

# The Fifth International Verification of Neural Networks Competition (VNN-COMP 2024): Summary and Results

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## Abstract

This report summarizes the fifth International Verification of Neural Networks Competition (VNN-COMP 2024), held as a part of the 6th Workshop on Formal Methods for ML-Enabled Autonomous Systems (FoMLAS) that was colocated 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 | $\alpha$ - $\beta$ -CROWN | 1564.8 |
| 2 | NeuralSAT                 | 1431.1 |
| 3 | PyRAT                     | 1229.3 |
| 4 | CORA                      | 988.0  |
| 5 | NNV                       | 796.7  |
| 6 | nnenum                    | 741.1  |
| 7 | SobolBox                  | 593.9  |

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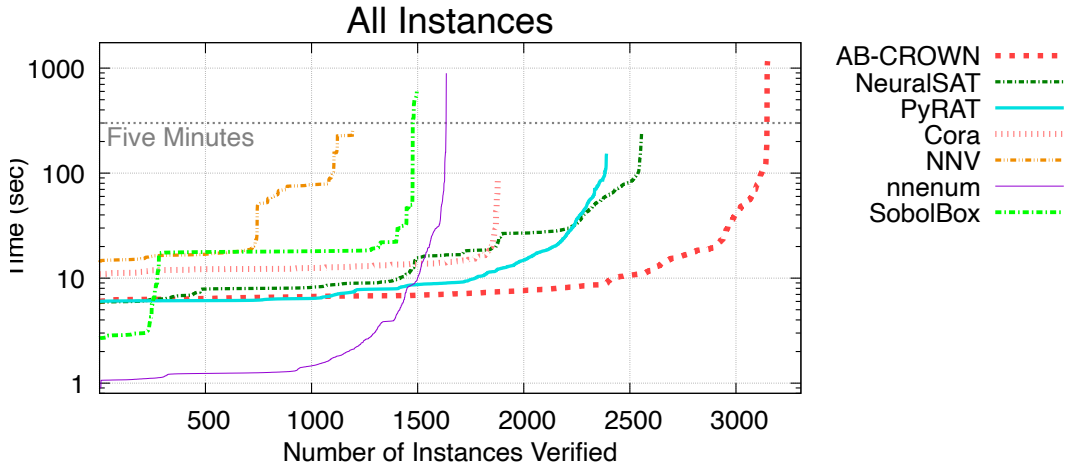


Figure 1: Cactus Plot for All Instances.

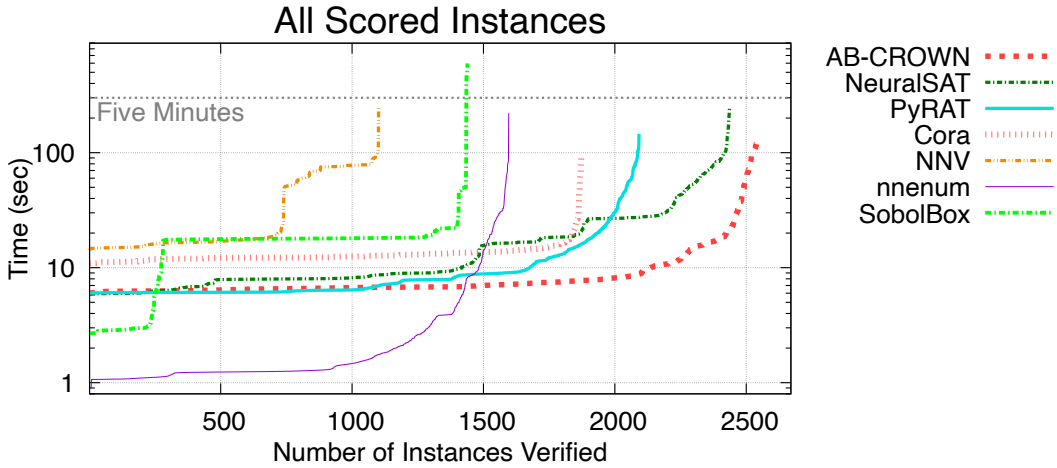


Figure 2: Cactus Plot for All Scored Instances.

## 2 Scored Benchmarks

Table 2: 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 | $\alpha$ - $\beta$ -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%  |

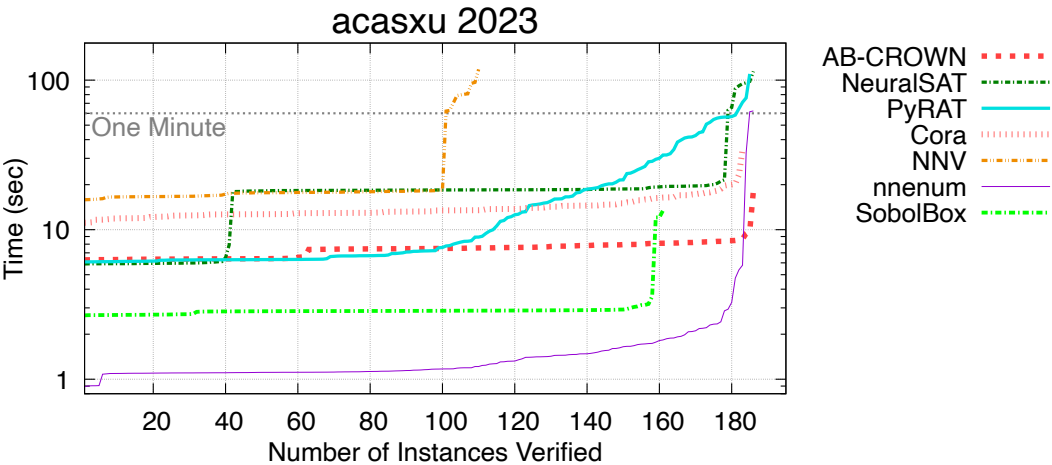


Figure 3: Cactus Plot for *acasxu* 2023.

Table 3: Benchmark 2025-cersyve

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%  |

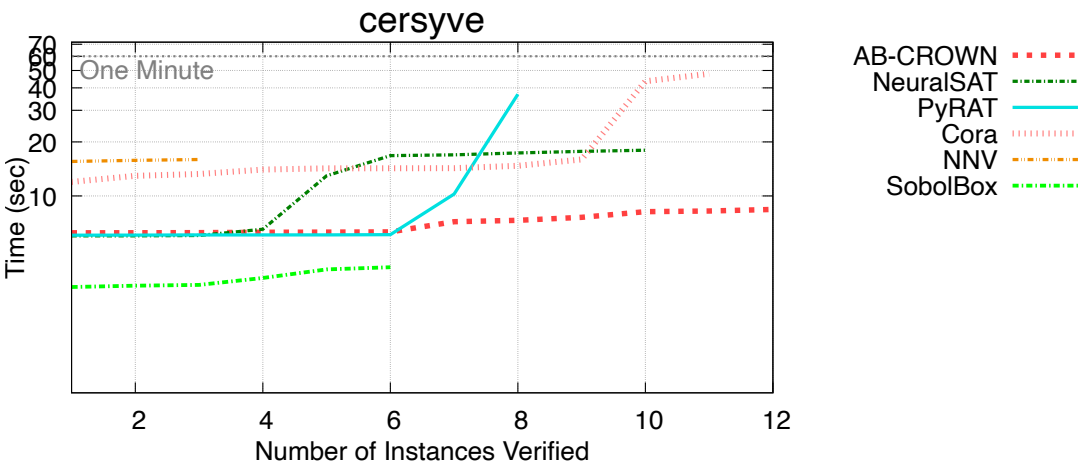


Figure 4: Cactus Plot for cersyve.

Table 4: 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 | $\alpha$ - $\beta$ -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%  |

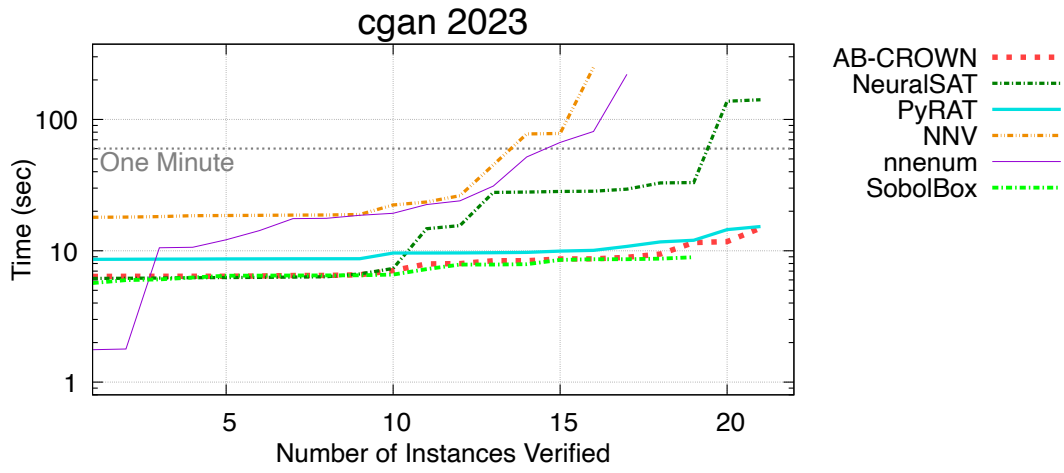


Figure 5: Cactus Plot for cgan 2023.

Table 5: Benchmark 2025-cifar100-2024

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | NNV                       | 190      | 0         | 0       | 0       | 1900   | 100.0 | 95.0%  |
| 2 | $\alpha$ - $\beta$ -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%   |

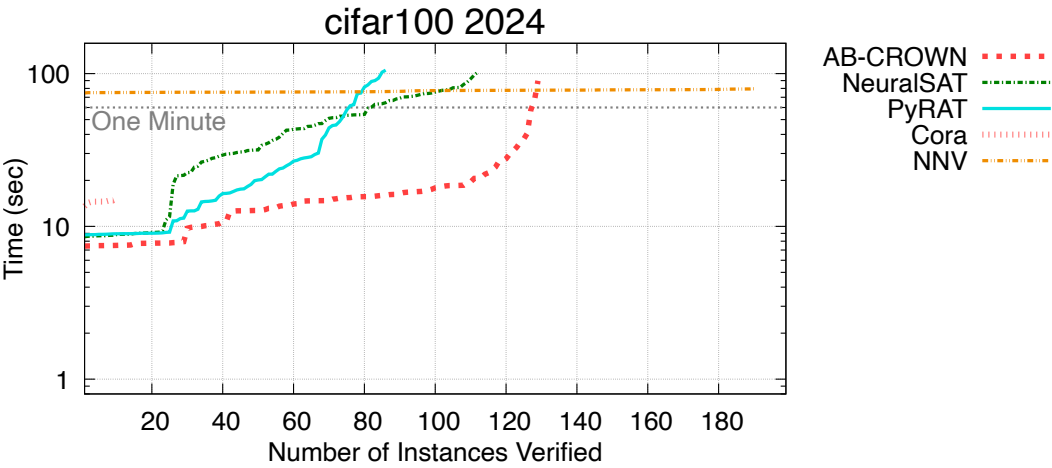


Figure 6: Cactus Plot for cifar100 2024.

Table 6: 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 | $\alpha$ - $\beta$ -CROWN | 39       | 23        | 0       | 0       | 620    | 100.0 | 100.0% |
| 7 | SobolBox                  | 19       | 15        | 0       | 0       | 340    | 54.8  | 54.8%  |

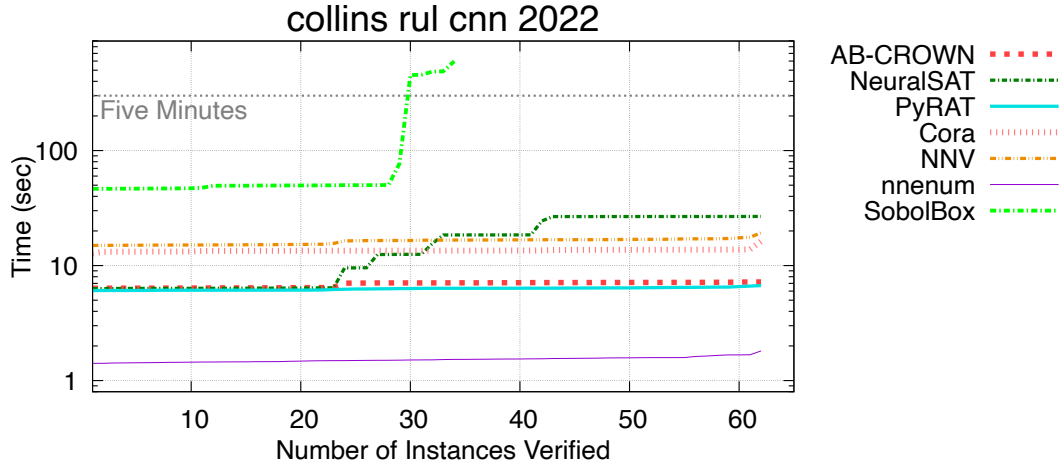


Figure 7: Cactus Plot for collins rul cnn 2022.



Table 7: Benchmark 2025-cora-2024

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%  |

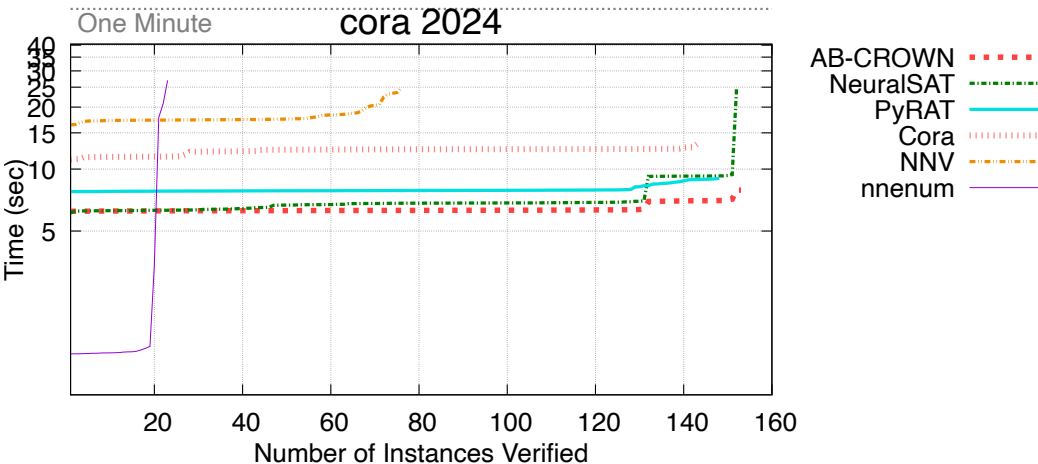


Figure 8: Cactus Plot for cora 2024.

Table 8: 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 | $\alpha$ - $\beta$ -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%  |

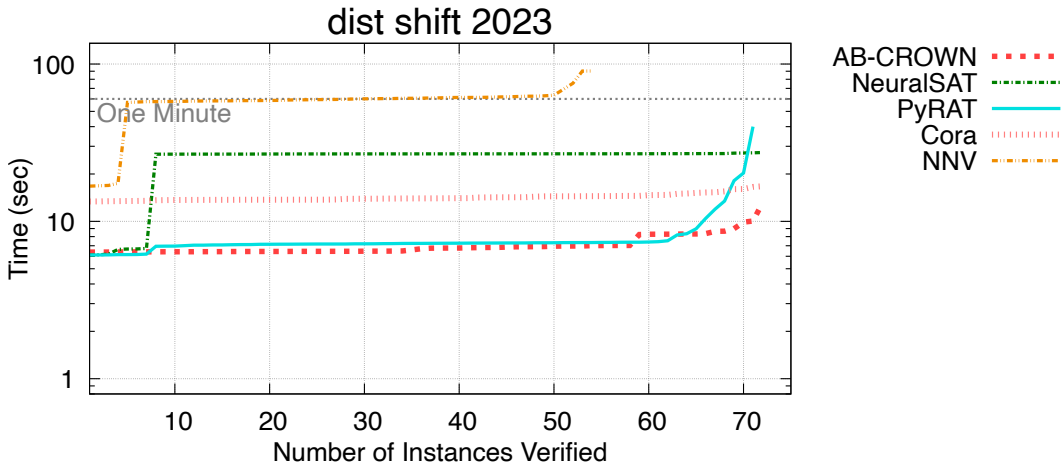


Figure 9: Cactus Plot for dist shift 2023.

Table 9: 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 | $\alpha$ - $\beta$ -CROWN | 59       | 1         | 0       | 0       | 600    | 100.0 | 100.0% |
| 7 | NNV                       | 40       | 1         | 0       | 0       | 410    | 68.3  | 68.3%  |

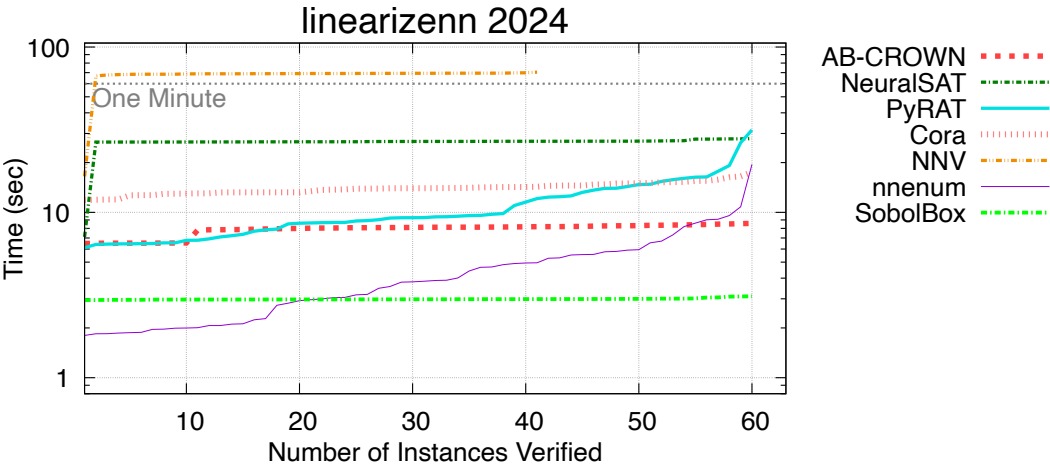


Figure 10: Cactus Plot for linearizenn 2024.

Table 10: Benchmark 2025-malbeware

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%  |

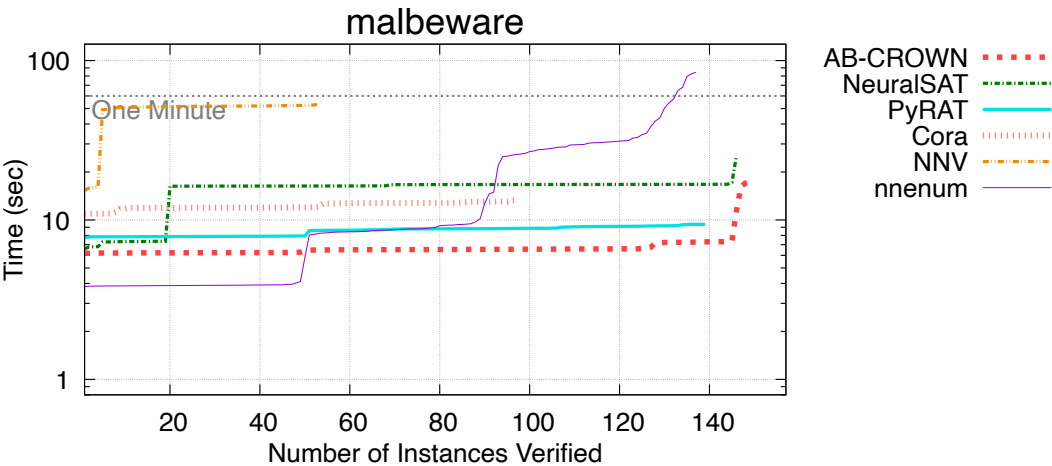


Figure 11: Cactus Plot for malbeware.

Table 11: 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 | $\alpha$ - $\beta$ -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%  |

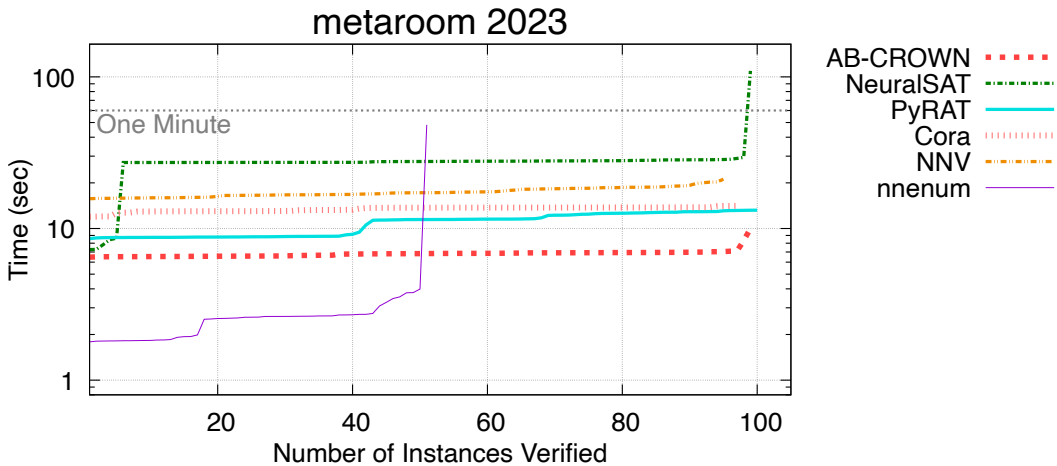


Figure 12: Cactus Plot for metaroom 2023.

