist Shift	30	UNSAT	3.03	-	7.07	2.33	-	-	-
2023 Dist Shift	31	UNSAT	1.61	42.3	2.07	2.29	-	-	-
2023 Dist Shift	32	UNSAT	2.97	-	1.37	2.28	-	-	-
2023 Dist Shift	33	UNSAT	3.05	121	1.69	2.30	-	-	-
2023 Dist Shift	34	UNSAT	0.96	10.0	0.70	1.67	-	-	-
2023 Dist Shift	35	UNSAT	1.50	80.5	0.73	2.30	-	-	-
2023 Dist Shift	36	UNSAT	3.03	134	2.73	2.31	-	-	-
2023 Dist Shift	37	UNSAT	3.05	9.03	1.39	2.28	-	-	-
2023 Dist Shift	38	UNSAT	0.98	8.03	0.69	1.64	-	-	-
2023 Dist Shift	39	UNSAT	0.97	9.04	0.74	1.66	-	-	-
2023 Dist Shift	40	UNSAT	0.96	9.03	1.87	1.67	-	-	-
2023 Dist Shift	41	UNSAT	0.99	8.03	0.77	1.63	-	-	-
2023 Dist Shift	42	UNSAT	0.97	8.03	0.71	1.68	-	-	-
2023 Dist Shift	43	SAT	0.03	<0.01	0.51	0.04	-	0.94	-
2023 Dist Shift	44	SAT	0.09	<0.01	0.50	0.03	-	1.06	-
2023 Dist Shift	45	UNSAT	3.06	-	0.72	2.28	-	-	-
2023 Dist Shift	46	UNSAT	0.94	8.03	0.72	1.66	-	-	-
2023 Dist Shift	47	UNSAT	1.72	8.03	0.71	2.29	-	-	-
2023 Dist Shift	48	UNSAT	0.94	8.03	0.69	1.65	-	-	-
2023 Dist Shift	49	UNSAT	1.74	159	0.70	2.26	-	-	-
2023 Dist Shift	50	UNSAT	1.00	8.03	0.77	1.67	-	-	-
2023 Dist Shift	51	UNSAT	0.98	8.03	0.70	1.62	-	-	-
2023 Dist Shift	52	UNSAT	0.95	8.03	0.71	1.64	-	-	-
2023 Dist Shift	53	UNSAT	0.99	8.03	0.69	1.64	-	-	-
2023 Dist Shift	54	SAT	0.08	2.02	142	0.39	-	-	-
2023 Dist Shift	55	UNSAT	0.97	8.03	0.71	1.66	-	-	-
2023 Dist Shift	56	UNSAT	4.05	-	4.41	2.36	-	-	-
2023 Dist Shift	57	UNSAT	1.48	14.1	1.34	2.27	-	-	-
2023 Dist Shift	58	UNSAT	0.95	8.03	0.70	1.64	-	-	-
2023 Dist Shift	59	UNSAT	0.99	8.03	0.71	1.64	-	-	-
2023 Dist Shift	60	UNSAT	0.97	8.03	0.71	1.68	-	-	-
2023 Dist Shift	61	UNSAT	0.99	8.03	0.69	1.65	-	-	-
2023 Dist Shift	62	UNSAT	1.45	46.3	0.70	2.31	-	-	-
2023 Dist Shift	63	UNSAT	1.51	16.1	0.72	2.28	-	-	-
2023 Dist Shift	64	UNSAT	1.60	16.1	10.2	2.31	-	-	-
2023 Dist Shift	65	UNSAT	1.86	13.1	2.82	3.19	-	-	-
2023 Dist Shift	66	UNSAT	9.61	-	23.5	3.46	-	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Dist Shift	67	UNSAT	0.97	8.03	0.71	1.65	-	-	-
2023 Dist Shift	68	UNSAT	0.95	11.0	0.68	1.68	-	-	-
2023 Dist Shift	69	UNSAT	5.35	-	38.1	3.41	-	-	-
2023 Dist Shift	70	UNSAT	0.92	8.02	0.70	1.64	-	-	-
2023 Dist Shift	71	UNSAT	1.42	12.1	0.72	2.29	-	-	-
2023 Ml4acopf	0	UNSAT	29.0	-	-	-	-	-	-
2023 Ml4acopf	1	?	-	-	-	-	-	-	-
2023 Ml4acopf	2	?	-	-	-	-	-	-	-
2023 Ml4acopf	3	UNSAT	2.22	-	-	-	-	-	-
2023 Ml4acopf	4	UNSAT	2.30	-	-	-	-	-	-
2023 Ml4acopf	5	UNSAT	2.15	-	-	-	-	-	-
2023 Ml4acopf	6	UNSAT	2.17	-	-	-	-	-	-
2023 Ml4acopf	7	UNSAT	2.60	-	-	-	-	-	-
2023 Ml4acopf	8	UNSAT	2.12	-	-	-	-	-	-
2023 Ml4acopf	9	UNSAT	2.18	-	-	-	-	-	-
2023 Ml4acopf	10	UNSAT	2.12	-	-	-	-	-	-
2023 Ml4acopf	11	UNSAT	2.21	-	-	-	-	-	-
2023 Ml4acopf	12	UNSAT	2.18	-	-	-	-	-	-
2023 Ml4acopf	13	UNSAT	2.11	-	-	-	-	-	-
2023 Ml4acopf	14	UNSAT	2.19	-	-	-	-	-	-
2023 Ml4acopf	15	UNSAT	7.92	-	-	-	-	-	-
2023 Ml4acopf	16	UNSAT	2.19	-	-	-	-	-	-
2023 Ml4acopf	17	UNSAT	2.14	-	-	-	-	-	-
2023 Ml4acopf	18	UNSAT	2.10	-	-	-	-	-	-
2023 Ml4acopf	19	?	-	-	-	-	-	-	-
2023 Ml4acopf	20	UNSAT	2.48	-	-	-	-	-	-
2023 Ml4acopf	21	SAT	0.66	-	-	-	-	-	-
2023 Ml4acopf	22	?	-	-	-	-	-	-	-