Table 12: Benchmark 2025-nn4sys

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%   |

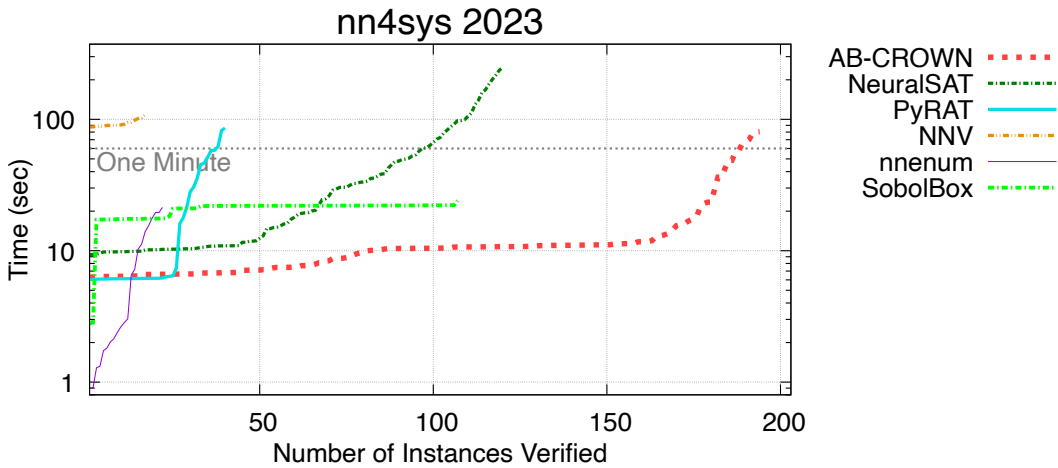


Figure 13: Cactus Plot for nn4sys 2023.

Table 13: Benchmark 2025-safenlp-2024

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | NeuralSAT                 | 425      | 645       | 0       | 0       | 10700  | 100.0 | 99.1%  |
| 2 | $\alpha$ - $\beta$ -CROWN | 401      | 647       | 0       | 0       | 10480  | 97.9  | 97.0%  |
| 3 | PyRAT                     | 331      | 647       | 0       | 0       | 9780   | 91.4  | 90.6%  |
| 4 | nenum                     | 340      | 636       | 0       | 0       | 9760   | 91.2  | 90.4%  |
| 5 | CORA                      | 338      | 644       | 0       | 1       | 9670   | 90.4  | 90.9%  |
| 6 | SobolBox                  | 795      | 215       | 0       | 21      | 6950   | 65.0  | 93.5%  |
| 7 | NNV                       | 172      | 176       | 0       | 0       | 3480   | 32.5  | 32.2%  |

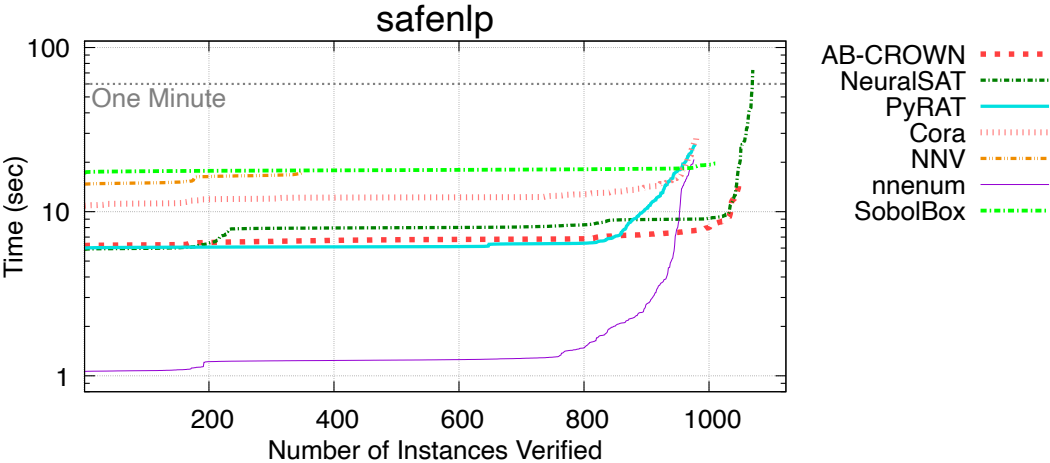


Figure 14: Cactus Plot for safenlp.

Table 14: 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 | $\alpha$ - $\beta$ -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%  |

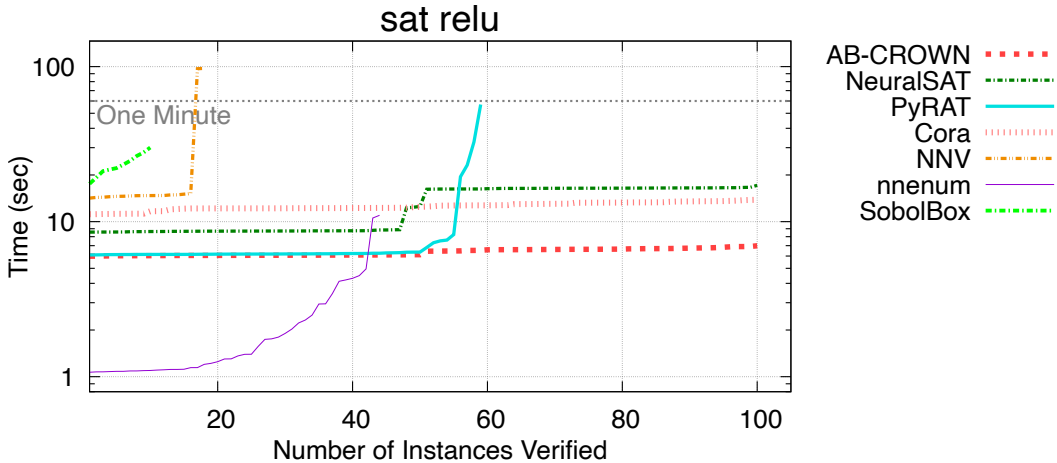


Figure 15: Cactus Plot for sat relu.



Table 15: Benchmark 2025-soundnessbench

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%  |

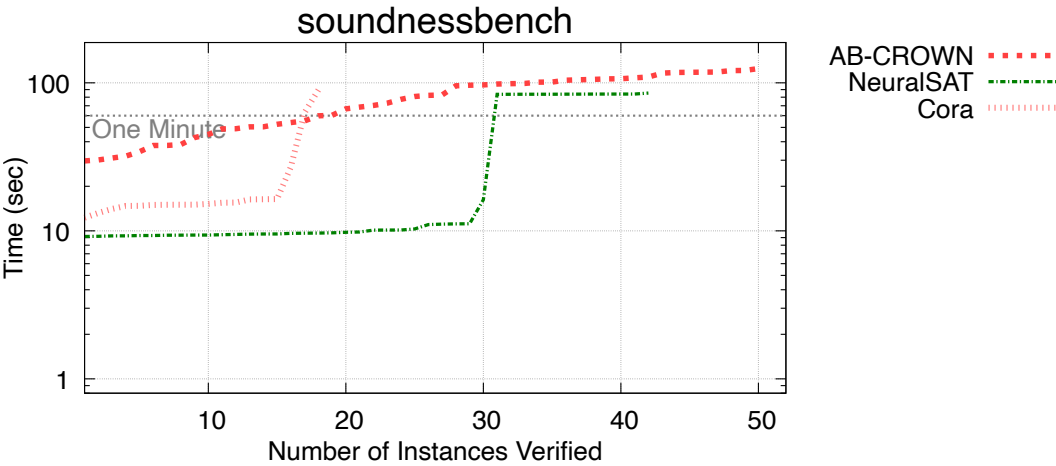


Figure 16: Cactus Plot for soundnessbench.

Table 16: Benchmark 2025-tinyimagenet-2024

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%   |

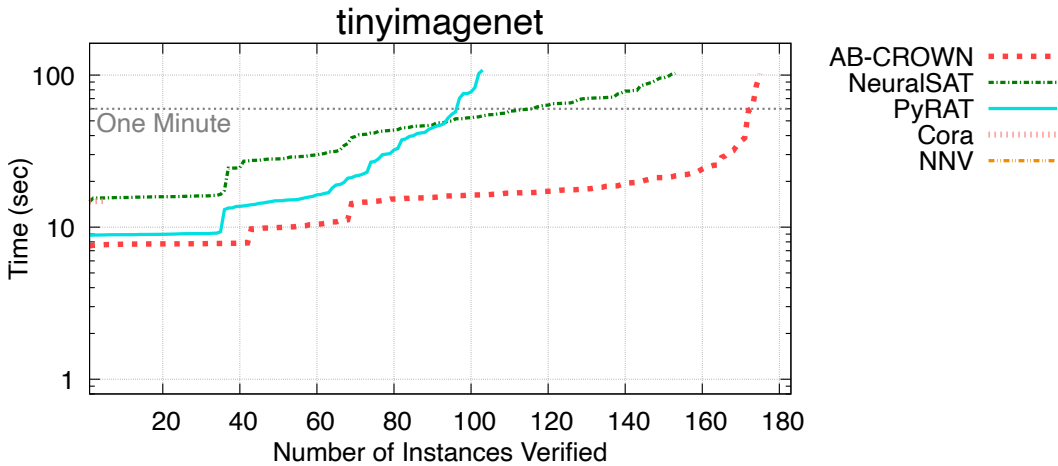


Figure 17: Cactus Plot for tinyimagenet.

Table 17: 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 | $\alpha$ - $\beta$ -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%  |

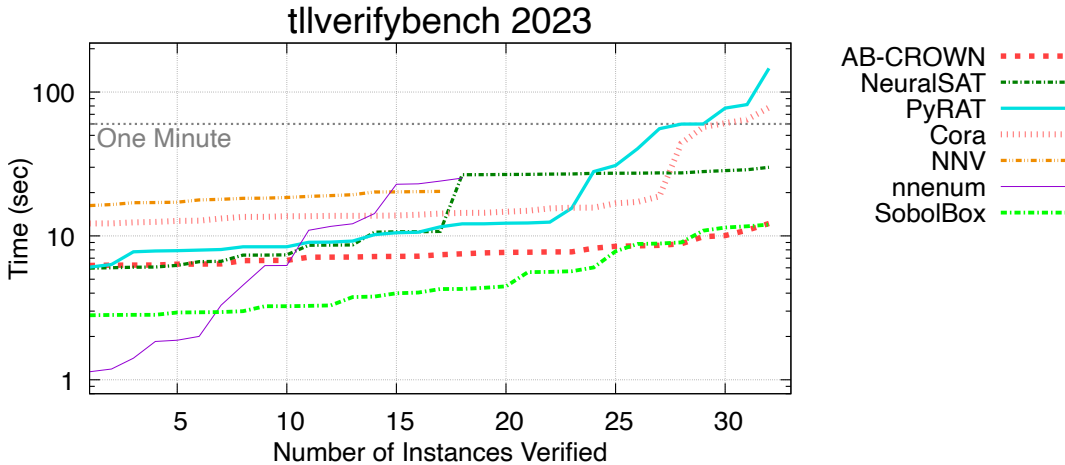


Figure 18: Cactus Plot for tllverifybench 2023.

### **3 Unscoresd Benchmarks**

Table 18: Benchmark 2025-cctsdbs-yolo-2023

| # | Tool                      | Verified | Falsified | Fastest | Penalty Points | Score | Solved       |
|---|---------------------------|----------|-----------|---------|----------------|-------|--------------|
| 1 | PyRAT                     | 11       | 28        | 0       | 0              | 390   | 100.0 100.0% |
| 2 | $\alpha$ - $\beta$ -CROWN | 11       | 28        | 0       | 0              | 390   | 100.0 100.0% |

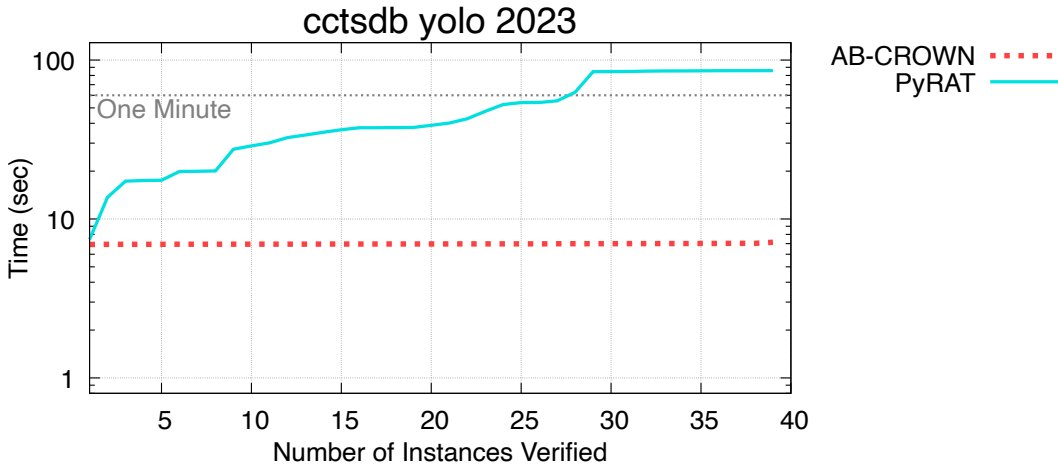


Figure 19: Cactus Plot for cctsdbs yolo 2023.

Table 19: 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 | $\alpha$ - $\beta$ -CROWN | 0        | 6         | 0       | 0              | 60    | 100.0 100.0% |

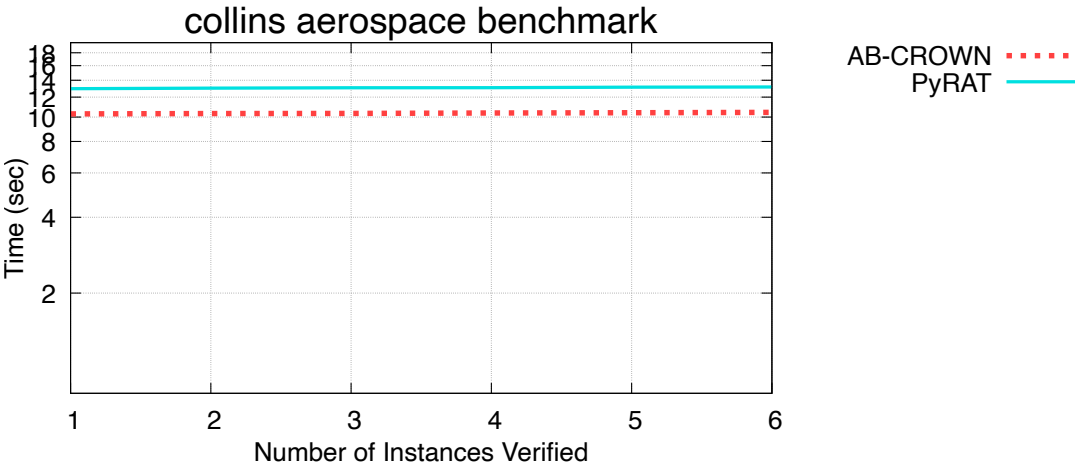


Figure 20: Cactus Plot for collins aerospace benchmark.

Table 20: Benchmark 2025-lsnc-relu

| # | Tool                      | Verified | Falsified | Fastest | Penalty Points | Score | Solved       |
|---|---------------------------|----------|-----------|---------|----------------|-------|--------------|
| 1 | $\alpha$ - $\beta$ -CROWN | 68       | 12        | 0       | 0              | 800   | 100.0 100.0% |

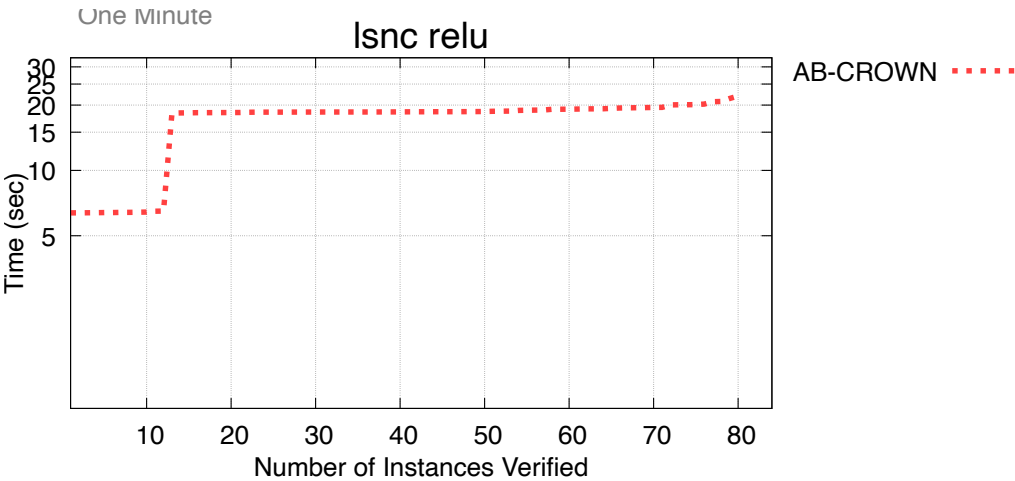


Figure 21: Cactus Plot for lsnc relu.

Table 21: Benchmark 2025-m14acopf-2024

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%  |

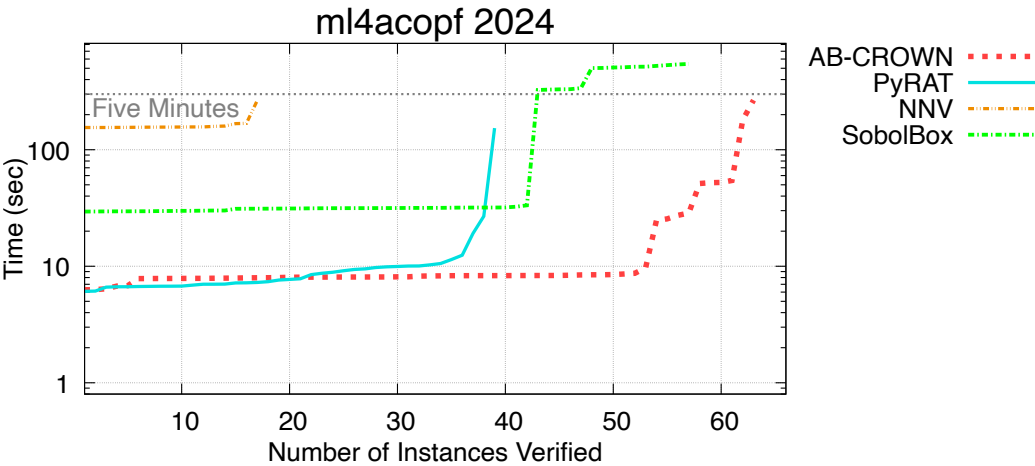


Figure 22: Cactus Plot for ml4acopf 2024.



Table 22: Benchmark 2025-relusplitter

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%   |

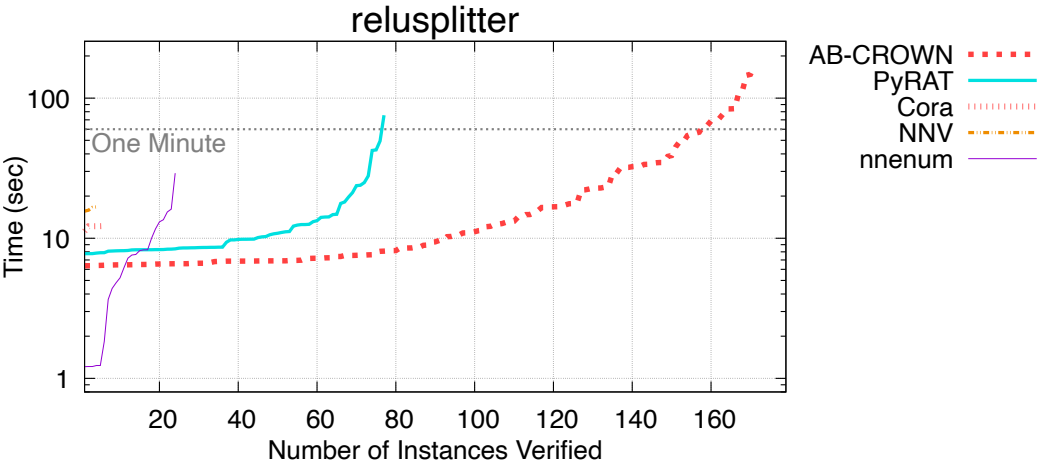


Figure 23: Cactus Plot for relusplitter.

Table 23: Benchmark 2025-traffic-signs-recognition-2023

| # | Tool                      | Verified | Falsified | Fastest | Penalty Points | Score | Solved      |
|---|---------------------------|----------|-----------|---------|----------------|-------|-------------|
| 1 | $\alpha$ - $\beta$ -CROWN | 0        | 43        | 0       | 0              | 430   | 100.0 95.6% |

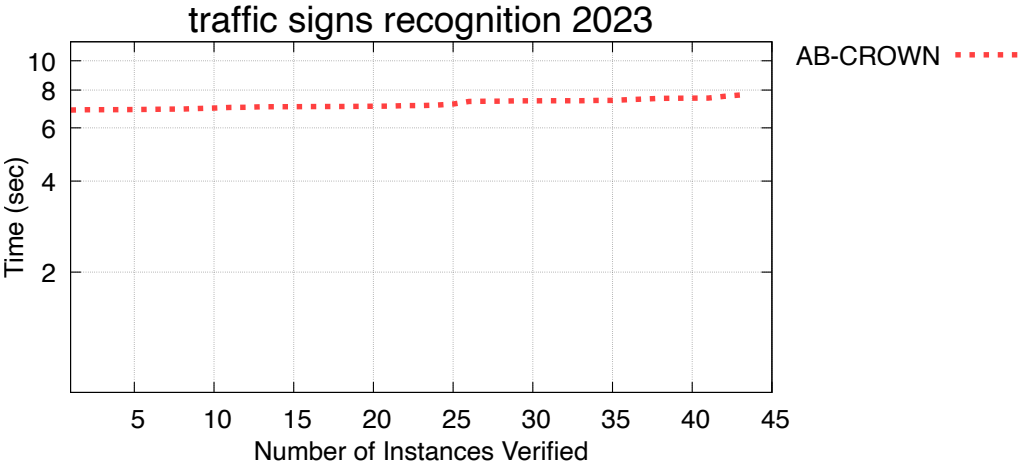


Figure 24: Cactus Plot for traffic signs recognition 2023.

Table 24: Benchmark 2025-vggnet16-2022

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%   |

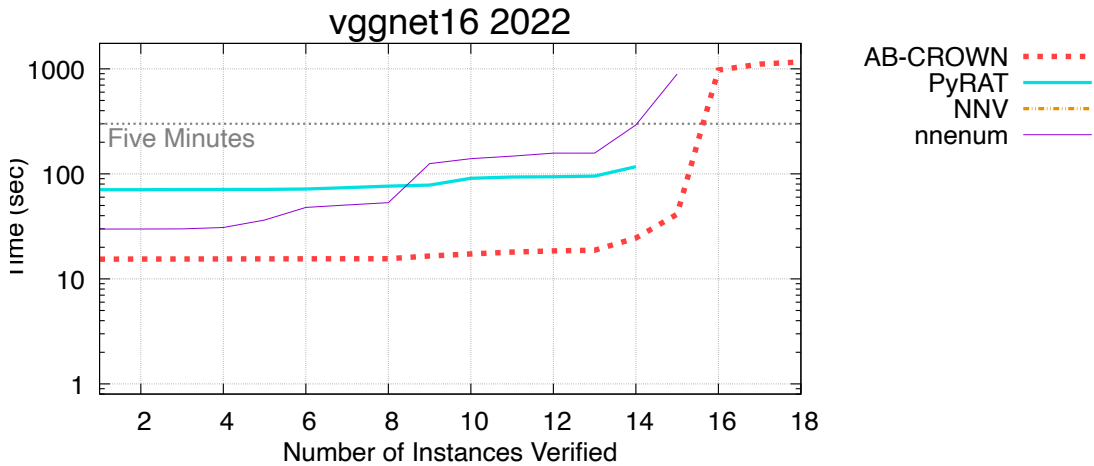


Figure 25: Cactus Plot for vggnet16 2022.

Table 25: Benchmark 2025-vit-2023

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | $\alpha$ - $\beta$ -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%  |

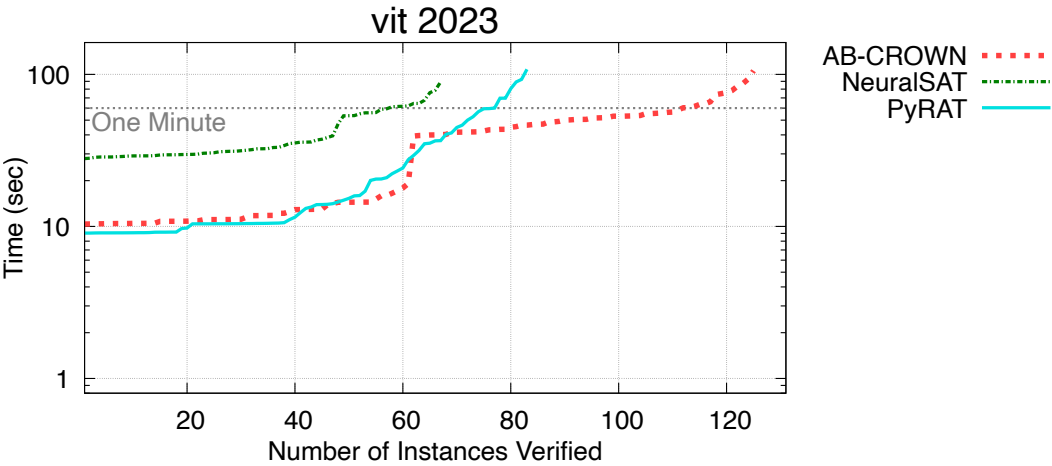


Figure 26: Cactus Plot for vit 2023.

Table 26: Benchmark 2025-yolo-2023

| # | Tool                      | Verified | Falsified | Fastest | Penalty | Points | Score | Solved |
|---|---------------------------|----------|-----------|---------|---------|--------|-------|--------|
| 1 | NNV                       | 71       | 0         | 0       | 0       | 710    | 100.0 | 98.6%  |
| 2 | $\alpha$ - $\beta$ -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%  |

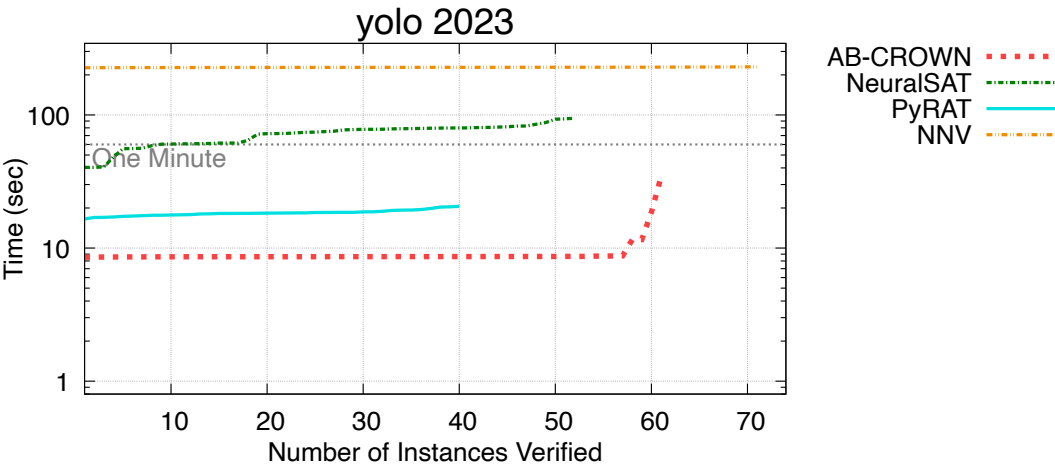


Figure 27: Cactus Plot for yolo 2023.

## 4 Stats

Table 27: Overhead

| # | Tool                      | Seconds |
|---|---------------------------|---------|
| 1 | nenum                     | 0.9     |
| 2 | SobolBox                  | 2.7     |
| 3 | NeuralSAT                 | 5.9     |
| 4 | $\alpha$ - $\beta$ -CROWN | 6.0     |
| 5 | PyRAT                     | 6.0     |
| 6 | CORA                      | 10.9    |
| 7 | NNV                       | 14.2    |

Table 28: Num Benchmarks Participated

| # | Tool                      | Count |
|---|---------------------------|-------|
| 1 | NeuralSAT                 | 16    |
| 2 | $\alpha$ - $\beta$ -CROWN | 16    |
| 3 | PyRAT                     | 15    |
| 4 | NNV                       | 15    |
| 5 | CORA                      | 14    |
| 6 | nenum                     | 11    |
| 7 | SobolBox                  | 9     |

Table 29: Num Instances Verified

| # | Tool                      | Count |
|---|---------------------------|-------|
| 1 | $\alpha$ - $\beta$ -CROWN | 2543  |
| 2 | NeuralSAT                 | 2437  |
| 3 | PyRAT                     | 2092  |
| 4 | CORA                      | 1872  |
| 5 | nenum                     | 1596  |
| 6 | SobolBox                  | 1439  |
| 7 | NNV                       | 1101  |

Table 30: Num SAT

| # | Tool                      | Count |
|---|---------------------------|-------|
| 1 | $\alpha$ - $\beta$ -CROWN | 1082  |
| 2 | NeuralSAT                 | 1055  |
| 3 | PyRAT                     | 1018  |
| 4 | CORA                      | 946   |
| 5 | nnenum                    | 786   |
| 6 | NNV                       | 354   |
| 7 | SobolBox                  | 317   |

Table 31: Num UNSAT

| # | Tool                      | Count |
|---|---------------------------|-------|
| 1 | $\alpha$ - $\beta$ -CROWN | 1461  |
| 2 | NeuralSAT                 | 1382  |
| 3 | SobolBox                  | 1122  |
| 4 | PyRAT                     | 1074  |
| 5 | CORA                      | 926   |
| 6 | nnenum                    | 810   |
| 7 | NNV                       | 747   |

Table 32: Incorrect Results (or Missing CE)

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

## 5 Detailed Results

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (✗).