2023 Nn4sys	0	UNSAT	2.36	7.02	0.18	4.36	-	-	-
2023 Nn4sys	1	UNSAT	2.34	7.02	0.35	3.55	-	-	-
2023 Nn4sys	2	UNSAT	0.81	7.02	0.28	3.10	-	-	-
2023 Nn4sys	3	UNSAT	2.42	7.02	0.23	3.55	-	-	-
2023 Nn4sys	4	UNSAT	0.82	7.02	0.19	3.10	-	-	-
2023 Nn4sys	5	UNSAT	1.90	-	-	4.83	-	-	-
2023 Nn4sys	6	UNSAT	3.88	-	-	-	-	-	-
2023 Nn4sys	7	UNSAT	2.37	7.02	0.27	3.62	-	-	-
2023 Nn4sys	8	UNSAT	3.92	-	-	-	-	-	-
2023 Nn4sys	9	UNSAT	0.82	7.02	0.23	3.10	-	-	-
2023 Nn4sys	10	UNSAT	3.92	-	-	-	-	-	-
2023 Nn4sys	11	UNSAT	2.37	7.02	0.25	3.59	-	-	-
2023 Nn4sys	12	UNSAT	0.83	7.02	0.14	3.10	-	-	-
2023 Nn4sys	13	UNSAT	0.84	7.02	0.16	3.05	-	-	-
2023 Nn4sys	14	UNSAT	3.87	-	-	5.54	-	-	-
2023 Nn4sys	15	UNSAT	0.83	7.02	0.15	3.08	-	-	-
2023 Nn4sys	16	UNSAT	3.91	-	-	-	-	-	-
2023 Nn4sys	17	UNSAT	2.34	7.02	0.27	3.60	-	-	-
2023 Nn4sys	18	UNSAT	0.84	7.02	0.20	3.08	-	-	-
2023 Nn4sys	19	UNSAT	0.82	7.02	0.23	3.09	-	-	-
2023 Nn4sys	20	UNSAT	0.83	7.02	0.23	3.06	-	-	-
2023 Nn4sys	21	UNSAT	2.36	8.03	0.24	3.83	-	-	-
2023 Nn4sys	22	UNSAT	0.85	7.02	0.14	3.09	-	-	-
2023 Nn4sys	23	UNSAT	3.92	-	-	-	-	-	-
2023 Nn4sys	24	UNSAT	1.91	-	-	4.81	-	-	-
2023 Nn4sys	25	UNSAT	2.37	7.02	0.17	3.57	-	-	-
2023 Nn4sys	26	UNSAT	3.93	-	-	5.57	-	-	-
2023 Nn4sys	27	UNSAT	2.33	7.02	0.17	3.55	-	-	-
2023 Nn4sys	28	UNSAT	1.89	-	-	4.85	-	-	-
2023 Nn4sys	29	UNSAT	0.82	7.02	0.17	3.09	-	-	-
2023 Nn4sys	30	UNSAT	0.86	7.02	0.16	3.07	-	-	-
2023 Nn4sys	31	UNSAT	2.45	7.02	0.25	3.58	-	-	-
2023 Nn4sys	32	UNSAT	2.40	8.03	0.24	3.88	-	-	-
2023 Nn4sys	33	UNSAT	2.44	8.03	0.32	3.83	-	-	-
2023 Nn4sys	34	UNSAT	2.40	8.03	0.21	3.83	-	-	-
2023 Nn4sys	35	UNSAT	6.28	-	-	-	-	-	-
2023 Nn4sys	36	UNSAT	6.11	-	-	-	-	-	-
2023 Nn4sys	37	UNSAT	6.34	-	-	-	-	-	-
2023 Nn4sys	38	UNSAT	6.27	-	-	-	-	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Nn4sys	39	UNSAT	6.70	-	-	-	-	-	-
2023 Nn4sys	40	UNSAT	6.46	-	-	-	-	-	-
2023 Nn4sys	41	UNSAT	5.99	-	-	-	-	-	-
2023 Nn4sys	42	UNSAT	6.40	-	-	-	-	-	-
2023 Nn4sys	43	UNSAT	6.74	-	-	-	-	-	-
2023 Nn4sys	44	UNSAT	6.32	-	-	-	-	-	-
2023 Nn4sys	45	UNSAT	6.35	-	-	-	-	-	-
2023 Nn4sys	46	UNSAT	6.28	-	-	-	-	-	-
2023 Nn4sys	47	UNSAT	6.53	-	-	-	-	-	-
2023 Nn4sys	48	UNSAT	6.25	-	-	-	-	-	-
2023 Nn4sys	49	UNSAT	6.36	-	-	-	-	-	-
2023 Nn4sys	50	UNSAT	6.53	-	-	-	-	-	-
2023 Nn4sys	51	UNSAT	6.67	-	-	-	-	-	-
2023 Nn4sys	52	UNSAT	6.22	-	-	-	-	-	-
2023 Nn4sys	53	UNSAT	6.44	-	-	-	-	-	-
2023 Nn4sys	54	UNSAT	6.68	-	-	-	-	-	-
2023 Nn4sys	55	UNSAT	6.25	-	-	-	-	-	-
2023 Nn4sys	56	UNSAT	7.01	-	-	-	-	-	-
2023 Nn4sys	57	UNSAT	6.16	-	-	-	-	-	-
2023 Nn4sys	58	UNSAT	6.18	-	-	-	-	-	-
2023 Nn4sys	59	UNSAT	6.25	-	-	-	-	-	-
2023 Nn4sys	60	UNSAT	6.19	-	-	-	-	-	-
2023 Nn4sys	61	UNSAT	6.45	-	-	-	-	-	-
2023 Nn4sys	62	UNSAT	6.47	-	-	-	-	-	-
2023 Nn4sys	63	UNSAT	6.59	-	-	-	-	-	-
2023 Nn4sys	64	UNSAT	6.06	-	-	-	-	-	-
2023 Nn4sys	65	UNSAT	6.43	-	-	-	-	-	-
2023 Nn4sys	66	UNSAT	6.12	-	-	-	-	-	-
2023 Nn4sys	67	UNSAT	6.45	-	-	-	-	-	-
2023 Nn4sys	68	UNSAT	6.43	-	-	-	-	-	-
2023 Nn4sys	69	UNSAT	6.40	-	-	-	-	-	-
2023 Nn4sys	70	UNSAT	6.47	-	-	-	-	-	-
2023 Nn4sys	71	UNSAT	6.77	-	-	-	-	-	-
2023 Nn4sys	72	UNSAT	6.78	-	-	-	-	-	-