| Category         | Id | Result | $\alpha$ - $\beta$ -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 |
| 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 |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category         | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 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 |
| 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 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category         | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 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  | X    | -    | -    | 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 | -    | -    | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category           | Id | Result | $\alpha$ | $\beta$ | C    | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|--------------------|----|--------|----------|---------|------|------|-------|------|------|------|----|
| 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 | -    | -    |    |
| 2025 Cifar100 2024 | 45 | UNSAT  | -        | -       | -    | -    | -     | 75.9 | -    | -    |    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category           | Id  | Result | $\alpha$ | $\beta$ | C NSAT | PyRAT | CORA | NNV | NNen | SB |
|--------------------|-----|--------|----------|---------|--------|-------|------|-----|------|----|
| 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     | X       | 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     | X       | -      | -     | 78.0 | -   | -    | -  |
| 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 | -   | -    | -  |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category           | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|--------------------|-----|--------|-----------------------|------|-------|------|------|------|----|
| 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                  | X    | -     | -    | 78.4 | -    | -  |
| 2025 Cifar100 2024 | 161 | UNSAT  | 7.74                  | X    | -     | -    | 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 | -    | -  |
| 2025 Cifar100 2024 | 181 | UNSAT  | 7.73                  | 9.16 | 9.01  | -    | 78.5 | -    | -  |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category                     | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|------------------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 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 | -    |
| 2025 Collins Rul Cnn 2022 49 |     | UNSAT  | 7.12                  | 18.5 | 6.34  | 13.5 | 16.4 | 1.55 | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category                     | Id | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|------------------------------|----|--------|-----------------------|------|-------|------|------|------|----|
| 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 | -    | -  |
| 2025 Cora 2024               | 55 | ?      | -                     | -    | -     | -    | -    | -    | -  |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category       | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|----------------|-----|--------|-----------------------|------|-------|------|------|------|----|
| 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 | -    | -    | -  |
| 2025 Cora 2024 | 123 | SAT    | 6.31                  | 6.84 | 7.84  | 11.5 | -    | -    | -  |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category             | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|----------------------|-----|--------|-----------------------|------|-------|------|------|------|----|
| 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 | -    | -  |
| 2025 Dist Shift 2023 | 11  | UNSAT  | 6.45                  | 26.8 | 7.12  | 13.4 | 59.4 | -    | -  |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category              | Id | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-----------------------|----|--------|-----------------------|------|-------|------|------|------|------|
| 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 |
| 2025 Linearizenn 2024 | 7  | UNSAT  | 6.48                  | 26.6 | 6.43  | 13.2 | 68.4 | 1.99 | 2.99 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category              | Id | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-----------------------|----|--------|-----------------------|------|-------|------|------|------|------|
| 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 | -    |
| 2025 Malbeware        | 15 | UNSAT  | 6.23                  | 16.3 | 7.84  | 11.9 | 52.2 | 3.87 | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category       | Id | Result | $\alpha$ | $\beta$ | C    | NSAT | PyRAT | CORA | NNV | NNen | SB |
|----------------|----|--------|----------|---------|------|------|-------|------|-----|------|----|
| 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 | -   |      |    |
| 2025 Malbeware | 83 | UNSAT  | 6.53     | 16.7    | 8.84 | 12.7 | -     | 9.48 | -   |      |    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category           | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNeN | SB |
|--------------------|-----|--------|-----------------------|------|-------|------|------|------|----|
| 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 | -    | -  |
| 2025 Metaroom 2023 | 1   | UNSAT  | 6.56                  | 27.3 | 8.70  | 12.0 | 16.0 | -    | -  |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category           | Id | Result | $\alpha$ | $\beta$ | C    | NSAT | PyRAT | CORA | NNV | NNen | SB |
|--------------------|----|--------|----------|---------|------|------|-------|------|-----|------|----|
| 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  | -    | -   | -    | -  |
| 2025 Metaroom 2023 | 69 | UNSAT  | 6.57     | 27.3    | 8.73 | 13.0 | 15.8  | -    | -   | -    | -  |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category           | Id | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|--------------------|----|--------|-----------------------|------|-------|------|------|------|------|
| 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 |
| 2025 Nn4sys        | 37 | UNSAT  | 10.8                  | -    | -     | -    | -    | -    | 22.0 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category    | Id  | Result | $\alpha$ | $\beta$ | C    | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------|-----|--------|----------|---------|------|------|-------|------|------|------|------|
| 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 |
| 2025 Nn4sys | 105 | UNSAT  | 6.27     | 9.33    | 6.33 | -    | -     | -    | 0.90 | 2.81 |      |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category    | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV | N Nen | SB   |
|-------------|-----|--------|-----------------------|------|-------|------|-----|-------|------|
| 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 | -     | -    | -   | -     | -    |
| 2025 Nn4sys | 173 | UNSAT  | 12.9                  | 35.7 | -     | -    | -   | -     | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 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  | 6.58                  | 8.99 | 6.12  | 12.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 1   | UNSAT  | 8.53                  | 10.4 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 2   | UNSAT  | 6.83                  | 8.91 | 6.17  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 3   | UNSAT  | 6.80                  | -    | 6.11  | 14.3 | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 4   | UNSAT  | 6.24                  | 7.94 | 6.37  | 11.9 | 17.0 | 1.07 | 19.0 |
| 2025 Safenlp 2024 | 5   | UNSAT  | 6.82                  | 8.21 | 6.10  | 12.2 | -    | 1.30 | 18.4 |
| 2025 Safenlp 2024 | 6   | UNSAT  | 6.73                  | 8.14 | 6.08  | 12.2 | -    | 1.25 | -    |
| 2025 Safenlp 2024 | 7   | UNSAT  | 7.64                  | 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  | 7.27                  | 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  | -                     | 8.03 | 6.86  | 12.9 | -    | 1.60 | 17.8 |
| 2025 Safenlp 2024 | 12  | UNSAT  | 6.60                  | 8.05 | 6.13  | 12.2 | -    | 1.30 | 18.1 |
| 2025 Safenlp 2024 | 13  | SAT    | 6.68                  | 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    | 6.84                  | 6.27 | 6.12  | 11.2 | -    | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 16  | UNSAT  | 6.27                  | 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  | 7.09                  | 8.01 | 11.7  | 13.5 | -    | 2.43 | 17.9 |
| 2025 Safenlp 2024 | 19  | UNSAT  | 6.60                  | 9.12 | 6.10  | 12.2 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 20  | SAT    | 6.76                  | 5.90 | 6.04  | 12.2 | 14.9 | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 21  | UNSAT  | 8.56                  | 9.00 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 22  | UNSAT  | 6.24                  | 7.91 | 6.40  | 10.9 | 16.6 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 23  | SAT    | 6.62                  | 5.98 | 6.07  | 12.2 | 15.0 | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 24  | SAT    | 6.79                  | 6.01 | 6.11  | 12.2 | 14.9 | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 25  | UNSAT  | 7.12                  | 8.29 | 15.2  | 13.8 | -    | 3.67 | -    |
| 2025 Safenlp 2024 | 26  | UNSAT  | 6.25                  | 7.88 | 6.38  | 11.9 | 16.3 | 1.13 | 17.7 |
| 2025 Safenlp 2024 | 27  | UNSAT  | 6.76                  | 8.97 | 6.11  | 12.3 | -    | 1.24 | -    |
| 2025 Safenlp 2024 | 28  | UNSAT  | 7.16                  | 8.02 | 14.6  | 13.6 | -    | 3.33 | 17.9 |
| 2025 Safenlp 2024 | 29  | SAT    | 6.76                  | 5.97 | 6.05  | 11.1 | 15.2 | 1.26 | 18.2 |
| 2025 Safenlp 2024 | 30  | SAT    | 6.54                  | 5.99 | 6.12  | 11.2 | 14.9 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 31  | UNSAT  | 6.69                  | 8.97 | 6.13  | 12.2 | -    | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 32  | UNSAT  | -                     | 8.00 | 8.61  | 13.5 | -    | 1.93 | 17.7 |
| 2025 Safenlp 2024 | 33  | UNSAT  | 6.40                  | 7.99 | 6.46  | 11.7 | 17.0 | 1.07 | 18.1 |
| 2025 Safenlp 2024 | 34  | UNSAT  | 6.76                  | 9.03 | 6.11  | 12.2 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 35  | UNSAT  | 6.58                  | 7.93 | 6.10  | 11.2 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 36  | UNSAT  | 6.82                  | 8.09 | 6.10  | 13.0 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 37  | UNSAT  | 6.27                  | 7.89 | 6.39  | 12.0 | 16.5 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 38  | UNSAT  | 6.79                  | 8.00 | 6.11  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 39  | UNSAT  | 6.50                  | 8.05 | 6.12  | 12.7 | -    | 1.47 | 18.0 |
| 2025 Safenlp 2024 | 40  | UNSAT  | 6.70                  | 8.01 | 6.12  | 12.7 | -    | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 41  | UNSAT  | 6.65                  | 8.06 | 6.12  | 11.4 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 42  | UNSAT  | 7.25                  | 7.96 | 6.62  | 12.7 | -    | 1.27 | 17.9 |
| 2025 Safenlp 2024 | 43  | UNSAT  | 7.21                  | 8.19 | 12.4  | 15.8 | -    | 2.73 | 17.8 |
| 2025 Safenlp 2024 | 44  | UNSAT  | 8.26                  | 8.86 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 45  | UNSAT  | 7.12                  | 8.04 | 8.26  | 13.2 | -    | 2.22 | 17.9 |
| 2025 Safenlp 2024 | 46  | UNSAT  | 6.61                  | 8.12 | 6.11  | 12.8 | -    | 1.43 | 18.1 |
| 2025 Safenlp 2024 | 47  | UNSAT  | 6.65                  | 8.96 | 6.10  | 12.2 | -    | 1.24 | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 48  | UNSAT  | 6.29                  | 7.90 | 6.42  | 10.9 | 16.4 | 1.10 | 17.5 |
| 2025 Safenlp 2024 | 49  | UNSAT  | 6.71                  | 8.98 | 6.06  | 12.7 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 50  | UNSAT  | 6.68                  | 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  | 6.75                  | 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  | 7.33                  | 8.19 | 17.6  | -    | -    | 20.8 | 17.9 |
| 2025 Safenlp 2024 | 55  | UNSAT  | 6.26                  | 7.93 | 6.38  | 11.9 | 16.4 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 56  | UNSAT  | 6.81                  | 8.06 | 6.11  | 12.2 | -    | 1.29 | 18.0 |
| 2025 Safenlp 2024 | 57  | UNSAT  | 6.76                  | 8.90 | 6.08  | 13.5 | -    | 1.78 | 18.2 |
| 2025 Safenlp 2024 | 58  | UNSAT  | 7.35                  | 8.32 | -     | 17.3 | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 59  | UNSAT  | 11.7                  | 26.7 | -     | -    | -    | -    | -    |
| 2025 Safenlp 2024 | 60  | UNSAT  | 7.31                  | 8.01 | 9.04  | 13.3 | -    | 2.03 | 17.7 |
| 2025 Safenlp 2024 | 61  | SAT    | 6.85                  | 5.96 | 6.07  | 12.3 | 15.1 | 1.24 | -    |
| 2025 Safenlp 2024 | 62  | UNSAT  | 7.19                  | 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  | 6.68                  | 8.00 | 6.10  | 12.2 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 65  | UNSAT  | 6.79                  | 8.99 | 6.07  | 11.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 66  | SAT    | 6.78                  | 6.34 | 6.10  | 12.2 | -    | 1.25 | X    |
| 2025 Safenlp 2024 | 67  | UNSAT  | 6.81                  | 8.95 | 6.09  | 12.3 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 68  | UNSAT  | 6.51                  | 8.00 | 6.11  | 12.3 | -    | 1.22 | 17.7 |
| 2025 Safenlp 2024 | 69  | UNSAT  | 6.63                  | 8.03 | 6.11  | 12.3 | -    | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 70  | SAT    | 6.81                  | 6.11 | 6.07  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 71  | SAT    | 6.56                  | 5.97 | 6.06  | 12.2 | 15.1 | 1.22 | 18.0 |
| 2025 Safenlp 2024 | 72  | UNSAT  | 6.81                  | 7.99 | 6.13  | 12.3 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 73  | UNSAT  | 6.80                  | 7.91 | 6.11  | 12.1 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 74  | UNSAT  | 6.27                  | 7.97 | 6.36  | 11.9 | 16.7 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 75  | UNSAT  | 9.11                  | 43.0 | -     | -    | -    | -    | 17.7 |
| 2025 Safenlp 2024 | 76  | SAT    | 6.82                  | 6.47 | 6.12  | 12.2 | -    | 1.23 | X    |
| 2025 Safenlp 2024 | 77  | SAT    | 6.80                  | 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  | 6.77                  | 9.00 | 6.12  | 12.2 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 80  | SAT    | 6.58                  | 5.95 | 6.06  | 11.2 | 14.9 | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 81  | UNSAT  | 6.73                  | 8.94 | 6.13  | 11.2 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 82  | UNSAT  | 6.27                  | 7.97 | 6.38  | 12.0 | 16.7 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 83  | UNSAT  | 6.71                  | 8.93 | 6.10  | 13.0 | -    | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 84  | SAT    | 6.57                  | 5.97 | 6.10  | 12.2 | 15.1 | 1.29 | 18.0 |
| 2025 Safenlp 2024 | 85  | UNSAT  | 6.77                  | 7.93 | 6.12  | 12.2 | -    | 1.28 | 18.3 |
| 2025 Safenlp 2024 | 86  | UNSAT  | 6.78                  | 8.94 | 6.14  | 13.0 | -    | 1.44 | 17.9 |
| 2025 Safenlp 2024 | 87  | UNSAT  | 6.26                  | 8.00 | 6.36  | 11.9 | 16.7 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 88  | UNSAT  | 6.37                  | 8.02 | 6.46  | 11.5 | 16.8 | 1.08 | 17.7 |
| 2025 Safenlp 2024 | 89  | SAT    | 6.75                  | 5.95 | 6.06  | 12.2 | 14.8 | 1.28 | 18.1 |
| 2025 Safenlp 2024 | 90  | UNSAT  | 6.62                  | 7.92 | 6.12  | 13.3 | -    | 1.76 | -    |
| 2025 Safenlp 2024 | 91  | SAT    | 6.77                  | 5.94 | 6.06  | 12.1 | 15.0 | 1.26 | 18.2 |
| 2025 Safenlp 2024 | 92  | SAT    | 6.62                  | 5.97 | 6.08  | 12.2 | 14.9 | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 93  | UNSAT  | 7.43                  | 8.95 | -     | 20.0 | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 94  | UNSAT  | 6.27                  | 7.93 | 6.39  | 10.9 | 16.3 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 95  | UNSAT  | 7.97                  | 20.6 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 96  | UNSAT  | 6.69                  | 8.93 | 6.08  | 11.2 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 97  | UNSAT  | 6.76                  | 9.66 | 6.09  | 13.2 | -    | 1.73 | 18.2 |
| 2025 Safenlp 2024 | 98  | UNSAT  | 6.74                  | 8.00 | 6.11  | 12.2 | -    | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 99  | UNSAT  | 6.26                  | 7.94 | 6.37  | 12.0 | 16.2 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 100 | SAT    | 6.68                  | 5.98 | 6.05  | 12.2 | 14.9 | 1.07 | 17.9 |
| 2025 Safenlp 2024 | 101 | UNSAT  | 6.30                  | 7.93 | 6.36  | 12.0 | 16.3 | 1.09 | 17.6 |
| 2025 Safenlp 2024 | 102 | SAT    | 6.50                  | 6.01 | 6.07  | 12.2 | 15.1 | 1.27 | 17.9 |
| 2025 Safenlp 2024 | 103 | SAT    | 6.52                  | 6.05 | 6.08  | 12.2 | 14.8 | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 104 | UNSAT  | 6.69                  | 7.99 | 6.13  | 12.3 | -    | 1.22 | 17.8 |
| 2025 Safenlp 2024 | 105 | UNSAT  | 6.76                  | 8.96 | 6.13  | 11.2 | -    | 1.28 | 18.0 |
| 2025 Safenlp 2024 | 106 | UNSAT  | 6.27                  | 7.94 | 6.41  | 11.9 | 16.3 | 1.13 | 17.7 |
| 2025 Safenlp 2024 | 107 | UNSAT  | 7.65                  | 8.12 | 12.5  | 14.7 | -    | 2.85 | 17.8 |
| 2025 Safenlp 2024 | 108 | UNSAT  | 6.76                  | 9.00 | 6.12  | 13.0 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 109 | UNSAT  | 6.80                  | 7.96 | 6.09  | 12.2 | -    | 1.29 | 18.3 |
| 2025 Safenlp 2024 | 110 | UNSAT  | 6.54                  | 8.92 | 6.13  | 12.0 | -    | 1.48 | 18.2 |
| 2025 Safenlp 2024 | 111 | SAT    | 6.78                  | 5.90 | 6.07  | 12.2 | 14.9 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 112 | UNSAT  | 6.27                  | 7.99 | 6.38  | 11.9 | 16.5 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 113 | SAT    | 6.79                  | 5.93 | 6.10  | 12.2 | 14.9 | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 114 | UNSAT  | 6.50                  | 8.95 | 6.10  | 12.3 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 115 | SAT    | 6.79                  | 5.91 | 6.04  | 12.3 | 15.3 | 1.24 | 17.9 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ | $\beta$ | C    | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|-------------------|-----|--------|----------|---------|------|------|-------|------|------|------|----|
| 2025 Safenlp 2024 | 116 | UNSAT  | 7.22     | 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    | 6.77     | 5.95    | 6.06 | 12.2 | 15.0  | 1.25 | 17.8 |      |    |
| 2025 Safenlp 2024 | 119 | UNSAT  | 6.30     | 7.96    | 6.40 | 11.9 | 16.8  | 1.07 | 17.8 |      |    |
| 2025 Safenlp 2024 | 120 | UNSAT  | 6.78     | 7.97    | 6.12 | 11.2 | -     | 1.25 | 18.3 |      |    |
| 2025 Safenlp 2024 | 121 | UNSAT  | 6.28     | 7.86    | 6.37 | 11.9 | 16.5  | 1.12 | 17.7 |      |    |
| 2025 Safenlp 2024 | 122 | UNSAT  | 6.74     | 9.02    | 6.11 | 13.8 | -     | -    | 18.2 |      |    |
| 2025 Safenlp 2024 | 123 | SAT    | 6.46     | 5.94    | 6.10 | 12.1 | 14.9  | 1.09 | 17.9 |      |    |
| 2025 Safenlp 2024 | 124 | SAT    | 6.71     | 5.97    | 6.04 | 12.2 | 14.8  | 1.25 | 18.3 |      |    |
| 2025 Safenlp 2024 | 125 | UNSAT  | 7.38     | 8.25    | -    | -    | -     | 12.6 | 17.7 |      |    |
| 2025 Safenlp 2024 | 126 | UNSAT  | 7.05     | 8.04    | 15.2 | 14.3 | -     | 5.54 | 17.9 |      |    |