2023 Nn4sys	73	UNSAT	6.79	-	-	-	-	-	-
2023 Nn4sys	74	UNSAT	6.48	-	-	-	-	-	-
2023 Nn4sys	75	UNSAT	6.69	-	-	-	-	-	-
2023 Nn4sys	76	UNSAT	6.97	-	-	-	-	-	-
2023 Nn4sys	77	UNSAT	6.72	-	-	-	-	-	-
2023 Nn4sys	78	UNSAT	6.73	-	-	-	-	-	-
2023 Nn4sys	79	UNSAT	7.31	-	-	-	-	-	-
2023 Nn4sys	80	UNSAT	6.69	-	-	-	-	-	-
2023 Nn4sys	81	UNSAT	6.72	-	-	-	-	-	-
2023 Nn4sys	82	UNSAT	6.47	-	-	-	-	-	-
2023 Nn4sys	83	UNSAT	6.94	-	-	-	-	-	-
2023 Nn4sys	84	UNSAT	6.75	-	-	-	-	-	-
2023 Nn4sys	85	UNSAT	6.77	-	-	-	-	-	-
2023 Nn4sys	86	UNSAT	6.71	-	-	-	-	-	-
2023 Nn4sys	87	UNSAT	6.65	-	-	-	-	-	-
2023 Nn4sys	88	UNSAT	6.37	-	-	-	-	-	-
2023 Nn4sys	89	UNSAT	6.64	-	-	-	-	-	-
2023 Nn4sys	90	UNSAT	6.61	-	-	-	-	-	-
2023 Nn4sys	91	UNSAT	7.23	-	-	-	-	-	-
2023 Nn4sys	92	UNSAT	6.41	-	-	-	-	-	-
2023 Nn4sys	93	UNSAT	6.64	-	-	-	-	-	-
2023 Nn4sys	94	UNSAT	6.37	-	-	-	-	-	-
2023 Nn4sys	95	UNSAT	6.42	-	-	-	-	-	-
2023 Nn4sys	96	UNSAT	6.60	-	-	-	-	-	-
2023 Nn4sys	97	UNSAT	6.38	-	-	-	-	-	-
2023 Nn4sys	98	UNSAT	6.49	-	-	-	-	-	-
2023 Nn4sys	99	UNSAT	6.54	-	-	-	-	-	-
2023 Nn4sys	100	UNSAT	6.63	-	-	-	-	-	-
2023 Nn4sys	101	UNSAT	6.39	-	-	-	-	-	-
2023 Nn4sys	102	UNSAT	6.77	-	-	-	-	-	-
2023 Nn4sys	103	UNSAT	6.57	-	-	-	-	-	-
2023 Nn4sys	104	UNSAT	6.76	-	-	-	-	-	-
2023 Nn4sys	105	UNSAT	0.09	6.02	0.36	1.55	0.02	-	-
2023 Nn4sys	106	UNSAT	0.09	7.02	0.35	1.58	0.03	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Nn4sys	107	UNSAT	0.29	21.1	13.3	1.07	0.43	✗	-
2023 Nn4sys	108	UNSAT	0.22	44.3	16.2	1.56	0.52	✗	-
2023 Nn4sys	109	UNSAT	0.24	36.2	24.8	1.47	0.83	✗	-
2023 Nn4sys	110	UNSAT	0.24	81.5	31.1	1.69	0.93	✗	-
2023 Nn4sys	111	UNSAT	0.22	50.3	39.1	2.42	1.22	✗	-
2023 Nn4sys	112	UNSAT	0.28	-	48.3	2.34	1.37	✗	-
2023 Nn4sys	113	UNSAT	0.22	65.4	51.4	1.78	1.61	✗	-
2023 Nn4sys	114	UNSAT	0.29	-	63.0	2.67	1.78	✗	-
2023 Nn4sys	115	SAT	✗	✗	✗	✗	✗	4.08	-
2023 Nn4sys	116	SAT	✗	-	✗	✗	✗	4.14	-
2023 Nn4sys	117	UNSAT	0.43	-	-	4.27	5.96	-	-
2023 Nn4sys	118	UNSAT	0.43	-	-	4.52	6.93	-	-
2023 Nn4sys	119	UNSAT	0.50	-	-	6.64	9.88	-	-
2023 Nn4sys	120	UNSAT	0.52	-	-	7.23	11.0	-	-
2023 Nn4sys	121	UNSAT	0.62	-	-	8.74	13.9	-	-
2023 Nn4sys	122	UNSAT	0.59	-	-	9.58	15.4	-	-
2023 Nn4sys	123	UNSAT	0.77	-	-	10.8	17.7	-	-
2023 Nn4sys	124	UNSAT	0.81	-	-	12.2	20.0	-	-
2023 Nn4sys	125	UNSAT	0.75	-	-	12.1	20.3	-	-
2023 Nn4sys	126	UNSAT	0.80	-	-	13.3	21.8	-	-
2023 Nn4sys	127	UNSAT	3.93	-	-	-	-	-	-
2023 Nn4sys	128	UNSAT	4.08	-	-	-	-	-	-
2023 Nn4sys	129	UNSAT	1.98	-	0.42	3.77	-	-	-
2023 Nn4sys	130	UNSAT	2.46	-	-	7.43	-	-	-
2023 Nn4sys	131	UNSAT	3.01	-	-	9.98	-	-	-
2023 Nn4sys	132	UNSAT	3.46	-	-	11.8	-	-	-
2023 Nn4sys	133	UNSAT	5.35	-	-	22.1	-	-	-
2023 Nn4sys	134	UNSAT	6.07	-	-	27.4	-	-	-
2023 Nn4sys	135	UNSAT	6.89	-	-	32.5	-	-	-
2023 Nn4sys	136	UNSAT	7.49	-	-	37.4	-	-	-
2023 Nn4sys	137	UNSAT	2.70	-	3.57	5.57	-	-	-
2023 Nn4sys	138	UNSAT	3.96	-	-	12.0	-	-	-
2023 Nn4sys	139	UNSAT	4.03	-	-	12.7	-	-	-
2023 Nn4sys	140	UNSAT	3.82	-	-	14.9	-	-	-
2023 Nn4sys	141	UNSAT	4.08	-	-	17.2	-	-	-
2023 Nn4sys	142	UNSAT	4.21	-	-	19.0	-	-	-
2023 Nn4sys	143	UNSAT	4.28	-	-	20.1	-	-	-