| 2025 Safenlp 2024 | 127 | UNSAT  | 8.80     | 17.2    | -    | -    | -     | -    | 18.1 |      |    |
| 2025 Safenlp 2024 | 128 | UNSAT  | 6.78     | 9.02    | 6.10 | 12.2 | -     | 1.25 | 17.8 |      |    |
| 2025 Safenlp 2024 | 129 | SAT    | 6.55     | 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  | 6.68     | 8.10    | 6.14 | 11.2 | -     | 1.24 | 18.0 |      |    |
| 2025 Safenlp 2024 | 132 | SAT    | 6.76     | 6.08    | 6.09 | 12.2 | 14.9  | 1.24 | 18.2 |      |    |
| 2025 Safenlp 2024 | 133 | SAT    | 6.76     | 6.00    | 6.05 | 12.2 | 14.8  | 1.06 | -    |      |    |
| 2025 Safenlp 2024 | 134 | UNSAT  | 6.23     | 7.92    | 6.39 | 12.0 | 16.1  | 1.08 | -    |      |    |
| 2025 Safenlp 2024 | 135 | UNSAT  | 6.75     | 8.00    | 6.12 | 12.3 | -     | 1.28 | 17.8 |      |    |
| 2025 Safenlp 2024 | 136 | UNSAT  | 6.27     | 7.92    | 6.37 | 11.9 | 16.5  | 1.07 | 17.6 |      |    |
| 2025 Safenlp 2024 | 137 | UNSAT  | 6.80     | 8.25    | 6.10 | 12.2 | -     | 1.61 | 18.0 |      |    |
| 2025 Safenlp 2024 | 138 | UNSAT  | 6.24     | 7.87    | 6.39 | 11.9 | 16.6  | 1.12 | 17.7 |      |    |
| 2025 Safenlp 2024 | 139 | SAT    | 6.76     | 5.98    | 6.04 | 12.2 | 14.9  | 1.24 | 18.0 |      |    |
| 2025 Safenlp 2024 | 140 | SAT    | 6.66     | 6.75    | 6.08 | 11.2 | 15.2  | 1.25 | 18.0 |      |    |
| 2025 Safenlp 2024 | 141 | UNSAT  | 7.53     | 8.27    | -    | 15.8 | -     | 14.4 | 18.1 |      |    |
| 2025 Safenlp 2024 | 142 | UNSAT  | 7.31     | 8.13    | 10.8 | 14.3 | -     | 2.12 | 17.8 |      |    |
| 2025 Safenlp 2024 | 143 | SAT    | 6.73     | 5.96    | 6.10 | 12.2 | 15.0  | 1.08 | 17.7 |      |    |
| 2025 Safenlp 2024 | 144 | UNSAT  | 6.23     | 7.87    | 6.35 | 11.0 | 16.4  | 1.14 | 17.7 |      |    |
| 2025 Safenlp 2024 | 145 | SAT    | 6.78     | 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  | 6.81     | 8.04    | 6.13 | 12.2 | -     | 1.23 | 17.8 |      |    |
| 2025 Safenlp 2024 | 148 | UNSAT  | 7.77     | 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  | 6.22     | 7.96    | 6.36 | 12.0 | 16.5  | 1.08 | 17.5 |      |    |
| 2025 Safenlp 2024 | 151 | UNSAT  | -        | 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    | 6.74     | 6.07    | 6.10 | 11.2 | 15.0  | 1.25 | 17.9 |      |    |
| 2025 Safenlp 2024 | 154 | UNSAT  | 6.28     | 7.94    | 6.38 | 11.0 | 16.6  | 1.07 | 17.6 |      |    |
| 2025 Safenlp 2024 | 155 | UNSAT  | 7.14     | 7.99    | 6.87 | 12.7 | -     | 1.27 | 17.9 |      |    |
| 2025 Safenlp 2024 | 156 | UNSAT  | 8.28     | 14.5    | -    | -    | -     | -    | 18.0 |      |    |
| 2025 Safenlp 2024 | 157 | UNSAT  | 6.28     | 7.82    | 6.45 | 12.5 | 16.7  | 1.08 | 17.8 |      |    |
| 2025 Safenlp 2024 | 158 | SAT    | 6.57     | 5.93    | 6.07 | 12.2 | 15.1  | 1.24 | 18.0 |      |    |
| 2025 Safenlp 2024 | 159 | UNSAT  | -        | 7.96    | 6.46 | 11.5 | -     | 1.37 | 17.5 |      |    |
| 2025 Safenlp 2024 | 160 | UNSAT  | 6.65     | 7.97    | 6.10 | 11.2 | -     | 1.33 | 18.0 |      |    |
| 2025 Safenlp 2024 | 161 | UNSAT  | 6.62     | 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  | 6.81     | 9.01    | 6.10 | 12.2 | -     | 1.25 | 18.3 |      |    |
| 2025 Safenlp 2024 | 165 | UNSAT  | 6.27     | 7.90    | 6.40 | 10.9 | 16.8  | 1.07 | 17.8 |      |    |
| 2025 Safenlp 2024 | 166 | UNSAT  | 6.65     | 8.06    | 6.14 | 12.2 | -     | 1.25 | 18.3 |      |    |
| 2025 Safenlp 2024 | 167 | UNSAT  | 6.53     | 8.89    | 6.14 | 12.3 | -     | 1.25 | 18.0 |      |    |
| 2025 Safenlp 2024 | 168 | UNSAT  | 6.27     | 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    | 6.76     | 6.11    | 6.06 | 12.3 | 15.2  | 1.25 | 17.9 |      |    |
| 2025 Safenlp 2024 | 171 | UNSAT  | 7.31     | 8.09    | 11.3 | 13.5 | -     | 2.57 | 17.9 |      |    |
| 2025 Safenlp 2024 | 172 | SAT    | 6.78     | 6.02    | 6.08 | 12.3 | 14.9  | 1.25 | 18.1 |      |    |
| 2025 Safenlp 2024 | 173 | UNSAT  | 6.27     | 7.87    | 6.35 | 12.0 | 16.5  | 1.07 | 18.8 |      |    |
| 2025 Safenlp 2024 | 174 | UNSAT  | 6.23     | 7.91    | 6.37 | 12.0 | 17.1  | 1.07 | 17.8 |      |    |
| 2025 Safenlp 2024 | 175 | UNSAT  | 7.23     | 8.30    | 23.2 | 16.7 | -     | 7.74 | 18.0 |      |    |
| 2025 Safenlp 2024 | 176 | UNSAT  | 6.26     | 7.94    | 6.36 | 11.9 | 16.6  | 1.07 | 17.6 |      |    |
| 2025 Safenlp 2024 | 177 | UNSAT  | 6.29     | 7.90    | 6.43 | 12.0 | 16.3  | 1.07 | 17.7 |      |    |
| 2025 Safenlp 2024 | 178 | UNSAT  | 6.83     | 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  | 7.15     | 8.21    | 15.8 | 25.3 | -     | 14.9 | 18.1 |      |    |
| 2025 Safenlp 2024 | 181 | UNSAT  | 6.64     | 8.02    | 6.12 | 12.2 | -     | 1.24 | 18.0 |      |    |
| 2025 Safenlp 2024 | 182 | UNSAT  | 6.27     | 7.94    | 6.38 | 12.0 | 16.6  | 1.07 | 17.7 |      |    |
| 2025 Safenlp 2024 | 183 | UNSAT  | 6.51     | 7.97    | 6.15 | 12.2 | -     | 1.21 | 18.0 |      |    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 184 | SAT    | 6.70                  | 7.10 | 6.09  | 12.2 | -    | 1.26 | X    |
| 2025 Safenlp 2024 | 185 | UNSAT  | 7.22                  | 8.09 | 19.6  | 14.3 | -    | 4.95 | 17.8 |
| 2025 Safenlp 2024 | 186 | UNSAT  | 6.20                  | 7.86 | 6.35  | 12.0 | 16.7 | 1.07 | 17.9 |
| 2025 Safenlp 2024 | 187 | SAT    | 6.61                  | 7.56 | 6.12  | 12.2 | 15.0 | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 188 | UNSAT  | 6.43                  | 7.94 | 6.48  | 12.5 | 16.5 | 1.07 | 19.0 |
| 2025 Safenlp 2024 | 189 | UNSAT  | 6.82                  | 7.98 | 6.09  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 190 | UNSAT  | 7.55                  | 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  | 6.80                  | 8.07 | 6.13  | 12.5 | -    | 1.43 | 18.2 |
| 2025 Safenlp 2024 | 193 | UNSAT  | 6.78                  | 8.09 | 6.12  | 11.2 | -    | 1.26 | 18.0 |
| 2025 Safenlp 2024 | 194 | UNSAT  | 6.26                  | 7.88 | 6.45  | 12.5 | 16.8 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 195 | SAT    | 6.76                  | 5.97 | 6.12  | 12.2 | 15.0 | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 196 | UNSAT  | -                     | 8.01 | 7.12  | 13.3 | -    | 1.44 | 17.9 |
| 2025 Safenlp 2024 | 197 | UNSAT  | 6.72                  | 8.97 | 6.13  | 12.2 | -    | 1.27 | 18.3 |
| 2025 Safenlp 2024 | 198 | UNSAT  | 7.25                  | 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  | 6.94                  | 8.92 | 6.10  | 12.2 | -    | 1.26 | 18.4 |
| 2025 Safenlp 2024 | 202 | UNSAT  | 6.71                  | 8.94 | 6.12  | 12.2 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 203 | SAT    | 6.71                  | 5.95 | 6.07  | 12.2 | 14.9 | 1.26 | 18.1 |
| 2025 Safenlp 2024 | 204 | UNSAT  | -                     | 8.03 | 8.99  | 13.5 | -    | 2.27 | 17.7 |
| 2025 Safenlp 2024 | 205 | UNSAT  | 6.27                  | 7.86 | 6.41  | 11.9 | 16.6 | 1.08 | 18.2 |
| 2025 Safenlp 2024 | 206 | SAT    | 6.60                  | 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  | 6.27                  | 7.93 | 6.40  | 12.0 | 16.7 | 1.07 | 17.9 |
| 2025 Safenlp 2024 | 209 | SAT    | 6.71                  | 7.32 | 6.14  | 12.2 | 14.9 | 1.30 | 18.3 |
| 2025 Safenlp 2024 | 210 | UNSAT  | 6.61                  | 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  | 6.80                  | 8.99 | 6.13  | 12.2 | -    | 1.27 | 17.9 |
| 2025 Safenlp 2024 | 213 | UNSAT  | 7.43                  | 8.12 | 10.9  | 15.3 | -    | 3.21 | 18.0 |
| 2025 Safenlp 2024 | 214 | UNSAT  | 6.80                  | 8.93 | 6.09  | 12.2 | -    | 1.26 | 18.1 |
| 2025 Safenlp 2024 | 215 | UNSAT  | 6.59                  | 7.92 | 6.13  | 11.2 | -    | 1.27 | 17.7 |
| 2025 Safenlp 2024 | 216 | UNSAT  | 6.26                  | 7.97 | 6.39  | 11.9 | 16.6 | 1.09 | 17.4 |
| 2025 Safenlp 2024 | 217 | SAT    | 6.44                  | 5.93 | 6.06  | 12.2 | 15.0 | 1.22 | 17.9 |
| 2025 Safenlp 2024 | 218 | UNSAT  | 7.22                  | 8.01 | 6.92  | 12.4 | -    | 1.46 | 17.9 |
| 2025 Safenlp 2024 | 219 | UNSAT  | 6.81                  | 8.02 | 6.13  | 11.7 | -    | 1.61 | -    |
| 2025 Safenlp 2024 | 220 | UNSAT  | 6.48                  | 7.98 | 6.14  | 12.2 | -    | 1.25 | 17.7 |
| 2025 Safenlp 2024 | 221 | SAT    | 6.77                  | 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    | 6.49                  | 5.98 | 6.04  | 12.2 | 15.2 | 1.22 | 17.7 |
| 2025 Safenlp 2024 | 224 | UNSAT  | 6.29                  | 7.88 | 6.36  | 11.9 | 16.7 | 1.08 | 18.1 |
| 2025 Safenlp 2024 | 225 | UNSAT  | 6.78                  | 8.94 | 6.10  | 12.8 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 226 | UNSAT  | 6.64                  | 7.93 | 6.13  | 11.2 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 227 | UNSAT  | 6.26                  | 7.96 | 6.39  | 11.9 | 16.5 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 228 | SAT    | 6.77                  | 5.93 | 6.06  | 12.3 | 14.9 | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 229 | UNSAT  | 6.29                  | 7.98 | 6.43  | 11.9 | 16.5 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 230 | UNSAT  | 6.76                  | 7.99 | 6.14  | 12.3 | -    | 1.26 | 18.0 |
| 2025 Safenlp 2024 | 231 | SAT    | 6.47                  | 5.97 | 6.06  | 12.2 | 14.8 | 1.12 | 17.9 |
| 2025 Safenlp 2024 | 232 | UNSAT  | 7.66                  | 8.24 | 14.5  | 14.3 | -    | 3.21 | 17.7 |
| 2025 Safenlp 2024 | 233 | UNSAT  | 6.59                  | 8.12 | 6.10  | 12.2 | -    | 1.47 | 17.9 |
| 2025 Safenlp 2024 | 234 | UNSAT  | 8.69                  | 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  | 8.42                  | 9.40 | -     | -    | -    | -    | 18.3 |
| 2025 Safenlp 2024 | 237 | UNSAT  | 6.29                  | 7.96 | 6.40  | 12.1 | 17.2 | 1.10 | 17.8 |
| 2025 Safenlp 2024 | 238 | UNSAT  | 6.49                  | 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  | 6.40                  | 7.97 | 6.43  | 12.8 | 16.5 | 1.07 | 17.9 |
| 2025 Safenlp 2024 | 241 | UNSAT  | 6.24                  | 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  | 6.78                  | 7.95 | 6.14  | 12.2 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 244 | UNSAT  | 7.36                  | 8.25 | -     | 13.2 | -    | 6.24 | 17.7 |
| 2025 Safenlp 2024 | 245 | UNSAT  | 6.28                  | 7.91 | 6.42  | 11.9 | 16.4 | 1.13 | 18.0 |
| 2025 Safenlp 2024 | 246 | UNSAT  | 6.83                  | 8.02 | 6.12  | 12.7 | -    | 1.25 | 18.3 |
| 2025 Safenlp 2024 | 247 | UNSAT  | 6.53                  | 7.98 | 6.12  | 12.2 | -    | 1.21 | 17.7 |
| 2025 Safenlp 2024 | 248 | SAT    | 6.73                  | 6.06 | 6.07  | 12.2 | 15.8 | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 249 | UNSAT  | 6.62                  | 8.02 | 6.12  | 12.2 | -    | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 250 | UNSAT  | 6.73                  | 7.96 | 6.10  | 11.2 | -    | 1.22 | -    |
| 2025 Safenlp 2024 | 251 | UNSAT  | 8.77                  | 11.9 | -     | -    | -    | -    | 18.2 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 252 | UNSAT  | 6.75                  | 8.08 | 6.13  | 12.2 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 253 | SAT    | 6.51                  | 5.97 | 6.08  | 12.3 | 14.8 | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 254 | SAT    | 6.71                  | 5.96 | 6.13  | 11.2 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 255 | UNSAT  | 6.71                  | 8.09 | 6.10  | 12.3 | -    | 1.40 | 17.9 |
| 2025 Safenlp 2024 | 256 | SAT    | 6.50                  | 6.10 | 6.14  | 12.2 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 257 | UNSAT  | 6.26                  | 7.93 | 6.42  | 11.9 | 16.6 | 1.08 | 17.9 |
| 2025 Safenlp 2024 | 258 | SAT    | 6.72                  | 6.00 | 6.07  | 12.3 | 14.8 | 1.24 | 18.4 |
| 2025 Safenlp 2024 | 259 | UNSAT  | 8.65                  | 12.7 | -     | -    | -    | -    | 18.1 |
| 2025 Safenlp 2024 | 260 | UNSAT  | 7.20                  | 8.02 | 9.39  | 13.3 | -    | 2.07 | 17.6 |
| 2025 Safenlp 2024 | 261 | UNSAT  | 6.92                  | 8.98 | 6.13  | 13.3 | -    | 1.25 | 18.4 |
| 2025 Safenlp 2024 | 262 | UNSAT  | 7.44                  | 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  | 6.79                  | 8.04 | 6.10  | 11.2 | -    | 1.26 | 18.3 |
| 2025 Safenlp 2024 | 265 | UNSAT  | 7.64                  | 9.14 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 266 | UNSAT  | 7.62                  | -    | -     | -    | -    | -    | 18.1 |
| 2025 Safenlp 2024 | 267 | UNSAT  | 6.48                  | 9.22 | 6.12  | 12.2 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 268 | SAT    | 6.59                  | 5.98 | 6.04  | 12.3 | 15.0 | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 269 | UNSAT  | 6.80                  | 8.05 | 6.10  | 11.3 | -    | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 270 | UNSAT  | 7.58                  | 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  | 9.73                  | 40.8 | -     | -    | -    | -    | 18.2 |
| 2025 Safenlp 2024 | 273 | UNSAT  | 6.27                  | 7.89 | 6.42  | 11.9 | 16.5 | 1.09 | 17.6 |
| 2025 Safenlp 2024 | 274 | UNSAT  | 7.19                  | 7.92 | 6.84  | 13.0 | -    | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 275 | UNSAT  | 6.29                  | 7.99 | 6.42  | 11.9 | 17.0 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 276 | SAT    | 6.67                  | 5.98 | 6.09  | 12.2 | 15.0 | 1.13 | 17.7 |
| 2025 Safenlp 2024 | 277 | UNSAT  | 7.08                  | 8.02 | 9.40  | 13.0 | -    | 2.44 | 18.2 |
| 2025 Safenlp 2024 | 278 | UNSAT  | 7.33                  | 8.19 | 14.1  | -    | -    | 3.62 | 17.7 |
| 2025 Safenlp 2024 | 279 | SAT    | 6.74                  | 5.97 | 6.09  | 12.3 | 15.0 | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 280 | UNSAT  | -                     | 28.6 | -     | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 281 | UNSAT  | 6.79                  | 7.98 | 6.11  | 13.0 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 282 | UNSAT  | 6.64                  | 7.93 | 6.14  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 283 | UNSAT  | 6.61                  | 8.11 | 6.11  | 12.2 | -    | 1.30 | 18.3 |
| 2025 Safenlp 2024 | 284 | UNSAT  | 6.55                  | 8.04 | 6.14  | 12.2 | -    | 1.41 | 17.9 |
| 2025 Safenlp 2024 | 285 | UNSAT  | 6.27                  | 7.93 | 6.37  | 11.9 | 16.5 | 1.09 | 17.8 |
| 2025 Safenlp 2024 | 286 | UNSAT  | 7.33                  | 8.01 | 6.88  | 12.4 | -    | 1.27 | -    |
| 2025 Safenlp 2024 | 287 | UNSAT  | 6.81                  | 8.12 | 6.12  | 13.0 | -    | 1.28 | 18.0 |
| 2025 Safenlp 2024 | 288 | UNSAT  | -                     | 8.78 | -     | -    | -    | -    | 18.2 |
| 2025 Safenlp 2024 | 289 | UNSAT  | 7.17                  | 8.28 | -     | 14.3 | -    | 16.5 | 18.1 |
| 2025 Safenlp 2024 | 290 | UNSAT  | 14.0                  | -    | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 291 | UNSAT  | 7.12                  | 8.33 | 15.4  | 16.0 | -    | 3.87 | 17.8 |
| 2025 Safenlp 2024 | 292 | SAT    | 6.65                  | 5.98 | 6.07  | 12.2 | 15.3 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 293 | UNSAT  | 8.42                  | 12.6 | -     | -    | -    | -    | 18.1 |
| 2025 Safenlp 2024 | 294 | UNSAT  | 7.71                  | 8.30 | 22.4  | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 295 | SAT    | 6.44                  | 5.96 | 6.09  | 12.2 | 15.0 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 296 | SAT    | 6.56                  | 5.95 | 6.07  | 12.2 | 14.9 | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 297 | UNSAT  | 7.36                  | 8.33 | 17.5  | 14.0 | -    | 8.03 | 18.0 |
| 2025 Safenlp 2024 | 298 | UNSAT  | 7.54                  | 8.38 | 21.7  | 24.8 | -    | 19.5 | 17.9 |
| 2025 Safenlp 2024 | 299 | UNSAT  | 6.26                  | 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    | 6.55                  | 5.98 | 6.06  | 12.2 | 15.0 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 302 | UNSAT  | 7.12                  | 7.97 | 10.5  | 13.3 | -    | 2.08 | 17.6 |
| 2025 Safenlp 2024 | 303 | SAT    | 6.77                  | 5.95 | 6.06  | 11.2 | 15.0 | 1.26 | 17.7 |
| 2025 Safenlp 2024 | 304 | UNSAT  | 7.45                  | 8.28 | 25.7  | 15.0 | -    | 15.3 | 17.6 |
| 2025 Safenlp 2024 | 305 | UNSAT  | 6.82                  | 7.98 | 6.14  | 11.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 306 | SAT    | 6.76                  | 5.97 | 6.05  | 12.2 | 14.9 | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 307 | SAT    | 6.65                  | 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 | X    |
| 2025 Safenlp 2024 | 310 | SAT    | 6.78                  | 7.90 | 6.11  | 12.1 | 14.9 | 1.25 | 18.4 |
| 2025 Safenlp 2024 | 311 | UNSAT  | 6.26                  | 7.96 | 6.39  | 12.0 | 16.6 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 312 | UNSAT  | 6.75                  | 9.02 | 6.16  | 13.5 | -    | 1.42 | 18.0 |
| 2025 Safenlp 2024 | 313 | UNSAT  | 6.27                  | 7.93 | 6.36  | 12.0 | 16.3 | 1.08 | 17.9 |
| 2025 Safenlp 2024 | 314 | UNSAT  | 7.26                  | 8.00 | 8.48  | 13.3 | -    | 2.26 | 17.9 |
| 2025 Safenlp 2024 | 315 | UNSAT  | 6.24                  | 7.94 | 6.36  | 10.9 | 16.8 | 1.07 | 17.9 |
| 2025 Safenlp 2024 | 316 | UNSAT  | 6.29                  | 7.95 | 6.39  | 11.9 | 16.6 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 317 | SAT    | 6.53                  | 6.64 | 6.11  | 12.2 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 318 | UNSAT  | 7.10                  | 8.24 | 11.8  | 14.2 | -    | 2.55 | 17.7 |
| 2025 Safenlp 2024 | 319 | UNSAT  | 7.72                  | 8.25 | -     | -    | -    | -    | 18.2 |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNeN | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 320 | UNSAT  | 7.16                  | 8.24 | 19.5  | 14.0 | -    | 4.86 | 18.1 |
| 2025 Safenlp 2024 | 321 | UNSAT  | 7.26                  | 8.03 | 10.3  | 16.3 | -    | 2.82 | -    |
| 2025 Safenlp 2024 | 322 | UNSAT  | 6.73                  | 7.96 | 6.10  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 323 | UNSAT  | 6.81                  | 8.95 | 6.11  | 11.3 | -    | 1.25 | 19.2 |
| 2025 Safenlp 2024 | 324 | SAT    | 6.77                  | 6.52 | 6.11  | 12.2 | -    | 1.26 | 18.3 |
| 2025 Safenlp 2024 | 325 | SAT    | 6.73                  | 5.97 | 6.06  | 12.3 | 14.9 | 1.28 | 18.1 |
| 2025 Safenlp 2024 | 326 | UNSAT  | 6.66                  | 7.95 | 6.12  | 11.2 | -    | 1.29 | 18.1 |
| 2025 Safenlp 2024 | 327 | UNSAT  | 6.58                  | 9.01 | 6.09  | 12.2 | -    | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 328 | UNSAT  | 6.28                  | 7.94 | 6.36  | 12.0 | 16.6 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 329 | SAT    | 6.74                  | 6.08 | 6.12  | 12.3 | 15.1 | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 330 | UNSAT  | 8.49                  | 11.4 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 331 | SAT    | 6.51                  | 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  | 6.30                  | 7.95 | 6.41  | 11.9 | 16.5 | 1.08 | -    |
| 2025 Safenlp 2024 | 334 | SAT    | 6.74                  | 5.97 | 6.09  | 11.3 | 14.8 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 335 | UNSAT  | 6.79                  | 8.99 | 6.11  | 13.1 | -    | 1.48 | 18.2 |
| 2025 Safenlp 2024 | 336 | UNSAT  | 6.26                  | 7.94 | 6.39  | 11.9 | 16.5 | 1.07 | 19.1 |
| 2025 Safenlp 2024 | 337 | UNSAT  | 9.30                  | 32.5 | -     | -    | -    | -    | 18.1 |
| 2025 Safenlp 2024 | 338 | UNSAT  | 7.18                  | 8.37 | 15.9  | 18.2 | -    | 4.56 | 18.0 |
| 2025 Safenlp 2024 | 339 | UNSAT  | 6.24                  | 7.92 | 6.37  | 11.0 | 16.6 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 340 | UNSAT  | -                     | 8.12 | 11.2  | 14.5 | -    | 2.33 | 18.0 |
| 2025 Safenlp 2024 | 341 | UNSAT  | 7.33                  | 8.06 | 7.57  | 12.9 | -    | 2.10 | 17.8 |
| 2025 Safenlp 2024 | 342 | UNSAT  | 7.00                  | 8.04 | 10.5  | 13.6 | -    | 2.98 | -    |
| 2025 Safenlp 2024 | 343 | UNSAT  | 6.79                  | 9.01 | 6.12  | 12.2 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 344 | UNSAT  | 6.24                  | 7.92 | 6.37  | 11.0 | 16.3 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 345 | UNSAT  | 7.43                  | 8.21 | 18.0  | 15.8 | -    | 3.71 | 17.7 |
| 2025 Safenlp 2024 | 346 | UNSAT  | 6.73                  | 8.10 | 6.12  | 12.0 | -    | 1.64 | 17.8 |
| 2025 Safenlp 2024 | 347 | SAT    | 6.77                  | 6.30 | 6.08  | 12.2 | -    | 1.26 | 18.4 |
| 2025 Safenlp 2024 | 348 | UNSAT  | 6.26                  | 7.92 | 6.39  | 12.0 | 16.5 | 1.09 | 17.7 |
| 2025 Safenlp 2024 | 349 | SAT    | 6.77                  | 6.22 | 6.09  | 12.2 | 14.8 | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 350 | UNSAT  | 6.62                  | 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  | 7.59                  | 8.02 | 9.80  | 13.8 | -    | 1.76 | 17.8 |
| 2025 Safenlp 2024 | 353 | UNSAT  | 12.4                  | -    | -     | -    | -    | -    | 18.2 |
| 2025 Safenlp 2024 | 354 | UNSAT  | 6.29                  | 8.05 | 6.38  | 12.0 | 16.3 | 1.13 | 17.6 |
| 2025 Safenlp 2024 | 355 | UNSAT  | 7.51                  | 8.41 | -     | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 356 | UNSAT  | 7.44                  | 8.16 | 12.3  | 21.5 | -    | 3.87 | 18.1 |
| 2025 Safenlp 2024 | 357 | UNSAT  | 6.60                  | 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  | 6.28                  | 7.91 | 6.36  | 12.0 | 16.5 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 360 | UNSAT  | 6.79                  | 8.04 | 6.10  | 12.3 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 361 | UNSAT  | 6.48                  | 8.52 | 6.09  | 26.6 | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 362 | UNSAT  | 6.81                  | 8.98 | 6.07  | 12.2 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 363 | UNSAT  | 6.28                  | 7.97 | 6.40  | 11.9 | 16.6 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 364 | UNSAT  | 6.71                  | 8.96 | 6.08  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 365 | SAT    | 6.45                  | 5.98 | 6.05  | 12.3 | 15.1 | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 366 | UNSAT  | 7.39                  | 7.99 | 7.39  | 12.8 | -    | 1.98 | 17.8 |
| 2025 Safenlp 2024 | 367 | UNSAT  | 7.22                  | 8.05 | 6.60  | 12.7 | -    | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 368 | UNSAT  | 6.78                  | 8.14 | 6.12  | 13.0 | -    | 1.45 | 18.1 |
| 2025 Safenlp 2024 | 369 | UNSAT  | 6.81                  | 8.94 | 6.12  | 11.2 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 370 | UNSAT  | 6.82                  | 8.04 | 6.09  | 13.0 | -    | 2.40 | 18.3 |
| 2025 Safenlp 2024 | 371 | UNSAT  | 7.18                  | 7.97 | 7.00  | 13.2 | -    | 1.53 | 17.8 |
| 2025 Safenlp 2024 | 372 | UNSAT  | 6.28                  | 8.00 | 6.44  | 12.5 | 16.8 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 373 | UNSAT  | 6.27                  | 7.97 | 6.40  | 11.9 | 16.4 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 374 | SAT    | 6.48                  | 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  | -                     | 7.96 | 6.58  | 12.7 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 377 | SAT    | 6.54                  | 7.16 | 6.12  | 12.3 | 14.9 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 378 | UNSAT  | 6.52                  | 7.93 | 6.11  | 12.3 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 379 | SAT    | 6.78                  | 5.98 | 6.05  | 12.2 | 15.1 | 1.26 | 18.1 |
| 2025 Safenlp 2024 | 380 | UNSAT  | 6.27                  | 7.94 | 6.38  | 11.0 | 16.5 | 1.06 | 18.0 |
| 2025 Safenlp 2024 | 381 | UNSAT  | 6.75                  | 8.18 | 6.14  | 12.2 | -    | 1.25 | 18.4 |
| 2025 Safenlp 2024 | 382 | UNSAT  | 6.83                  | 8.96 | 6.09  | 12.2 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 383 | SAT    | 6.74                  | 5.99 | 6.03  | 12.2 | 14.8 | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 384 | UNSAT  | 6.25                  | 7.90 | 6.40  | 11.9 | 16.4 | 1.13 | 17.8 |
| 2025 Safenlp 2024 | 385 | UNSAT  | 6.53                  | 9.33 | 6.11  | 12.2 | -    | 1.29 | 17.9 |
| 2025 Safenlp 2024 | 386 | SAT    | 6.78                  | 6.05 | 6.11  | 11.2 | -    | 1.25 | X    |
| 2025 Safenlp 2024 | 387 | UNSAT  | 6.27                  | 7.96 | 6.39  | 11.9 | 16.6 | 1.08 | 17.8 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 388 | SAT    | 6.70                  | 6.06 | 6.08  | 12.2 | 14.8 | 1.26 | 18.1 |
| 2025 Safenlp 2024 | 389 | SAT    | 6.79                  | 5.98 | 6.07  | 12.2 | 14.9 | 1.25 | 17.7 |
| 2025 Safenlp 2024 | 390 | UNSAT  | 6.23                  | 7.92 | 6.37  | 10.9 | 16.5 | 1.08 | 17.7 |
| 2025 Safenlp 2024 | 391 | UNSAT  | 6.24                  | 7.94 | 6.39  | 11.9 | 16.4 | 1.09 | 17.9 |
| 2025 Safenlp 2024 | 392 | UNSAT  | 6.79                  | 7.97 | 6.06  | 12.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 393 | UNSAT  | 6.49                  | 8.96 | 6.11  | 12.3 | -    | 1.24 | 17.7 |
| 2025 Safenlp 2024 | 394 | UNSAT  | 6.77                  | 9.01 | 6.10  | 11.2 | -    | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 395 | UNSAT  | 6.25                  | 7.92 | 6.38  | 11.9 | 16.5 | 1.09 | 17.8 |
| 2025 Safenlp 2024 | 396 | UNSAT  | 6.79                  | 7.96 | 6.09  | 12.3 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 397 | SAT    | 6.70                  | 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  | 6.28                  | 7.92 | 6.39  | 12.0 | 17.0 | 1.12 | 17.9 |
| 2025 Safenlp 2024 | 400 | UNSAT  | 6.76                  | 9.11 | 6.12  | 12.2 | -    | 1.92 | 18.5 |
| 2025 Safenlp 2024 | 401 | UNSAT  | 6.51                  | 8.02 | 6.11  | 11.2 | -    | 1.22 | 17.6 |
| 2025 Safenlp 2024 | 402 | SAT    | 6.81                  | 6.71 | 6.10  | 12.3 | -    | 1.23 | X    |
| 2025 Safenlp 2024 | 403 | UNSAT  | 7.63                  | 8.29 | -     | 16.2 | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 404 | UNSAT  | 9.32                  | 56.3 | -     | -    | -    | -    | 18.2 |
| 2025 Safenlp 2024 | 405 | UNSAT  | 6.54                  | 9.00 | 6.09  | 12.3 | -    | 1.26 | 18.1 |
| 2025 Safenlp 2024 | 406 | SAT    | 6.76                  | 5.95 | 6.04  | 12.2 | 15.0 | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 407 | UNSAT  | 7.08                  | 7.99 | 10.9  | 15.0 | -    | 2.61 | 17.9 |
| 2025 Safenlp 2024 | 408 | UNSAT  | 7.61                  | 8.25 | 25.2  | 23.8 | -    | 8.82 | 17.7 |
| 2025 Safenlp 2024 | 409 | UNSAT  | 6.67                  | 9.01 | 6.12  | 12.7 | -    | 1.57 | 17.9 |
| 2025 Safenlp 2024 | 410 | UNSAT  | 6.30                  | 7.94 | 6.38  | 11.0 | 16.3 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 411 | UNSAT  | 6.27                  | 7.96 | 6.39  | 11.0 | 16.7 | 1.09 | -    |
| 2025 Safenlp 2024 | 412 | UNSAT  | 7.39                  | 8.28 | 17.2  | 16.0 | -    | 5.22 | 18.1 |
| 2025 Safenlp 2024 | 413 | UNSAT  | 6.80                  | 9.02 | 6.10  | 12.2 | -    | 1.25 | 18.4 |
| 2025 Safenlp 2024 | 414 | UNSAT  | 6.24                  | 8.00 | 6.36  | 11.0 | 16.7 | 1.08 | 17.7 |
| 2025 Safenlp 2024 | 415 | UNSAT  | 6.35                  | 7.95 | 6.39  | 11.4 | 16.5 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 416 | SAT    | 6.72                  | 5.96 | 6.05  | 12.2 | 14.8 | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 417 | UNSAT  | 6.22                  | 7.95 | 6.39  | 10.9 | 16.5 | 1.08 | 17.9 |
| 2025 Safenlp 2024 | 418 | UNSAT  | 6.26                  | 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  | 6.25                  | 7.97 | 6.37  | 12.0 | 16.4 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 421 | SAT    | 6.78                  | 6.04 | 6.10  | 12.2 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 422 | UNSAT  | 6.28                  | 7.92 | 6.33  | 11.0 | 16.6 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 423 | SAT    | 6.58                  | 5.98 | 6.06  | 12.2 | 15.1 | 1.09 | 17.8 |
| 2025 Safenlp 2024 | 424 | SAT    | 6.75                  | 7.93 | 6.11  | 12.2 | 14.8 | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 425 | UNSAT  | 7.37                  | 7.98 | 8.32  | 12.2 | -    | 2.25 | 17.7 |
| 2025 Safenlp 2024 | 426 | UNSAT  | 6.73                  | 8.05 | 6.09  | 12.2 | -    | 1.23 | 18.3 |
| 2025 Safenlp 2024 | 427 | UNSAT  | 6.25                  | 7.91 | 6.39  | 11.0 | 16.6 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 428 | UNSAT  | 6.82                  | 7.99 | 6.12  | 12.2 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 429 | UNSAT  | 7.83                  | 9.23 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 430 | UNSAT  | 6.74                  | 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    | 6.79                  | 6.13 | 6.10  | 12.2 | -    | 1.26 | 18.0 |
| 2025 Safenlp 2024 | 433 | UNSAT  | 6.79                  | 8.83 | 6.13  | 12.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 434 | UNSAT  | 6.54                  | 7.99 | 6.11  | 12.3 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 435 | UNSAT  | -                     | 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  | 6.26                  | 7.96 | 6.39  | 11.0 | 16.6 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 438 | UNSAT  | 6.81                  | 8.00 | 6.09  | 11.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 439 | UNSAT  | 6.57                  | 8.01 | 6.07  | 14.7 | -    | -    | 18.1 |
| 2025 Safenlp 2024 | 440 | SAT    | 6.67                  | 5.95 | 6.05  | 12.3 | 15.1 | 1.28 | 18.0 |
| 2025 Safenlp 2024 | 441 | SAT    | 6.65                  | 6.40 | 6.12  | 11.2 | -    | 1.24 | X    |
| 2025 Safenlp 2024 | 442 | UNSAT  | 6.23                  | 7.94 | 6.37  | 12.0 | 16.7 | 1.07 | 18.0 |
| 2025 Safenlp 2024 | 443 | UNSAT  | 6.80                  | 7.96 | 6.12  | 12.2 | -    | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 444 | UNSAT  | 6.26                  | 7.91 | 6.40  | 12.0 | 16.5 | 1.08 | -    |
| 2025 Safenlp 2024 | 445 | UNSAT  | 7.37                  | 7.93 | 7.23  | 13.5 | -    | 1.46 | 18.0 |
| 2025 Safenlp 2024 | 446 | UNSAT  | 6.58                  | 8.96 | 6.11  | 12.2 | -    | 1.29 | 18.2 |
| 2025 Safenlp 2024 | 447 | UNSAT  | 6.80                  | 8.99 | 6.12  | 12.3 | -    | 1.43 | 18.0 |
| 2025 Safenlp 2024 | 448 | SAT    | 6.80                  | 5.98 | 6.13  | 12.2 | 14.9 | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 449 | UNSAT  | 6.70                  | 8.94 | 6.10  | 12.3 | -    | 1.28 | 17.9 |
| 2025 Safenlp 2024 | 450 | UNSAT  | 11.9                  | 42.3 | -     | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 451 | SAT    | 6.60                  | 5.97 | 6.05  | 12.2 | 14.9 | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 452 | UNSAT  | 7.65                  | 8.86 | -     | -    | -    | 14.0 | 18.1 |
| 2025 Safenlp 2024 | 453 | UNSAT  | 6.59                  | 8.01 | 6.08  | 12.3 | -    | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 454 | UNSAT  | 15.7                  | 25.7 | -     | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 455 | UNSAT  | 6.78                  | 8.00 | 6.10  | 12.2 | -    | 1.29 | 18.4 |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 456 | UNSAT  | 7.63                  | 8.12 | 11.5  | 13.8 | -    | 2.22 | 17.9 |
| 2025 Safenlp 2024 | 457 | UNSAT  | 6.79                  | 8.02 | 6.13  | 12.2 | -    | 1.26 | 18.1 |
| 2025 Safenlp 2024 | 458 | SAT    | 6.72                  | 5.95 | 6.02  | 11.3 | 15.1 | 1.23 | 18.2 |
| 2025 Safenlp 2024 | 459 | UNSAT  | 7.12                  | 8.53 | -     | 26.2 | -    | -    | 17.7 |
| 2025 Safenlp 2024 | 460 | SAT    | 6.73                  | 5.95 | 6.09  | 12.2 | 15.3 | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 461 | UNSAT  | 6.96                  | 8.04 | 6.11  | 11.2 | -    | 1.26 | 18.0 |
| 2025 Safenlp 2024 | 462 | SAT    | 6.76                  | 5.95 | 6.05  | 12.2 | 15.0 | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 463 | UNSAT  | 6.76                  | 8.89 | 6.10  | 12.2 | -    | 1.22 | 17.7 |
| 2025 Safenlp 2024 | 464 | UNSAT  | 6.76                  | 7.97 | 6.09  | 12.7 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 465 | SAT    | 6.66                  | 6.69 | 6.10  | 12.2 | 14.8 | 1.22 | 18.0 |
| 2025 Safenlp 2024 | 466 | UNSAT  | 6.78                  | 8.02 | 6.10  | 12.2 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 467 | UNSAT  | 6.85                  | 8.10 | 6.09  | 12.7 | -    | 1.42 | 18.0 |
| 2025 Safenlp 2024 | 468 | UNSAT  | 6.58                  | 8.90 | 6.11  | 12.2 | -    | 1.28 | 18.2 |
| 2025 Safenlp 2024 | 469 | SAT    | 6.70                  | 5.98 | 6.06  | 12.2 | 15.1 | 1.23 | -    |
| 2025 Safenlp 2024 | 470 | UNSAT  | 7.51                  | 8.00 | 9.09  | 13.8 | -    | 2.24 | 17.9 |
| 2025 Safenlp 2024 | 471 | SAT    | 6.77                  | 6.45 | 6.09  | 11.2 | -    | 1.28 | 18.5 |
| 2025 Safenlp 2024 | 472 | UNSAT  | 6.80                  | 7.98 | 6.08  | 12.2 | -    | 1.24 | 18.4 |
| 2025 Safenlp 2024 | 473 | SAT    | 6.77                  | 6.29 | 6.13  | 12.3 | 14.7 | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 474 | UNSAT  | 6.62                  | 7.97 | 6.10  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 475 | UNSAT  | 7.35                  | 8.20 | 13.0  | 14.3 | -    | 2.42 | 18.0 |
| 2025 Safenlp 2024 | 476 | SAT    | 6.80                  | 8.97 | 6.10  | 11.2 | -    | 1.29 | 18.2 |
| 2025 Safenlp 2024 | 477 | UNSAT  | 6.27                  | 7.88 | 6.38  | 11.9 | 16.6 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 478 | SAT    | 6.78                  | 7.17 | 6.09  | 11.2 | -    | 1.25 | X    |
| 2025 Safenlp 2024 | 479 | UNSAT  | 6.25                  | 7.94 | 6.39  | 12.0 | 16.6 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 480 | SAT    | 6.50                  | 5.97 | 6.06  | 12.2 | 15.0 | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 481 | UNSAT  | 6.78                  | 8.78 | 6.08  | 13.3 | -    | 1.76 | 18.0 |
| 2025 Safenlp 2024 | 482 | UNSAT  | 6.58                  | 7.99 | 6.11  | 12.2 | -    | 1.26 | 18.2 |
| 2025 Safenlp 2024 | 483 | UNSAT  | 6.46                  | 7.94 | 6.11  | 12.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 484 | SAT    | 6.48                  | 5.96 | 6.04  | 12.2 | 15.0 | 1.09 | 17.9 |
| 2025 Safenlp 2024 | 485 | UNSAT  | 7.49                  | 8.10 | 9.13  | 13.3 | -    | 2.10 | 17.9 |
| 2025 Safenlp 2024 | 486 | UNSAT  | 6.77                  | 7.94 | 6.07  | 12.2 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 487 | UNSAT  | 6.58                  | 7.99 | 6.09  | 11.2 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 488 | SAT    | 6.70                  | 5.95 | 6.07  | 12.2 | 14.9 | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 489 | SAT    | 6.82                  | 7.20 | 6.11  | 12.2 | -    | 1.25 | X    |
| 2025 Safenlp 2024 | 490 | SAT    | 6.59                  | 8.93 | 6.07  | 12.2 | -    | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 491 | UNSAT  | 6.83                  | 8.00 | 6.10  | 12.2 | -    | 1.22 | 18.0 |
| 2025 Safenlp 2024 | 492 | UNSAT  | 6.77                  | 9.27 | 6.09  | 12.7 | -    | 1.27 | 18.3 |
| 2025 Safenlp 2024 | 493 | UNSAT  | 7.21                  | 8.10 | 10.9  | 14.3 | -    | 3.99 | 17.9 |
| 2025 Safenlp 2024 | 494 | UNSAT  | 6.55                  | 9.01 | 6.12  | 13.0 | -    | 1.62 | 18.0 |
| 2025 Safenlp 2024 | 495 | UNSAT  | 6.81                  | 9.00 | 6.07  | 11.2 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 496 | UNSAT  | 6.76                  | 8.93 | 6.09  | 12.2 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 497 | UNSAT  | 7.48                  | 7.97 | 6.86  | 11.5 | -    | 1.42 | 17.9 |
| 2025 Safenlp 2024 | 498 | UNSAT  | 6.76                  | 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  | 6.79                  | 9.01 | 6.09  | 11.2 | -    | 1.27 | 18.4 |
| 2025 Safenlp 2024 | 501 | UNSAT  | 6.48                  | 7.95 | 6.13  | 11.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 502 | SAT    | 6.76                  | 6.00 | 6.06  | 12.2 | 15.2 | 1.30 | 18.5 |
| 2025 Safenlp 2024 | 503 | UNSAT  | 7.64                  | 8.31 | 21.0  | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 504 | SAT    | 6.44                  | 5.93 | 6.03  | 11.2 | 14.9 | 1.29 | 17.9 |
| 2025 Safenlp 2024 | 505 | UNSAT  | 6.23                  | 7.87 | 6.47  | 12.4 | 16.8 | 1.07 | 17.9 |
| 2025 Safenlp 2024 | 506 | UNSAT  | 6.27                  | 7.84 | 6.34  | 11.0 | 16.4 | 1.07 | 18.0 |
| 2025 Safenlp 2024 | 507 | UNSAT  | -                     | 8.18 | 17.9  | 21.3 | -    | 4.55 | 17.8 |
| 2025 Safenlp 2024 | 508 | SAT    | 6.65                  | 7.94 | 6.09  | 12.3 | 14.9 | 1.24 | 18.4 |
| 2025 Safenlp 2024 | 509 | UNSAT  | 6.77                  | 8.96 | 6.07  | 11.2 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 510 | UNSAT  | 6.29                  | 7.99 | 6.38  | 11.9 | 16.4 | 1.06 | 17.9 |
| 2025 Safenlp 2024 | 511 | UNSAT  | 6.30                  | 7.91 | 6.35  | 11.9 | 16.6 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 512 | UNSAT  | 7.69                  | 8.34 | 18.7  | 18.1 | -    | 3.90 | 18.2 |
| 2025 Safenlp 2024 | 513 | UNSAT  | 6.75                  | 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  | -                     | 8.31 | 22.4  | 19.1 | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 516 | SAT    | 6.79                  | 6.35 | 6.04  | 12.1 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 517 | UNSAT  | 6.53                  | 9.13 | 6.08  | 12.2 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 518 | SAT    | 6.79                  | 6.02 | 6.07  | 11.2 | -    | 1.25 | 17.7 |
| 2025 Safenlp 2024 | 519 | UNSAT  | 6.69                  | 9.00 | 6.06  | 11.2 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 520 | UNSAT  | 6.27                  | 7.92 | 6.37  | 12.0 | 16.3 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 521 | SAT    | 6.75                  | 6.03 | 6.04  | 12.2 | 14.9 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 522 | UNSAT  | 7.66                  | 8.44 | 24.7  | 22.1 | -    | 17.5 | 18.1 |
| 2025 Safenlp 2024 | 523 | UNSAT  | -                     | 9.33 | -     | -    | -    | -    | 17.9 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ | $\beta$ | C    | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|-------------------|-----|--------|----------|---------|------|------|-------|------|------|------|----|
| 2025 Safenlp 2024 | 524 | UNSAT  | 6.31     | 7.91    | 6.33 | 12.0 | 16.7  | 1.07 | 17.7 |      |    |
| 2025 Safenlp 2024 | 525 | UNSAT  | 6.74     | 8.01    | 6.09 | 12.2 | 15.2  | 1.24 | -    |      |    |
| 2025 Safenlp 2024 | 526 | SAT    | 6.47     | 6.01    | 6.01 | 12.2 | 14.9  | 1.24 | 18.1 |      |    |
| 2025 Safenlp 2024 | 527 | UNSAT  | 6.80     | 8.01    | 6.11 | 12.2 | -     | 1.25 | 18.2 |      |    |
| 2025 Safenlp 2024 | 528 | SAT    | 6.53     | 6.05    | 6.11 | 12.2 | -     | 1.27 | 17.9 |      |    |
| 2025 Safenlp 2024 | 529 | UNSAT  | 6.71     | 8.98    | 6.10 | 12.2 | -     | 1.24 | 18.0 |      |    |
| 2025 Safenlp 2024 | 530 | UNSAT  | 7.10     | 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    | 6.59     | 6.00    | 6.08 | 12.2 | 14.8  | 1.26 | 18.1 |      |    |
| 2025 Safenlp 2024 | 533 | UNSAT  | 8.50     | 9.48    | -    | -    | -     | -    | 18.1 |      |    |
| 2025 Safenlp 2024 | 534 | UNSAT  | 8.78     | 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  | 6.52     | 7.98    | 6.11 | 12.7 | -     | 1.57 | 18.0 |      |    |
| 2025 Safenlp 2024 | 537 | UNSAT  | 7.84     | 11.1    | -    | -    | -     | -    | 18.3 |      |    |
| 2025 Safenlp 2024 | 538 | SAT    | 6.55     | 6.03    | 6.09 | 12.2 | 15.0  | 1.25 | 18.5 |      |    |