2023 Nn4sys	144	UNSAT	4.26	-	-	23.7	-	-	-
2023 Nn4sys	145	UNSAT	8.56	-	-	47.5	-	-	-
2023 Nn4sys	146	UNSAT	9.49	-	-	59.3	-	-	-
2023 Nn4sys	147	UNSAT	12.0	-	-	74.0	-	-	-
2023 Nn4sys	148	UNSAT	14.0	-	-	97.3	-	-	-
2023 Nn4sys	149	UNSAT	15.3	-	-	96.8	-	-	-
2023 Nn4sys	150	UNSAT	16.9	-	-	110	-	-	-
2023 Nn4sys	151	UNSAT	19.3	-	-	127	-	-	-
2023 Nn4sys	152	UNSAT	20.2	-	-	157	-	-	-
2023 Nn4sys	153	UNSAT	21.8	-	-	142	-	-	-
2023 Nn4sys	154	UNSAT	22.4	-	-	154	-	-	-
2023 Nn4sys	155	UNSAT	25.2	-	-	171	-	-	-
2023 Nn4sys	156	UNSAT	27.1	-	-	-	-	-	-
2023 Nn4sys	157	UNSAT	28.5	-	-	198	-	-	-
2023 Nn4sys	158	UNSAT	30.3	-	-	-	-	-	-
2023 Nn4sys	159	UNSAT	33.1	-	-	259	-	-	-
2023 Nn4sys	160	UNSAT	3.75	-	35.9	6.32	-	-	-
2023 Nn4sys	161	UNSAT	5.98	-	-	-	-	-	-
2023 Nn4sys	162	UNSAT	8.72	-	-	-	-	-	-
2023 Nn4sys	163	UNSAT	9.94	-	-	-	-	-	-
2023 Nn4sys	164	UNSAT	19.8	-	-	-	-	-	-
2023 Nn4sys	165	UNSAT	24.5	-	-	-	-	-	-
2023 Nn4sys	166	UNSAT	28.9	-	-	-	-	-	-
2023 Nn4sys	167	UNSAT	33.3	-	-	-	-	-	-
2023 Nn4sys	168	UNSAT	38.0	-	-	-	-	-	-
2023 Nn4sys	169	UNSAT	42.6	-	-	-	-	-	-
2023 Nn4sys	170	UNSAT	46.8	-	-	-	-	-	-
2023 Nn4sys	171	UNSAT	3.98	-	-	8.69	-	-	-
2023 Nn4sys	172	UNSAT	7.58	-	-	-	-	-	-
2023 Nn4sys	173	UNSAT	8.89	-	-	-	-	-	-
2023 Nn4sys	174	UNSAT	10.8	-	-	-	-	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Nn4sys	175	UNSAT	12.2	-	-	-	-	-	-
2023 Nn4sys	176	UNSAT	15.3	-	-	-	-	-	-
2023 Nn4sys	177	UNSAT	16.9	-	-	-	-	-	-
2023 Nn4sys	178	UNSAT	17.9	-	-	-	-	-	-
2023 Nn4sys	179	UNSAT	40.2	-	-	-	-	-	-
2023 Nn4sys	180	UNSAT	50.0	-	-	-	-	-	-
2023 Nn4sys	181	UNSAT	59.0	-	-	-	-	-	-
2023 Nn4sys	182	UNSAT	71.7	-	-	-	-	-	-
2023 Nn4sys	183	UNSAT	80.6	-	-	-	-	-	-
2023 Nn4sys	184	UNSAT	93.7	-	-	-	-	-	-
2023 Nn4sys	185	UNSAT	105	-	-	-	-	-	-
2023 Nn4sys	186	UNSAT	115	-	-	-	-	-	-
2023 Nn4sys	187	UNSAT	127	-	-	-	-	-	-
2023 Nn4sys	188	UNSAT	134	-	-	-	-	-	-
2023 Nn4sys	189	UNSAT	144	-	-	-	-	-	-
2023 Nn4sys	190	UNSAT	157	-	-	-	-	-	-
2023 Nn4sys	191	UNSAT	166	-	-	-	-	-	-
2023 Nn4sys	192	UNSAT	176	-	-	-	-	-	-
2023 Nn4sys	193	UNSAT	188	-	-	-	-	-	-
2023 Tllverifybench	0	UNSAT	0.97	8.03	13.5	2.43	-	399	0.01
2023 Tllverifybench	1	UNSAT	1.04	7.03	7.68	2.46	1.51	-	0.15
2023 Tllverifybench	2	SAT	0.06	<0.01	0.26	0.02	0.49	1.23	<0.01
2023 Tllverifybench	3	UNSAT	0.97	7.02	6.49	2.43	1.52	-	0.11
2023 Tllverifybench	4	SAT	0.11	<0.01	0.32	0.06	0.71	0.71	0.04
2023 Tllverifybench	5	SAT	0.37	<0.01	-	0.19	0.96	0.21	0.19
2023 Tllverifybench	6	SAT	0.07	<0.01	0.35	0.05	0.64	<0.01	0.08
2023 Tllverifybench	7	SAT	0.09	<0.01	0.32	0.03	0.80	0.09	0.07
2023 Tllverifybench	8	SAT	0.26	<0.01	0.40	0.09	0.53	0.40	0.01
2023 Tllverifybench	9	UNSAT	1.82	-	26.7	2.93	-	-	0.08
2023 Tllverifybench	10	UNSAT	1.47	29.3	9.50	2.96	-	-	0.06
2023 Tllverifybench	11	UNSAT	3.24	-	181	3.14	-	-	0.01
2023 Tllverifybench	12	SAT	0.66	<0.01	-	0.23	1.71	1.50	0.22
2023 Tllverifybench	13	UNSAT	2.34	-	149	3.16	-	-	0.01
2023 Tllverifybench	14	UNSAT	1.87	-	48.0	3.09	-	-	0.16
2023 Tllverifybench	15	SAT	0.66	<0.01	0.63	0.12	1.00	0.51	0.07
2023 Tllverifybench	16	SAT	1.64	<0.01	1.10	0.36	3.34	0.93	0.09