| 2025 Safenlp 2024 | 539 | UNSAT  | 11.8     | 26.1    | -    | -    | -     | -    | 18.1 |      |    |
| 2025 Safenlp 2024 | 540 | SAT    | 6.78     | 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  | 6.29     | 7.93    | 6.37 | 11.9 | 16.7  | 1.09 | 17.9 |      |    |
| 2025 Safenlp 2024 | 543 | UNSAT  | -        | 8.31    | -    | 16.0 | -     | 15.2 | 17.7 |      |    |
| 2025 Safenlp 2024 | 544 | UNSAT  | 6.56     | 8.03    | 6.12 | 12.3 | -     | 1.28 | 18.1 |      |    |
| 2025 Safenlp 2024 | 545 | UNSAT  | 7.21     | 8.10    | 15.2 | 14.8 | -     | 3.85 | 18.0 |      |    |
| 2025 Safenlp 2024 | 546 | UNSAT  | 6.80     | 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  | 6.71     | 8.97    | 6.11 | 12.3 | -     | 1.23 | 17.8 |      |    |
| 2025 Safenlp 2024 | 549 | SAT    | 6.73     | 6.46    | 6.06 | 11.2 | 15.4  | 1.23 | 18.2 |      |    |
| 2025 Safenlp 2024 | 550 | UNSAT  | 6.78     | 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    | 6.72     | 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    | 6.56     | 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  | 8.43     | 9.00    | -    | -    | -     | -    | 18.1 |      |    |
| 2025 Safenlp 2024 | 557 | UNSAT  | 7.09     | 8.04    | 8.59 | 13.1 | -     | 1.95 | 18.0 |      |    |
| 2025 Safenlp 2024 | 558 | UNSAT  | 6.31     | 7.94    | 6.34 | 11.0 | 16.5  | 1.08 | 17.8 |      |    |
| 2025 Safenlp 2024 | 559 | UNSAT  | 6.77     | 9.14    | 6.11 | 12.2 | -     | 1.48 | 18.2 |      |    |
| 2025 Safenlp 2024 | 560 | UNSAT  | 6.62     | 8.01    | 6.12 | 12.2 | -     | 1.24 | 18.2 |      |    |
| 2025 Safenlp 2024 | 561 | SAT    | 6.79     | 5.97    | 6.07 | 12.3 | 15.1  | 1.24 | 18.0 |      |    |
| 2025 Safenlp 2024 | 562 | UNSAT  | 6.31     | 7.94    | 6.48 | 12.5 | 16.7  | 1.08 | 17.8 |      |    |
| 2025 Safenlp 2024 | 563 | UNSAT  | 6.28     | 7.99    | 6.34 | 11.9 | 16.5  | 1.07 | 17.9 |      |    |
| 2025 Safenlp 2024 | 564 | UNSAT  | 6.50     | 8.04    | 6.10 | 11.7 | -     | 1.48 | 18.1 |      |    |
| 2025 Safenlp 2024 | 565 | UNSAT  | 7.95     | 8.69    | -    | -    | -     | -    | 18.2 |      |    |
| 2025 Safenlp 2024 | 566 | UNSAT  | 6.28     | 7.93    | 6.38 | 12.0 | 16.3  | 1.07 | 17.7 |      |    |
| 2025 Safenlp 2024 | 567 | UNSAT  | -        | 8.33    | 22.7 | -    | -     | 16.7 | 18.3 |      |    |
| 2025 Safenlp 2024 | 568 | UNSAT  | 6.27     | 7.99    | 6.38 | 12.0 | 16.7  | 1.07 | 17.8 |      |    |
| 2025 Safenlp 2024 | 569 | UNSAT  | 6.27     | 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  | 6.75     | 8.96    | 6.11 | 12.2 | -     | 1.24 | 18.0 |      |    |
| 2025 Safenlp 2024 | 572 | UNSAT  | 6.76     | 7.99    | 6.09 | 12.2 | -     | 1.25 | 18.3 |      |    |
| 2025 Safenlp 2024 | 573 | SAT    | 6.78     | 7.08    | 6.10 | 12.2 | -     | 1.25 | X    |      |    |
| 2025 Safenlp 2024 | 574 | UNSAT  | 8.02     | 8.71    | -    | -    | -     | -    | 18.3 |      |    |
| 2025 Safenlp 2024 | 575 | SAT    | 6.63     | 5.96    | 6.07 | 12.3 | 15.0  | 1.25 | 18.2 |      |    |
| 2025 Safenlp 2024 | 576 | UNSAT  | 6.57     | 8.03    | 6.09 | 12.2 | -     | 1.23 | 17.9 |      |    |
| 2025 Safenlp 2024 | 577 | UNSAT  | 6.48     | 8.91    | 6.10 | 11.2 | -     | 1.26 | 18.0 |      |    |
| 2025 Safenlp 2024 | 578 | UNSAT  | 8.62     | 9.20    | -    | -    | -     | -    | 17.9 |      |    |
| 2025 Safenlp 2024 | 579 | UNSAT  | 6.78     | 9.03    | 6.08 | 13.0 | -     | 1.43 | 18.1 |      |    |
| 2025 Safenlp 2024 | 580 | SAT    | 6.77     | 6.01    | 6.08 | 12.2 | -     | 1.25 | -    |      |    |
| 2025 Safenlp 2024 | 581 | UNSAT  | 6.26     | 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  | 7.15     | 8.29    | 16.7 | 16.5 | -     | 3.52 | 17.9 |      |    |
| 2025 Safenlp 2024 | 584 | UNSAT  | 7.48     | 8.60    | -    | 17.3 | -     | -    | 17.7 |      |    |
| 2025 Safenlp 2024 | 585 | UNSAT  | 6.71     | 7.97    | 6.07 | 12.3 | -     | 1.23 | 18.2 |      |    |
| 2025 Safenlp 2024 | 586 | UNSAT  | 7.09     | 8.04    | 7.66 | 13.8 | -     | 2.05 | 17.8 |      |    |
| 2025 Safenlp 2024 | 587 | UNSAT  | 6.73     | 8.03    | 6.10 | 12.3 | -     | 1.24 | 18.2 |      |    |
| 2025 Safenlp 2024 | 588 | UNSAT  | -        | 29.0    | -    | -    | -     | -    | 18.2 |      |    |
| 2025 Safenlp 2024 | 589 | UNSAT  | 7.59     | 8.31    | -    | -    | -     | -    | 17.9 |      |    |
| 2025 Safenlp 2024 | 590 | UNSAT  | 6.78     | 7.99    | 6.06 | 13.0 | -     | 1.25 | 18.2 |      |    |
| 2025 Safenlp 2024 | 591 | UNSAT  | 8.39     | 8.82    | -    | -    | -     | -    | 18.3 |      |    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 592 | SAT    | 6.48                  | 5.98 | 6.08  | 12.2 | 14.7 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 593 | UNSAT  | 6.34                  | 8.00 | 6.38  | 12.0 | 16.3 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 594 | UNSAT  | 6.75                  | 8.98 | 6.12  | 11.7 | -    | 1.43 | 18.3 |
| 2025 Safenlp 2024 | 595 | UNSAT  | 6.68                  | 8.94 | 6.11  | 12.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 596 | UNSAT  | 6.80                  | 7.91 | 6.11  | 12.2 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 597 | UNSAT  | 6.53                  | 7.99 | 6.06  | 11.2 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 598 | UNSAT  | 7.72                  | 8.68 | 25.3  | -    | -    | 19.5 | 18.2 |
| 2025 Safenlp 2024 | 599 | UNSAT  | 7.20                  | 8.07 | 13.0  | 16.0 | -    | 3.40 | 18.1 |
| 2025 Safenlp 2024 | 600 | UNSAT  | 6.48                  | 8.99 | 6.06  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 601 | UNSAT  | 7.08                  | 7.91 | 7.11  | 13.0 | -    | 1.64 | 17.9 |
| 2025 Safenlp 2024 | 602 | UNSAT  | 6.85                  | 8.88 | 6.11  | 12.3 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 603 | UNSAT  | 7.19                  | 8.02 | 12.1  | 13.8 | -    | 3.08 | -    |
| 2025 Safenlp 2024 | 604 | UNSAT  | 12.4                  | -    | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 605 | UNSAT  | 7.40                  | 9.64 | -     | -    | -    | 18.0 | 17.8 |
| 2025 Safenlp 2024 | 606 | UNSAT  | 6.26                  | 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    | 6.71                  | 5.99 | 6.05  | 12.2 | 15.0 | 1.28 | 19.3 |
| 2025 Safenlp 2024 | 609 | UNSAT  | 6.69                  | 8.99 | 6.10  | 13.0 | -    | 1.44 | 18.2 |
| 2025 Safenlp 2024 | 610 | UNSAT  | 6.70                  | 9.40 | 6.12  | 15.5 | -    | 2.32 | 17.9 |
| 2025 Safenlp 2024 | 611 | UNSAT  | 6.66                  | 9.01 | 6.10  | 13.0 | -    | 2.15 | 18.2 |
| 2025 Safenlp 2024 | 612 | UNSAT  | 7.35                  | 8.14 | 18.5  | 18.5 | -    | 4.58 | 17.8 |
| 2025 Safenlp 2024 | 613 | SAT    | 6.72                  | 7.97 | 6.08  | 12.1 | 14.9 | 1.27 | 18.2 |
| 2025 Safenlp 2024 | 614 | SAT    | 6.68                  | 5.97 | 6.09  | 11.2 | 15.3 | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 615 | UNSAT  | 6.78                  | 8.01 | 6.11  | 12.2 | -    | 1.27 | 17.7 |
| 2025 Safenlp 2024 | 616 | UNSAT  | 6.81                  | 8.98 | 6.10  | 12.9 | -    | 1.76 | 17.9 |
| 2025 Safenlp 2024 | 617 | SAT    | 6.79                  | 6.25 | 6.11  | 12.2 | -    | 1.23 | -    |
| 2025 Safenlp 2024 | 618 | SAT    | 6.47                  | 6.01 | 6.05  | 11.2 | 15.3 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 619 | UNSAT  | 6.83                  | 8.98 | 6.13  | 12.3 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 620 | UNSAT  | 6.82                  | 7.95 | 6.08  | 12.1 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 621 | UNSAT  | 6.79                  | 8.86 | 6.10  | 11.3 | -    | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 622 | UNSAT  | -                     | 8.00 | 7.13  | 12.7 | -    | 1.81 | 17.7 |
| 2025 Safenlp 2024 | 623 | UNSAT  | 6.80                  | 8.93 | 6.09  | 12.2 | -    | 1.28 | 17.8 |
| 2025 Safenlp 2024 | 624 | UNSAT  | 7.16                  | 7.99 | 6.69  | 11.7 | -    | 1.27 | 17.8 |
| 2025 Safenlp 2024 | 625 | UNSAT  | 6.81                  | 8.14 | 6.12  | 11.7 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 626 | UNSAT  | 6.58                  | 9.01 | 6.08  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 627 | SAT    | 6.55                  | 5.96 | 6.07  | 11.2 | 15.5 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 628 | UNSAT  | 6.65                  | 8.97 | 6.10  | 12.2 | -    | 1.23 | -    |
| 2025 Safenlp 2024 | 629 | SAT    | 6.65                  | 5.92 | 6.04  | 12.2 | 15.1 | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 630 | UNSAT  | 6.72                  | 9.25 | 6.11  | 13.0 | -    | 1.30 | 17.8 |
| 2025 Safenlp 2024 | 631 | UNSAT  | 6.78                  | 8.03 | 6.09  | 12.2 | -    | 1.22 | 18.3 |
| 2025 Safenlp 2024 | 632 | UNSAT  | 8.92                  | 9.48 | -     | -    | -    | -    | 18.2 |
| 2025 Safenlp 2024 | 633 | UNSAT  | 6.55                  | 9.00 | 6.09  | 12.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 634 | UNSAT  | 6.76                  | 7.97 | 6.10  | 12.2 | -    | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 635 | UNSAT  | 6.26                  | 7.91 | 6.39  | 11.9 | 16.3 | 1.09 | -    |
| 2025 Safenlp 2024 | 636 | UNSAT  | 6.75                  | 8.06 | 6.10  | 11.7 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 637 | UNSAT  | 6.80                  | 8.91 | 6.10  | 11.1 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 638 | UNSAT  | 6.63                  | 8.02 | 6.08  | 12.7 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 639 | UNSAT  | 6.26                  | 7.87 | 6.43  | 11.9 | 16.2 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 640 | UNSAT  | 7.33                  | 8.04 | 9.66  | 14.7 | -    | 2.43 | 17.6 |
| 2025 Safenlp 2024 | 641 | UNSAT  | 8.81                  | 10.9 | -     | -    | -    | -    | 17.7 |
| 2025 Safenlp 2024 | 642 | SAT    | 6.80                  | 5.95 | 6.04  | 12.2 | 14.9 | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 643 | UNSAT  | 6.28                  | 7.86 | 6.45  | 12.5 | 16.5 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 644 | UNSAT  | 6.67                  | 9.00 | 6.11  | 11.3 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 645 | UNSAT  | 7.39                  | 8.07 | 12.2  | 14.5 | -    | 2.76 | 17.9 |
| 2025 Safenlp 2024 | 646 | UNSAT  | 6.76                  | 8.02 | 6.09  | 12.2 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 647 | UNSAT  | 6.82                  | 8.02 | 6.12  | 12.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 648 | UNSAT  | 6.79                  | 9.75 | 6.11  | X    | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 649 | UNSAT  | 6.75                  | 8.93 | 6.10  | 12.3 | -    | 1.22 | 18.0 |
| 2025 Safenlp 2024 | 650 | UNSAT  | 6.82                  | 8.96 | 6.10  | 12.2 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 651 | UNSAT  | 6.80                  | 8.99 | 6.09  | 12.2 | -    | 1.28 | 18.1 |
| 2025 Safenlp 2024 | 652 | SAT    | 6.77                  | 6.41 | 6.10  | 12.2 | -    | 1.28 | X    |
| 2025 Safenlp 2024 | 653 | UNSAT  | 6.27                  | 7.93 | 6.38  | 11.9 | 16.5 | 1.06 | 17.8 |
| 2025 Safenlp 2024 | 654 | SAT    | 6.81                  | 6.15 | 6.04  | 12.2 | -    | 1.28 | 18.3 |
| 2025 Safenlp 2024 | 655 | UNSAT  | 6.79                  | 7.94 | 6.10  | 11.2 | -    | 1.27 | 17.9 |
| 2025 Safenlp 2024 | 656 | SAT    | 6.46                  | 7.97 | 6.08  | 12.3 | -    | 1.27 | 17.8 |
| 2025 Safenlp 2024 | 657 | UNSAT  | 6.56                  | 8.00 | 6.05  | 11.2 | -    | 1.27 | 18.0 |
| 2025 Safenlp 2024 | 658 | SAT    | 6.74                  | 5.97 | 6.09  | 11.2 | 14.8 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 659 | UNSAT  | 6.24                  | 7.99 | 6.39  | 12.0 | 16.6 | 1.07 | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 660 | UNSAT  | 6.67                  | 8.99 | 6.10  | 12.2 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 661 | UNSAT  | 6.78                  | 8.96 | 6.11  | 11.2 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 662 | UNSAT  | 7.35                  | 8.00 | 8.92  | 12.0 | -    | 2.06 | 17.9 |
| 2025 Safenlp 2024 | 663 | UNSAT  | 6.31                  | 7.93 | 6.37  | 12.0 | 16.6 | 1.08 | 17.9 |
| 2025 Safenlp 2024 | 664 | UNSAT  | 7.31                  | 8.05 | 8.94  | 12.6 | -    | 2.10 | 18.1 |
| 2025 Safenlp 2024 | 665 | UNSAT  | 6.78                  | 7.97 | 6.09  | 12.2 | -    | 1.29 | 18.2 |
| 2025 Safenlp 2024 | 666 | SAT    | 6.61                  | 5.96 | 6.07  | 12.2 | 15.1 | 1.10 | 17.9 |
| 2025 Safenlp 2024 | 667 | UNSAT  | 6.23                  | 7.92 | 6.40  | 12.0 | 16.7 | 1.12 | 17.7 |
| 2025 Safenlp 2024 | 668 | UNSAT  | 7.25                  | 8.08 | 8.67  | 12.5 | -    | 2.10 | 17.9 |
| 2025 Safenlp 2024 | 669 | UNSAT  | 6.24                  | 7.95 | 6.35  | 11.9 | 16.5 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 670 | UNSAT  | 7.14                  | 8.28 | 18.0  | 14.2 | -    | 10.1 | 18.0 |
| 2025 Safenlp 2024 | 671 | UNSAT  | 7.02                  | 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    | 6.67                  | 6.30 | 6.14  | 12.3 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 674 | UNSAT  | 7.30                  | 8.18 | 16.0  | 13.8 | -    | 3.73 | 17.6 |
| 2025 Safenlp 2024 | 675 | UNSAT  | 8.97                  | 32.1 | -     | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 676 | UNSAT  | 7.17                  | 8.00 | 6.64  | 11.7 | -    | 1.70 | 18.0 |
| 2025 Safenlp 2024 | 677 | SAT    | 6.73                  | 6.18 | 6.06  | 11.2 | -    | 1.24 | X    |
| 2025 Safenlp 2024 | 678 | UNSAT  | 6.70                  | 8.05 | 6.12  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 679 | SAT    | 6.73                  | 6.32 | 6.10  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 680 | SAT    | 6.44                  | 5.97 | 6.00  | 12.2 | 15.2 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 681 | SAT    | 6.76                  | 6.57 | 6.06  | 12.2 | -    | 1.26 | 18.0 |
| 2025 Safenlp 2024 | 682 | UNSAT  | 6.82                  | 8.03 | 6.12  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 683 | UNSAT  | 6.59                  | 8.01 | 6.08  | 12.2 | -    | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 684 | SAT    | 6.81                  | 5.96 | 6.07  | 12.2 | 14.9 | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 685 | UNSAT  | 6.80                  | 8.01 | 6.09  | 12.3 | -    | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 686 | UNSAT  | 6.80                  | 8.58 | 6.09  | 29.3 | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 687 | UNSAT  | 6.25                  | 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  | 6.56                  | 8.98 | 6.12  | 11.2 | -    | 1.23 | 18.0 |
| 2025 Safenlp 2024 | 690 | UNSAT  | 8.25                  | 51.4 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 691 | UNSAT  | 7.43                  | 8.13 | 13.6  | 20.0 | -    | 7.89 | 17.8 |
| 2025 Safenlp 2024 | 692 | UNSAT  | 6.80                  | 8.98 | 6.09  | 12.2 | -    | 1.25 | 18.3 |
| 2025 Safenlp 2024 | 693 | UNSAT  | 6.68                  | 9.01 | 6.11  | 12.2 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 694 | UNSAT  | 7.20                  | 8.06 | 8.17  | 14.8 | -    | 2.43 | 17.7 |
| 2025 Safenlp 2024 | 695 | UNSAT  | 6.75                  | 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    | 6.78                  | 5.95 | 6.08  | 12.2 | 14.8 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 698 | UNSAT  | 6.52                  | 8.27 | 6.08  | 12.7 | -    | 1.44 | 18.3 |
| 2025 Safenlp 2024 | 699 | UNSAT  | 6.65                  | 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  | -                     | 8.06 | 9.06  | 13.2 | -    | 2.33 | 17.8 |
| 2025 Safenlp 2024 | 702 | UNSAT  | 7.17                  | 7.96 | 6.82  | 11.8 | -    | 1.52 | 17.7 |
| 2025 Safenlp 2024 | 703 | SAT    | 6.72                  | 5.95 | 6.08  | 11.3 | 14.8 | 1.12 | 17.8 |
| 2025 Safenlp 2024 | 704 | UNSAT  | 6.81                  | 9.02 | 6.12  | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 705 | UNSAT  | 7.26                  | 8.13 | 19.9  | 15.0 | -    | 3.44 | 17.7 |
| 2025 Safenlp 2024 | 706 | UNSAT  | 6.77                  | 9.05 | 6.10  | 12.2 | -    | 1.28 | 18.3 |
| 2025 Safenlp 2024 | 707 | UNSAT  | 6.55                  | 8.08 | 6.12  | 12.2 | -    | 1.30 | 18.3 |
| 2025 Safenlp 2024 | 708 | UNSAT  | 6.54                  | 7.98 | 6.12  | 12.2 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 709 | UNSAT  | -                     | 8.92 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 710 | UNSAT  | 6.70                  | 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  | 7.96                  | 42.1 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 713 | UNSAT  | 6.78                  | 8.04 | 6.10  | 12.0 | -    | 1.23 | 18.2 |
| 2025 Safenlp 2024 | 714 | UNSAT  | 6.70                  | 8.02 | 6.09  | 12.2 | -    | 1.30 | 18.3 |
| 2025 Safenlp 2024 | 715 | UNSAT  | 7.20                  | 8.09 | 9.76  | 14.5 | -    | 2.10 | 17.7 |
| 2025 Safenlp 2024 | 716 | UNSAT  | 6.78                  | 8.97 | 6.10  | 12.3 | -    | 1.29 | 18.2 |
| 2025 Safenlp 2024 | 717 | UNSAT  | 6.76                  | 8.10 | 6.07  | 12.2 | -    | 1.28 | 18.2 |
| 2025 Safenlp 2024 | 718 | UNSAT  | 6.25                  | 7.99 | 6.39  | 12.0 | 16.8 | 1.07 | 17.9 |
| 2025 Safenlp 2024 | 719 | SAT    | 6.71                  | 7.87 | 6.12  | 11.2 | 14.8 | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 720 | UNSAT  | 6.72                  | 9.31 | 6.11  | 12.8 | -    | 1.61 | 18.1 |
| 2025 Safenlp 2024 | 721 | UNSAT  | 6.59                  | 8.90 | 6.09  | 12.2 | -    | 1.26 | 17.7 |
| 2025 Safenlp 2024 | 722 | UNSAT  | 6.71                  | 9.02 | 6.12  | 12.2 | -    | 1.31 | 17.9 |
| 2025 Safenlp 2024 | 723 | UNSAT  | 9.43                  | 25.7 | -     | -    | -    | -    | 18.1 |
| 2025 Safenlp 2024 | 724 | UNSAT  | 6.61                  | 8.94 | 6.12  | 11.2 | -    | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 725 | SAT    | 6.67                  | 5.98 | 6.08  | 12.2 | 14.9 | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 726 | SAT    | 6.77                  | 5.94 | 6.04  | 12.2 | 14.8 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 727 | UNSAT  | 7.51                  | 11.3 | -     | -    | -    | -    | 17.7 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 728 | SAT    | 6.74                  | 5.97 | 6.10  | 12.2 | 15.3 | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 729 | UNSAT  | 6.49                  | 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    | 6.63                  | 6.01 | 6.08  | 12.2 | 14.8 | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 732 | UNSAT  | 7.28                  | 8.16 | 12.3  | 14.8 | -    | 2.41 | 17.7 |
| 2025 Safenlp 2024 | 733 | UNSAT  | -                     | 8.05 | 11.5  | 15.0 | -    | 2.78 | 17.9 |
| 2025 Safenlp 2024 | 734 | UNSAT  | 7.12                  | 7.92 | 6.85  | 12.7 | -    | 1.34 | 18.0 |
| 2025 Safenlp 2024 | 735 | UNSAT  | 6.80                  | 8.00 | 6.12  | 12.3 | -    | 1.21 | 17.6 |
| 2025 Safenlp 2024 | 736 | UNSAT  | 6.79                  | 8.05 | 6.16  | 12.2 | -    | 1.27 | 17.9 |
| 2025 Safenlp 2024 | 737 | UNSAT  | 6.79                  | 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  | 6.61                  | 8.02 | 6.09  | 12.3 | -    | 1.23 | 18.1 |
| 2025 Safenlp 2024 | 740 | UNSAT  | 6.59                  | 9.02 | 6.10  | 12.2 | -    | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 741 | UNSAT  | 6.85                  | 8.98 | 6.13  | 12.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 742 | UNSAT  | 7.86                  | 8.40 | 23.8  | 21.8 | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 743 | SAT    | 6.63                  | 5.95 | 6.06  | 11.3 | 15.1 | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 744 | UNSAT  | 6.60                  | 8.01 | 6.09  | 12.2 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 745 | SAT    | 6.78                  | 6.02 | 6.09  | 12.2 | -    | 1.22 | 17.9 |