2023 Tllverifybench	17	UNSAT	4.87	185	94.4	5.11	-	-	0.08
2023 Tllverifybench	18	UNSAT	10.9	-	-	5.50	-	-	0.02
2023 Tllverifybench	19	UNSAT	5.62	-	250	5.32	-	-	0.41
2023 Tllverifybench	20	SAT	3.28	<0.01	-	0.73	7.47	0.74	0.45
2023 Tllverifybench	21	SAT	3.26	<0.01	2.60	0.72	7.49	0.66	0.20
2023 Tllverifybench	22	UNSAT	9.03	-	-	7.03	-	-	<0.01
2023 Tllverifybench	23	SAT	3.24	<0.01	1.81	0.74	5.21	1.11	0.02
2023 Tllverifybench	24	UNSAT	18.9	-	-	44.9	-	-	0.03
2023 Tllverifybench	25	SAT	6.07	<0.01	4.07	1.40	11.1	1.16	0.03
2023 Tllverifybench	26	SAT	6.22	<0.01	3.67	1.40	11.3	0.95	0.03
2023 Tllverifybench	27	SAT	6.05	0.01	3.63	1.43	12.3	1.31	0.10
2023 Tllverifybench	28	UNSAT	16.6	-	-	70.0	-	-	0.27
2023 Tllverifybench	29	SAT	10.6	1.01	-	2.38	-	-	0.01
2023 Tllverifybench	30	SAT	10.2	1.02	-	2.39	25.1	1.99	0.54
2023 Tllverifybench	31	UNSAT	16.9	-	-	72.8	-	-	0.63
2023 Traffic Signs Recognition 0		SAT	1.90	0.01	1.01	-	-	-	-
2023 Traffic Signs Recognition 1		SAT	1.91	<0.01	1.01	-	-	-	-
2023 Traffic Signs Recognition 2		SAT	1.91	<0.01	0.95	-	-	-	-
2023 Traffic Signs Recognition 3		SAT	1.90	<0.01	1.02	-	-	-	-
2023 Traffic Signs Recognition 4		SAT	1.91	0.01	0.94	-	-	-	-
2023 Traffic Signs Recognition 5		?	-	-	-	-	-	-	-
2023 Traffic Signs Recognition 6		?	-	-	-	-	-	-	-
2023 Traffic Signs Recognition 7		SAT	2.55	-	-	-	-	-	-
2023 Traffic Signs Recognition 8		SAT	2.28	-	-	-	-	-	-
2023 Traffic Signs Recognition 9		SAT	2.18	-	-	-	-	-	-
2023 Traffic Signs Recognition 10		SAT	2.24	-	-	0.83	-	-	-
2023 Traffic Signs Recognition 11		SAT	2.31	47.3	-	0.84	-	-	-
2023 Traffic Signs Recognition 12		SAT	2.22	7.06	-	0.86	-	-	-
2023 Traffic Signs Recognition 13		SAT	1.92	<0.01	-	0.83	-	-	-
2023 Traffic Signs Recognition 14		SAT	1.94	<0.01	-	0.84	-	-	-
2023 Traffic Signs Recognition 15		UNSAT	✗	-	-	✗	-	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Traffic Signs Recognition 16		SAT	2.42	-	-	1.47	-	-	-
2023 Traffic Signs Recognition 17		SAT	2.34	-	-	1.47	-	-	-
2023 Traffic Signs Recognition 18		SAT	2.35	-	-	1.47	-	-	-
2023 Traffic Signs Recognition 19		SAT	2.36	276	-	1.46	-	-	-
2023 Traffic Signs Recognition 20		SAT	2.50	-	-	1.42	-	-	-
2023 Traffic Signs Recognition 21		SAT	2.33	-	-	1.46	-	-	-
2023 Traffic Signs Recognition 22		UNSAT	✗	-	-	✗	-	-	-
2023 Traffic Signs Recognition 23		SAT	2.33	-	-	1.46	-	-	-
2023 Traffic Signs Recognition 24		SAT	2.33	-	-	1.48	-	-	-
2023 Traffic Signs Recognition 25		SAT	2.03	<0.01	-	1.46	-	-	-
2023 Traffic Signs Recognition 26		SAT	2.04	<0.01	3.67	1.46	-	-	-
2023 Traffic Signs Recognition 27		SAT	2.05	<0.01	-	1.45	-	-	-
2023 Traffic Signs Recognition 28		UNSAT	✗	✗	✗	✗	-	-	-
2023 Traffic Signs Recognition 29		SAT	1.99	<0.01	3.63	1.44	-	-	-
2023 Traffic Signs Recognition 30		SAT	2.63	-	-	2.45	-	-	-
2023 Traffic Signs Recognition 31		SAT	2.60	-	-	2.47	-	-	-
2023 Traffic Signs Recognition 32		SAT	2.59	-	-	2.33	-	-	-
2023 Traffic Signs Recognition 33		SAT	2.54	-	-	2.25	-	-	-
2023 Traffic Signs Recognition 34		SAT	2.56	9.07	-	2.22	-	-	-
2023 Traffic Signs Recognition 35		UNSAT	-	-	-	✗	-	-	-
2023 Traffic Signs Recognition 36		SAT	3.39	-	-	2.17	-	-	-
2023 Traffic Signs Recognition 37		SAT	3.04	-	-	2.16	-	-	-
2023 Traffic Signs Recognition 38		SAT	2.80	-	-	2.16	-	-	-
2023 Traffic Signs Recognition 39		SAT	2.63	-	-	2.18	-	-	-
2023 Traffic Signs Recognition 40		SAT	2.57	-	-	2.20	-	-	-
2023 Traffic Signs Recognition 41		SAT	2.62	-	-	2.21	-	-	-
2023 Traffic Signs Recognition 42		SAT	2.59	121	-	2.18	-	-	-
2023 Traffic Signs Recognition 43		SAT	2.58	21.1	-	2.20	-	-	-
2023 Traffic Signs Recognition 44		SAT	2.21	1.01	-	2.18	-	-	-
2023 Vggnet16	0	UNSAT	9.46	30.5	63.1	50.9	33.2	-	-
2023 Vggnet16	1	UNSAT	9.41	211	63.1	51.0	29.7	-	-
2023 Vggnet16	2	UNSAT	9.40	-	68.2	-	33.0	-	-
2023 Vggnet16	3	UNSAT	9.27	-	69.7	50.9	30.9	-	-
2023 Vggnet16	4	UNSAT	9.28	-	73.3	-	37.0	-	-
2023 Vggnet16	5	UNSAT	9.36	-	85.5	-	52.7	-	-
2023 Vggnet16	6	UNSAT	9.30	-	75.8	50.8	32.0	-	-
2023 Vggnet16	7	UNSAT	9.41	-	77.1	-	42.4	-	-
2023 Vggnet16	8	UNSAT	11.1	-	228	-	121	-	-
2023 Vggnet16	9	UNSAT	9.45	-	88.2	51.2	36.8	-	-
2023 Vggnet16	10	UNSAT	9.50	-	101	-	60.8	-	-
2023 Vggnet16	11	UNSAT	9.43	-	115	-	68.3	-	-
2023 Vggnet16	12	UNSAT	783	-	-	-	-	-	-
2023 Vggnet16	13	UNSAT	20.7	-	287	-	229	-	-
2023 Vggnet16	14	UNSAT	41.8	-	-	-	632	-	-
2023 Vggnet16	15	SAT	-	3.03	33.7	36.1	-	-	-
2023 Vggnet16	16	?	-	-	-	-	-	-	-
2023 Vggnet16	17	?	-	-	-	-	-	-	-
2023 Vit	0	UNSAT	-	12.2	-	-	-	-	-
2023 Vit	1	UNSAT	-	12.2	-	-	-	-	-
2023 Vit	2	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	3	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	4	UNSAT	-	13.1	-	-	-	-	-
2023 Vit	5	UNSAT	9.08	14.2	-	-	-	-	-
2023 Vit	6	UNSAT	7.86	13.1	-	-	-	-	-
2023 Vit	7	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	8	UNSAT	-	14.3	-	-	-	-	-
2023 Vit	9	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	10	UNSAT	8.23	13.3	-	-	-	-	-
2023 Vit	11	UNSAT	7.80	13.1	-	-	-	-	-
2023 Vit	12	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	13	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	14	UNSAT	-	14.1	-	-	-	-	-
2023 Vit	15	UNSAT	11.3	13.3	-	-	-	-	-
2023 Vit	16	UNSAT	7.40	13.3	-	-	-	-	-
2023 Vit	17	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	18	UNSAT	17.8	13.2	-	-	-	-	-
2023 Vit	19	UNSAT	-	13.2	-	-	-	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Vit	20	UNSAT -	13.3	-	-	-	-	-
2023 Vit	21	UNSAT -	13.1	-	-	-	-	-
2023 Vit	22	UNSAT -	13.2	-	-	-	-	-
2023 Vit	23	UNSAT -	13.2	-	-	-	-	-
2023 Vit	24	UNSAT -	13.2	-	-	-	-	-
2023 Vit	25	UNSAT 9.17	13.2	-	-	-	-	-
2023 Vit	26	UNSAT 19.7	13.2	-	-	-	-	-
2023 Vit	27	UNSAT -	14.3	-	-	-	-	-
2023 Vit	28	UNSAT -	13.3	-	-	-	-	-
2023 Vit	29	UNSAT -	14.3	-	-	-	-	-
2023 Vit	30	UNSAT -	14.3	-	-	-	-	-
2023 Vit	31	UNSAT -	12.2	-	-	-	-	-
2023 Vit	32	UNSAT 7.42	14.2	-	-	-	-	-
2023 Vit	33	UNSAT 9.54	13.2	-	-	-	-	-
2023 Vit	34	UNSAT -	14.2	-	-	-	-	-
2023 Vit	35	UNSAT -	13.2	-	-	-	-	-
2023 Vit	36	UNSAT 9.99	13.2	-	-	-	-	-
2023 Vit	37	UNSAT -	13.3	-	-	-	-	-
2023 Vit	38	UNSAT -	13.2	-	-	-	-	-
2023 Vit	39	UNSAT -	13.2	-	-	-	-	-
2023 Vit	40	UNSAT -	13.2	-	-	-	-	-
2023 Vit	41	UNSAT -	14.2	-	-	-	-	-
2023 Vit	42	UNSAT -	13.2	-	-	-	-	-
2023 Vit	43	UNSAT -	13.2	-	-	-	-	-
2023 Vit	44	UNSAT -	14.2	-	-	-	-	-
2023 Vit	45	UNSAT -	13.2	-	-	-	-	-
2023 Vit	46	UNSAT -	13.2	-	-	-	-	-
2023 Vit	47	UNSAT -	13.3	-	-	-	-	-
2023 Vit	48	UNSAT -	13.2	-	-	-	-	-
2023 Vit	49	UNSAT 6.94	13.2	-	-	-	-	-
2023 Vit	50	UNSAT 20.8	13.2	-	-	-	-	-
2023 Vit	51	UNSAT -	13.2	-	-	-	-	-
2023 Vit	52	UNSAT 11.7	13.3	-	-	-	-	-
2023 Vit	53	UNSAT -	13.2	-	-	-	-	-
2023 Vit	54	UNSAT -	13.2	-	-	-	-	-
2023 Vit	55	UNSAT 14.0	14.2	-	-	-	-	-
2023 Vit	56	UNSAT 8.19	13.2	-	-	-	-	-
2023 Vit	57	UNSAT 11.3	14.2	-	-	-	-	-
2023 Vit	58	UNSAT -	14.2	-	-	-	-	-
2023 Vit	59	UNSAT 9.13	13.2	-	-	-	-	-
2023 Vit	60	UNSAT -	13.2	-	-	-	-	-
2023 Vit	61	UNSAT -	13.2	-	-	-	-	-
2023 Vit	62	UNSAT 18.7	13.1	-	-	-	-	-
2023 Vit	63	UNSAT 9.56	14.2	-	-	-	-	-
2023 Vit	64	UNSAT -	13.2	-	-	-	-	-
2023 Vit	65	UNSAT -	13.2	-	-	-	-	-
2023 Vit	66	UNSAT 9.13	14.2	-	-	-	-	-
2023 Vit	67	UNSAT 10.4	13.2	-	-	-	-	-
2023 Vit	68	UNSAT -	13.3	-	-	-	-	-
2023 Vit	69	UNSAT 28.4	13.2	-	-	-	-	-
2023 Vit	70	UNSAT 7.04	14.2	-	-	-	-	-
2023 Vit	71	UNSAT -	13.2	-	-	-	-	-
2023 Vit	72	UNSAT 10.5	13.2	-	-	-	-	-
2023 Vit	73	UNSAT 7.00	13.2	-	-	-	-	-
2023 Vit	74	UNSAT -	13.3	-	-	-	-	-
2023 Vit	75	UNSAT -	13.2	-	-	-	-	-
2023 Vit	76	UNSAT 19.3	13.1	-	-	-	-	-
2023 Vit	77	UNSAT -	13.2	-	-	-	-	-
2023 Vit	78	UNSAT 8.31	13.2	-	-	-	-	-
2023 Vit	79	UNSAT 7.46	14.2	-	-	-	-	-
2023 Vit	80	UNSAT 10.4	13.2	-	-	-	-	-
2023 Vit	81	UNSAT 9.62	13.3	-	-	-	-	-
2023 Vit	82	UNSAT 10.5	12.2	-	-	-	-	-
2023 Vit	83	UNSAT 8.64	13.3	-	-	-	-	-
2023 Vit	84	UNSAT 6.98	13.1	-	-	-	-	-
2023 Vit	85	UNSAT -	13.2	-	-	-	-	-
2023 Vit	86	UNSAT 9.52	13.2	-	-	-	-	-
2023 Vit	87	UNSAT 7.83	13.2	-	-	-	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Vit	88	UNSAT	9.07	14.2	-	-	-	-	-
2023 Vit	89	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	90	UNSAT	9.12	13.2	-	-	-	-	-
2023 Vit	91	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	92	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	93	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	94	UNSAT	-	14.3	-	-	-	-	-
2023 Vit	95	UNSAT	-	14.2	-	-	-	-	-
2023 Vit	96	UNSAT	20.3	14.2	-	-	-	-	-
2023 Vit	97	UNSAT	8.69	13.2	-	-	-	-	-
2023 Vit	98	UNSAT	-	13.2	-	-	-	-	-
2023 Vit	99	UNSAT	8.68	13.2	-	-	-	-	-
2023 Vit	100	UNSAT	-	60.2	-	-	-	-	-
2023 Vit	101	UNSAT	-	60.2	-	-	-	-	-
2023 Vit	102	UNSAT	-	58.1	-	-	-	-	-
2023 Vit	103	UNSAT	43.0	60.2	-	-	-	-	-
2023 Vit	104	UNSAT	35.7	58.1	-	-	-	-	-
2023 Vit	105	UNSAT	33.2	59.9	-	-	-	-	-
2023 Vit	106	UNSAT	-	58.0	-	-	-	-	-
2023 Vit	107	UNSAT	15.2	59.1	-	-	-	-	-
2023 Vit	108	UNSAT	-	61.1	-	-	-	-	-
2023 Vit	109	UNSAT	39.1	58.0	-	-	-	-	-
2023 Vit	110	UNSAT	-	53.9	-	-	-	-	-
2023 Vit	111	UNSAT	31.8	60.1	-	-	-	-	-
2023 Vit	112	UNSAT	12.2	59.2	-	-	-	-	-
2023 Vit	113	UNSAT	-	57.1	-	-	-	-	-
2023 Vit	114	UNSAT	-	58.0	-	-	-	-	-
2023 Vit	115	UNSAT	-	60.0	-	-	-	-	-
2023 Vit	116	UNSAT	-	58.0	-	-	-	-	-
2023 Vit	117	UNSAT	-	59.0	-	-	-	-	-
2023 Vit	118	UNSAT	-	61.1	-	-	-	-	-
2023 Vit	119	UNSAT	10.1	61.1	-	-	-	-	-
2023 Vit	120	UNSAT	68.2	59.1	-	-	-	-	-
2023 Vit	121	UNSAT	-	60.0	-	-	-	-	-
2023 Vit	122	UNSAT	30.3	59.0	-	-	-	-	-
2023 Vit	123	UNSAT	31.7	58.0	-	-	-	-	-
2023 Vit	124	UNSAT	10.0	58.2	-	-	-	-	-
2023 Vit	125	UNSAT	-	58.3	-	-	-	-	-
2023 Vit	126	UNSAT	-	54.9	-	-	-	-	-
2023 Vit	127	UNSAT	21.3	59.2	-	-	-	-	-
2023 Vit	128	UNSAT	-	58.1	-	-	-	-	-
2023 Vit	129	UNSAT	-	57.1	-	-	-	-	-
2023 Vit	130	UNSAT	-	59.0	-	-	-	-	-
2023 Vit	131	UNSAT	-	54.9	-	-	-	-	-
2023 Vit	132	UNSAT	-	59.2	-	-	-	-	-
2023 Vit	133	UNSAT	35.8	58.2	-	-	-	-	-
2023 Vit	134	UNSAT	-	59.0	-	-	-	-	-
2023 Vit	135	UNSAT	53.9	56.9	-	-	-	-	-
2023 Vit	136	UNSAT	9.04	56.0	-	-	-	-	-
2023 Vit	137	UNSAT	-	60.0	-	-	-	-	-
2023 Vit	138	UNSAT	-	59.2	-	-	-	-	-
2023 Vit	139	UNSAT	-	57.9	-	-	-	-	-
2023 Vit	140	UNSAT	34.7	58.0	-	-	-	-	-
2023 Vit	141	UNSAT	-	57.0	-	-	-	-	-
2023 Vit	142	UNSAT	15.2	58.2	-	-	-	-	-
2023 Vit	143	UNSAT	-	57.9	-	-	-	-	-
2023 Vit	144	UNSAT	-	59.1	-	-	-	-	-
2023 Vit	145	UNSAT	-	57.2	-	-	-	-	-
2023 Vit	146	UNSAT	11.1	58.0	-	-	-	-	-
2023 Vit	147	UNSAT	-	54.9	-	-	-	-	-
2023 Vit	148	UNSAT	-	61.3	-	-	-	-	-
2023 Vit	149	UNSAT	34.0	59.0	-	-	-	-	-
2023 Vit	150	UNSAT	-	55.9	-	-	-	-	-
2023 Vit	151	UNSAT	-	59.1	-	-	-	-	-
2023 Vit	152	UNSAT	-	56.1	-	-	-	-	-
2023 Vit	153	UNSAT	14.2	57.9	-	-	-	-	-
2023 Vit	154	UNSAT	-	62.0	-	-	-	-	-
2023 Vit	155	UNSAT	12.2	61.3	-	-	-	-	-

Table 35: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

Category	Id	Result	α-β-C	Marab	PyRat	NSAT	NNen	NNV	FastBaT
2023 Vit	156	UNSAT 34.1	59.0	-	-	-	-	-
2023 Vit	157	UNSAT 34.8	59.9	-	-	-	-	-
2023 Vit	158	UNSAT -	58.8	-	-	-	-	-
2023 Vit	159	UNSAT -	57.0	-	-	-	-	-
2023 Vit	160	UNSAT 40.6	58.0	-	-	-	-	-
2023 Vit	161	UNSAT -	59.2	-	-	-	-	-
2023 Vit	162	UNSAT 12.3	60.1	-	-	-	-	-
2023 Vit	163	UNSAT -	58.1	-	-	-	-	-
2023 Vit	164	UNSAT -	60.1	-	-	-	-	-
2023 Vit	165	UNSAT 31.8	55.9	-	-	-	-	-
2023 Vit	166	UNSAT -	57.1	-	-	-	-	-
2023 Vit	167	UNSAT -	60.0	-	-	-	-	-
2023 Vit	168	UNSAT -	61.0	-	-	-	-	-
2023 Vit	169	UNSAT -	61.1	-	-	-	-	-
2023 Vit	170	UNSAT -	57.0	-	-	-	-	-
2023 Vit	171	UNSAT -	60.1	-	-	-	-	-
2023 Vit	172	UNSAT 18.3	59.1	-	-	-	-	-
2023 Vit	173	UNSAT -	60.2	-	-	-	-	-
2023 Vit	174	UNSAT -	57.9	-	-	-	-	-
2023 Vit	175	UNSAT 14.3	56.8	-	-	-	-	-
2023 Vit	176	UNSAT 14.2	57.8	-	-	-	-	-
2023 Vit	177	UNSAT -	57.1	-	-	-	-	-
2023 Vit	178	UNSAT 9.13	59.1	-	-	-	-	-
2023 Vit	179	UNSAT -	60.0	-	-	-	-	-
2023 Vit	180	UNSAT -	60.1	-	-	-	-	-
2023 Vit	181	UNSAT -	57.0	-	-	-	-	-
2023 Vit	182	UNSAT -	62.1	-	-	-	-	-
2023 Vit	183	UNSAT 12.2	56.1	-	-	-	-	-
2023 Vit	184	UNSAT 33.3	59.0	-	-	-	-	-
2023 Vit	185	UNSAT 17.4	56.0	-	-	-	-	-
2023 Vit	186	UNSAT -	59.1	-	-	-	-	-
2023 Vit	187	UNSAT -	60.1	-	-	-	-	-
2023 Vit	188	UNSAT -	58.0	-	-	-	-	-
2023 Vit	189	UNSAT -	59.2	-	-	-	-	-
2023 Vit	190	UNSAT 15.3	56.9	-	-	-	-	-
2023 Vit	191	UNSAT -	59.1	-	-	-	-	-
2023 Vit	192	UNSAT -	56.9	-	-	-	-	-
2023 Vit	193	UNSAT 11.2	61.3	-	-	-	-	-
2023 Vit	194	UNSAT -	57.0	-	-	-	-	-
2023 Vit	195	UNSAT -	56.9	-	-	-	-	-
2023 Vit	196	UNSAT -	60.1	-	-	-	-	-
2023 Vit	197	UNSAT -	59.2	-	-	-	-	-
2023 Vit	198	UNSAT -	53.8	-	-	-	-	-
2023 Vit	199	UNSAT 34.2	56.0	-	-	-	-	-