| 2025 Safenlp 2024 | 746 | UNSAT  | 13.6                  | 24.4 | -     | -    | -    | -    | 18.2 |
| 2025 Safenlp 2024 | 747 | SAT    | 6.79                  | 5.96 | 6.04  | 12.2 | 15.4 | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 748 | UNSAT  | 6.55                  | 8.98 | 6.09  | 11.2 | -    | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 749 | SAT    | 6.44                  | 6.07 | 6.14  | 11.2 | 15.0 | 1.22 | 17.8 |
| 2025 Safenlp 2024 | 750 | SAT    | 6.49                  | 5.98 | 6.07  | 12.2 | 14.9 | 1.25 | 18.3 |
| 2025 Safenlp 2024 | 751 | SAT    | 6.73                  | 6.04 | 6.05  | 11.3 | 15.0 | 1.23 | 17.9 |
| 2025 Safenlp 2024 | 752 | UNSAT  | 6.80                  | 7.98 | 6.10  | 11.2 | -    | 1.23 | -    |
| 2025 Safenlp 2024 | 753 | UNSAT  | 7.25                  | 8.02 | 10.4  | 13.1 | -    | 2.18 | 17.8 |
| 2025 Safenlp 2024 | 754 | UNSAT  | 6.66                  | 8.96 | 6.11  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 755 | UNSAT  | 6.64                  | 7.96 | 6.10  | 12.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 756 | SAT    | 6.80                  | 7.12 | 6.09  | 11.2 | -    | 1.25 | X    |
| 2025 Safenlp 2024 | 757 | UNSAT  | 6.29                  | 7.97 | 6.39  | 11.9 | 16.5 | 1.13 | 17.7 |
| 2025 Safenlp 2024 | 758 | UNSAT  | 6.24                  | 7.94 | 6.35  | 12.0 | 16.5 | 1.07 | -    |
| 2025 Safenlp 2024 | 759 | SAT    | 6.83                  | 6.50 | 6.09  | 11.2 | -    | 1.23 | X    |
| 2025 Safenlp 2024 | 760 | UNSAT  | 6.78                  | 7.98 | 6.10  | 11.3 | -    | 1.24 | 18.0 |
| 2025 Safenlp 2024 | 761 | UNSAT  | 6.29                  | 7.94 | 6.38  | 12.5 | 16.4 | 1.08 | 17.7 |
| 2025 Safenlp 2024 | 762 | UNSAT  | 7.40                  | 8.27 | -     | 18.5 | -    | 18.2 | 17.8 |
| 2025 Safenlp 2024 | 763 | UNSAT  | -                     | 7.96 | 6.63  | 12.4 | -    | 1.33 | 17.9 |
| 2025 Safenlp 2024 | 764 | UNSAT  | 7.28                  | 8.18 | -     | 14.8 | -    | 5.04 | 17.9 |
| 2025 Safenlp 2024 | 765 | UNSAT  | 7.10                  | 8.00 | 10.3  | 13.5 | -    | 3.55 | 17.9 |
| 2025 Safenlp 2024 | 766 | UNSAT  | 6.31                  | 7.96 | 6.44  | 11.4 | 16.7 | 1.09 | 17.9 |
| 2025 Safenlp 2024 | 767 | UNSAT  | 7.04                  | 7.99 | 6.54  | 12.5 | -    | 1.30 | 17.8 |
| 2025 Safenlp 2024 | 768 | SAT    | 6.72                  | 6.79 | 6.09  | 12.2 | -    | 1.24 | X    |
| 2025 Safenlp 2024 | 769 | UNSAT  | 6.81                  | 8.15 | 6.09  | 13.6 | -    | 1.45 | 18.0 |
| 2025 Safenlp 2024 | 770 | SAT    | 6.76                  | 7.99 | 6.10  | 12.2 | 14.8 | 1.25 | 18.4 |
| 2025 Safenlp 2024 | 771 | SAT    | 6.53                  | 5.98 | 6.12  | 12.2 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 772 | UNSAT  | 7.60                  | 8.02 | 7.95  | 12.7 | -    | 2.01 | 17.6 |
| 2025 Safenlp 2024 | 773 | UNSAT  | 6.68                  | 7.96 | 6.08  | 12.2 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 774 | UNSAT  | 8.66                  | 13.9 | -     | -    | -    | -    | 17.7 |
| 2025 Safenlp 2024 | 775 | UNSAT  | 6.97                  | 8.02 | 7.04  | 12.7 | -    | 1.28 | 17.8 |
| 2025 Safenlp 2024 | 776 | UNSAT  | 6.26                  | 7.90 | 6.37  | 12.0 | 16.5 | 1.07 | 18.5 |
| 2025 Safenlp 2024 | 777 | UNSAT  | 6.75                  | 7.96 | 6.10  | 12.2 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 778 | UNSAT  | 6.67                  | 8.00 | 6.08  | 12.2 | -    | 1.28 | 17.6 |
| 2025 Safenlp 2024 | 779 | UNSAT  | 6.49                  | 8.11 | 6.09  | 12.2 | -    | 1.23 | 17.6 |
| 2025 Safenlp 2024 | 780 | SAT    | 6.80                  | 6.54 | 6.08  | 12.2 | -    | 1.27 | X    |
| 2025 Safenlp 2024 | 781 | UNSAT  | 7.79                  | 8.37 | -     | -    | -    | 15.9 | 17.8 |
| 2025 Safenlp 2024 | 782 | UNSAT  | -                     | 8.03 | 13.0  | 12.8 | -    | 3.15 | 17.5 |
| 2025 Safenlp 2024 | 783 | UNSAT  | 6.26                  | 7.96 | 6.38  | 11.9 | 16.6 | 1.07 | 19.1 |
| 2025 Safenlp 2024 | 784 | UNSAT  | 6.24                  | 7.93 | 6.33  | 11.9 | 16.7 | 1.08 | -    |
| 2025 Safenlp 2024 | 785 | UNSAT  | 6.80                  | 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  | 6.26                  | 7.86 | 6.36  | 11.0 | 16.4 | 1.08 | 17.3 |
| 2025 Safenlp 2024 | 788 | SAT    | 6.74                  | 6.03 | 6.10  | 12.2 | 14.8 | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 789 | UNSAT  | 6.31                  | 7.91 | 6.49  | 12.5 | 16.7 | 1.07 | 17.5 |
| 2025 Safenlp 2024 | 790 | UNSAT  | -                     | 19.7 | -     | -    | -    | -    | 19.4 |
| 2025 Safenlp 2024 | 791 | UNSAT  | 7.05                  | 8.13 | 15.9  | 19.8 | -    | 3.56 | 17.3 |
| 2025 Safenlp 2024 | 792 | UNSAT  | 6.78                  | 8.93 | 6.08  | 12.2 | -    | 1.25 | 17.6 |
| 2025 Safenlp 2024 | 793 | UNSAT  | 6.28                  | 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 |
| 2025 Safenlp 2024 | 795 | UNSAT  | 6.26                  | 7.95 | 6.39  | 12.0 | 16.6 | 1.08 | 17.8 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 796 | SAT    | 6.64                  | 6.02 | 6.12  | 11.2 | 14.8 | 1.24 | 17.7 |
| 2025 Safenlp 2024 | 797 | SAT    | 6.76                  | 5.99 | 6.05  | 12.2 | 14.9 | 1.24 | 19.5 |
| 2025 Safenlp 2024 | 798 | UNSAT  | -                     | 8.16 | 17.1  | 14.8 | -    | 4.22 | 17.8 |
| 2025 Safenlp 2024 | 799 | SAT    | 6.74                  | 6.31 | 6.10  | 12.2 | 15.1 | 1.29 | 17.8 |
| 2025 Safenlp 2024 | 800 | UNSAT  | 6.27                  | 7.99 | 6.41  | 12.5 | 16.8 | 1.07 | 17.5 |
| 2025 Safenlp 2024 | 801 | SAT    | 6.62                  | 5.95 | 6.04  | 12.2 | 15.0 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 802 | UNSAT  | 6.79                  | 7.96 | 6.08  | 11.3 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 803 | UNSAT  | 7.21                  | 7.94 | 6.63  | 12.7 | -    | 1.30 | 17.7 |
| 2025 Safenlp 2024 | 804 | UNSAT  | 7.19                  | 7.93 | 9.90  | 13.8 | -    | 2.17 | 17.8 |
| 2025 Safenlp 2024 | 805 | UNSAT  | 6.75                  | 7.99 | 6.09  | 11.2 | -    | 1.23 | 17.5 |
| 2025 Safenlp 2024 | 806 | UNSAT  | 6.81                  | 8.01 | 6.08  | 12.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 807 | UNSAT  | 6.76                  | 8.01 | 6.10  | 12.2 | -    | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 808 | SAT    | 6.76                  | 5.99 | 6.06  | 12.3 | 15.0 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 809 | UNSAT  | 6.24                  | 7.96 | 6.36  | 11.0 | 16.4 | 1.07 | -    |
| 2025 Safenlp 2024 | 810 | UNSAT  | 7.25                  | 8.06 | 9.54  | 13.3 | -    | 2.06 | 17.5 |
| 2025 Safenlp 2024 | 811 | UNSAT  | 7.94                  | -    | -     | -    | -    | -    | 17.7 |
| 2025 Safenlp 2024 | 812 | SAT    | 6.76                  | 6.02 | 6.05  | 11.2 | 14.9 | 1.24 | -    |
| 2025 Safenlp 2024 | 813 | UNSAT  | 6.66                  | 7.95 | 6.10  | 12.2 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 814 | SAT    | 6.76                  | 5.98 | 6.01  | 11.3 | 15.0 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 815 | SAT    | 6.75                  | 5.95 | 6.11  | 12.2 | 15.1 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 816 | SAT    | 6.51                  | 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  | 8.01                  | 12.3 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 819 | SAT    | 6.74                  | 5.95 | 6.09  | 12.2 | 14.8 | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 820 | UNSAT  | -                     | -    | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 821 | UNSAT  | 8.76                  | -    | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 822 | SAT    | 6.80                  | 6.96 | 6.10  | 12.2 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 823 | UNSAT  | 8.34                  | 8.57 | -     | -    | -    | -    | 18.2 |
| 2025 Safenlp 2024 | 824 | UNSAT  | 7.21                  | 8.36 | -     | 14.2 | -    | 11.1 | 17.8 |
| 2025 Safenlp 2024 | 825 | UNSAT  | 6.76                  | 8.01 | 6.14  | 12.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 826 | SAT    | 6.76                  | 6.00 | 6.08  | 12.2 | 15.1 | 1.25 | -    |
| 2025 Safenlp 2024 | 827 | UNSAT  | 6.77                  | 8.99 | 6.11  | 12.9 | -    | -    | 18.3 |
| 2025 Safenlp 2024 | 828 | UNSAT  | -                     | 8.19 | 19.5  | 15.0 | -    | 7.11 | 18.3 |
| 2025 Safenlp 2024 | 829 | UNSAT  | 6.81                  | 8.06 | 6.08  | 12.2 | -    | 1.24 | 17.7 |
| 2025 Safenlp 2024 | 830 | SAT    | 6.65                  | 5.94 | 6.04  | 12.3 | 14.9 | 1.29 | 17.9 |
| 2025 Safenlp 2024 | 831 | UNSAT  | 7.79                  | 8.47 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 832 | SAT    | 6.62                  | 6.08 | 6.07  | 12.2 | -    | 1.27 | -    |
| 2025 Safenlp 2024 | 833 | UNSAT  | 6.31                  | 7.90 | 6.37  | 12.0 | 16.6 | 1.10 | 17.6 |
| 2025 Safenlp 2024 | 834 | UNSAT  | 6.83                  | 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  | 6.28                  | 7.92 | 6.35  | 11.0 | 16.6 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 837 | UNSAT  | 6.68                  | 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  | 7.40                  | 8.11 | -     | 15.8 | -    | -    | 17.6 |
| 2025 Safenlp 2024 | 840 | UNSAT  | 6.80                  | 7.90 | 6.10  | 11.2 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 841 | UNSAT  | 6.79                  | 8.02 | 6.09  | 11.2 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 842 | SAT    | 6.70                  | 5.99 | 6.09  | 12.3 | 14.7 | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 843 | SAT    | 6.63                  | 5.97 | 6.05  | 12.2 | 14.9 | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 844 | UNSAT  | 13.2                  | 38.1 | -     | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 845 | UNSAT  | 7.14                  | 8.00 | 7.39  | 13.6 | -    | 2.09 | 17.5 |
| 2025 Safenlp 2024 | 846 | UNSAT  | 6.78                  | 9.21 | 6.07  | 14.5 | -    | 2.11 | 17.8 |
| 2025 Safenlp 2024 | 847 | SAT    | 6.47                  | 5.97 | 6.10  | 11.2 | 15.3 | 1.22 | 17.7 |
| 2025 Safenlp 2024 | 848 | UNSAT  | 6.73                  | 7.97 | 6.10  | 12.2 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 849 | UNSAT  | -                     | 8.44 | 21.8  | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 850 | UNSAT  | 6.80                  | 8.87 | 6.09  | 12.2 | -    | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 851 | UNSAT  | 6.56                  | 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    | 6.76                  | 6.57 | 6.09  | 12.2 | -    | 1.22 | 17.9 |
| 2025 Safenlp 2024 | 854 | UNSAT  | 6.62                  | 8.01 | 6.08  | 12.2 | -    | 1.22 | 17.6 |
| 2025 Safenlp 2024 | 855 | UNSAT  | 6.24                  | 7.95 | 6.37  | 11.0 | 16.5 | 1.08 | 17.5 |
| 2025 Safenlp 2024 | 856 | SAT    | 6.81                  | 7.54 | 6.12  | 12.2 | -    | 1.26 | X    |
| 2025 Safenlp 2024 | 857 | UNSAT  | -                     | 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  | 6.78                  | 9.27 | 6.12  | 13.2 | -    | 1.60 | 17.9 |
| 2025 Safenlp 2024 | 860 | UNSAT  | 6.57                  | 7.98 | 6.11  | 11.1 | -    | 1.24 | 17.9 |
| 2025 Safenlp 2024 | 861 | UNSAT  | 7.69                  | 8.65 | -     | -    | -    | 20.3 | 17.7 |
| 2025 Safenlp 2024 | 862 | UNSAT  | 7.15                  | 8.17 | 22.8  | 26.5 | -    | 4.09 | 17.7 |
| 2025 Safenlp 2024 | 863 | SAT    | 6.74                  | 7.78 | 6.11  | 11.2 | 14.9 | 1.26 | 18.2 |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNeN | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 864 | UNSAT  | -                     | 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  | 6.63                  | 8.03 | 6.10  | 12.2 | -    | 1.23 | 17.7 |
| 2025 Safenlp 2024 | 867 | UNSAT  | 6.27                  | 7.92 | 6.37  | 12.0 | 16.4 | 1.12 | 17.5 |
| 2025 Safenlp 2024 | 868 | UNSAT  | 6.40                  | 7.97 | 6.44  | 12.7 | 16.7 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 869 | UNSAT  | 7.21                  | 8.23 | 24.2  | -    | -    | 3.06 | 17.8 |
| 2025 Safenlp 2024 | 870 | UNSAT  | 6.73                  | 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  | -                     | 8.48 | -     | -    | -    | 15.7 | 17.8 |
| 2025 Safenlp 2024 | 873 | UNSAT  | 6.28                  | 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  | 6.52                  | 8.97 | 6.11  | 11.7 | -    | 1.71 | 17.9 |
| 2025 Safenlp 2024 | 876 | UNSAT  | 6.29                  | 7.96 | 6.34  | 10.9 | 16.7 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 877 | UNSAT  | 6.81                  | 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    | 6.84                  | 5.94 | 6.07  | 12.2 | 14.8 | 1.22 | 17.7 |
| 2025 Safenlp 2024 | 880 | UNSAT  | 6.28                  | 7.89 | 6.35  | 12.0 | 16.3 | 1.09 | 17.5 |
| 2025 Safenlp 2024 | 881 | SAT    | 6.59                  | 5.99 | 6.04  | 12.2 | 14.9 | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 882 | UNSAT  | 6.78                  | 8.00 | 6.11  | 12.2 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 883 | UNSAT  | 8.83                  | 9.20 | -     | -    | -    | -    | 18.0 |
| 2025 Safenlp 2024 | 884 | UNSAT  | 6.23                  | 7.92 | 6.35  | 11.0 | 16.5 | 1.08 | 19.2 |
| 2025 Safenlp 2024 | 885 | UNSAT  | 6.78                  | 9.21 | 6.08  | 14.0 | -    | 2.00 | 17.8 |
| 2025 Safenlp 2024 | 886 | UNSAT  | 6.84                  | 8.00 | 6.14  | 11.8 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 887 | UNSAT  | 6.80                  | 8.93 | 6.06  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 888 | UNSAT  | 6.77                  | 8.00 | 6.08  | 12.3 | -    | 1.32 | 18.0 |
| 2025 Safenlp 2024 | 889 | SAT    | 6.70                  | 5.96 | 6.06  | 12.2 | 15.3 | 1.28 | 17.9 |
| 2025 Safenlp 2024 | 890 | UNSAT  | 7.73                  | 8.42 | -     | 24.3 | -    | -    | 19.3 |
| 2025 Safenlp 2024 | 891 | UNSAT  | 6.58                  | 7.98 | 6.12  | 12.3 | -    | 1.23 | -    |
| 2025 Safenlp 2024 | 892 | SAT    | 6.58                  | 5.99 | 6.11  | 12.3 | 14.8 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 893 | UNSAT  | 6.25                  | 7.94 | 6.36  | 12.0 | 16.3 | 1.07 | 18.0 |
| 2025 Safenlp 2024 | 894 | SAT    | 6.79                  | 6.03 | 6.10  | 11.2 | 14.9 | 1.24 | -    |
| 2025 Safenlp 2024 | 895 | SAT    | 6.68                  | 5.99 | 6.09  | 12.2 | -    | 1.23 | X    |
| 2025 Safenlp 2024 | 896 | SAT    | 6.74                  | 6.00 | 6.07  | 11.3 | -    | 1.27 | 18.1 |
| 2025 Safenlp 2024 | 897 | UNSAT  | 7.37                  | 8.25 | 18.1  | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 898 | UNSAT  | 7.12                  | 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    | 6.79                  | 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    | 6.80                  | 5.96 | 6.12  | 11.2 | 15.1 | 1.25 | 18.1 |
| 2025 Safenlp 2024 | 904 | UNSAT  | 13.0                  | -    | -     | -    | -    | -    | 17.5 |
| 2025 Safenlp 2024 | 905 | UNSAT  | 6.23                  | 8.05 | 6.39  | 11.9 | 16.4 | 1.07 | 17.4 |
| 2025 Safenlp 2024 | 906 | SAT    | 6.55                  | 6.10 | 6.09  | 12.2 | -    | 1.30 | 17.8 |
| 2025 Safenlp 2024 | 907 | SAT    | 6.77                  | 5.96 | 6.04  | 12.1 | 14.9 | 1.09 | 17.7 |
| 2025 Safenlp 2024 | 908 | UNSAT  | 6.40                  | 7.89 | 6.50  | 11.8 | 16.6 | 1.07 | 17.5 |
| 2025 Safenlp 2024 | 909 | UNSAT  | 8.60                  | 9.31 | -     | -    | -    | -    | 17.7 |
| 2025 Safenlp 2024 | 910 | UNSAT  | 7.21                  | 8.07 | 15.5  | 13.6 | -    | 3.77 | 17.6 |
| 2025 Safenlp 2024 | 911 | UNSAT  | 6.65                  | 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  | 7.08                  | 7.97 | 7.79  | 13.2 | -    | 1.83 | 17.5 |
| 2025 Safenlp 2024 | 914 | UNSAT  | 6.28                  | 7.96 | 6.36  | 12.0 | 16.5 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 915 | UNSAT  | 6.80                  | 7.88 | 6.08  | 12.2 | -    | 1.24 | 19.2 |
| 2025 Safenlp 2024 | 916 | SAT    | 6.74                  | 5.98 | 6.03  | 12.2 | 14.8 | 1.23 | 19.2 |
| 2025 Safenlp 2024 | 917 | UNSAT  | 6.81                  | 8.01 | 6.11  | 12.2 | -    | 1.24 | -    |
| 2025 Safenlp 2024 | 918 | UNSAT  | 6.80                  | 8.95 | 6.09  | 11.2 | -    | 1.26 | 19.3 |
| 2025 Safenlp 2024 | 919 | UNSAT  | 6.26                  | 7.94 | 6.37  | 12.0 | 16.6 | 1.07 | 17.5 |
| 2025 Safenlp 2024 | 920 | UNSAT  | 6.72                  | 7.88 | 6.12  | 11.2 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 921 | UNSAT  | 6.28                  | 7.93 | 6.38  | 11.9 | 16.7 | 1.07 | 19.2 |
| 2025 Safenlp 2024 | 922 | UNSAT  | 6.64                  | 8.96 | 6.08  | 11.2 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 923 | SAT    | 6.54                  | 5.96 | 6.03  | 11.2 | -    | 1.23 | 17.6 |
| 2025 Safenlp 2024 | 924 | UNSAT  | 6.56                  | 7.98 | 6.12  | 12.2 | -    | 1.39 | 17.7 |
| 2025 Safenlp 2024 | 925 | UNSAT  | 8.21                  | 11.7 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 926 | UNSAT  | 6.48                  | 8.01 | 6.09  | 11.2 | -    | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 927 | UNSAT  | 7.74                  | 9.64 | 6.10  | 13.0 | -    | -    | 19.3 |
| 2025 Safenlp 2024 | 928 | SAT    | 6.67                  | 5.98 | 6.05  | 12.3 | 14.9 | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 929 | UNSAT  | 6.71                  | 8.89 | 6.09  | 12.2 | -    | 1.22 | 18.2 |
| 2025 Safenlp 2024 | 930 | UNSAT  | 7.67                  | 8.37 | -     | -    | -    | -    | 19.1 |
| 2025 Safenlp 2024 | 931 | UNSAT  | 11.5                  | 19.3 | -     | -    | -    | -    | 18.1 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNeN | SB   |
|-------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 932 | SAT    | 6.82                  | 6.01 | 6.06  | 12.2 | 15.0 | 1.26 | 18.0 |
| 2025 Safenlp 2024 | 933 | UNSAT  | 7.25                  | 8.00 | 6.56  | 12.4 | -    | 1.47 | 17.5 |
| 2025 Safenlp 2024 | 934 | SAT    | 6.80                  | 6.19 | 6.09  | 12.2 | -    | 1.26 | X    |
| 2025 Safenlp 2024 | 935 | SAT    | 6.73                  | 5.99 | 6.05  | 12.2 | 14.9 | 1.27 | 18.0 |
| 2025 Safenlp 2024 | 936 | UNSAT  | 8.65                  | 9.47 | -     | -    | -    | -    | 17.7 |
| 2025 Safenlp 2024 | 937 | SAT    | 6.80                  | 6.34 | 6.09  | 12.2 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 938 | UNSAT  | 6.27                  | 7.89 | 6.36  | 12.0 | 16.6 | 1.08 | 17.4 |
| 2025 Safenlp 2024 | 939 | SAT    | 6.77                  | 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  | 9.43                  | 27.0 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 942 | UNSAT  | 6.77                  | 8.02 | 6.09  | 12.7 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 943 | UNSAT  | 6.60                  | 8.21 | 6.12  | 12.8 | -    | 2.44 | 17.5 |
| 2025 Safenlp 2024 | 944 | UNSAT  | 7.51                  | 8.91 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 945 | UNSAT  | 6.77                  | -    | 6.09  | 12.2 | -    | 1.30 | 18.5 |
| 2025 Safenlp 2024 | 946 | SAT    | 6.75                  | 5.95 | 6.05  | 12.2 | 14.9 | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 947 | SAT    | 6.44                  | 5.92 | 6.06  | 12.2 | 14.8 | 1.24 | 17.7 |
| 2025 Safenlp 2024 | 948 | SAT    | 6.55                  | 5.97 | 6.03  | 12.2 | 14.9 | 1.26 | 18.0 |
| 2025 Safenlp 2024 | 949 | UNSAT  | 6.83                  | 7.96 | 6.09  | 12.2 | -    | 1.84 | 17.9 |
| 2025 Safenlp 2024 | 950 | UNSAT  | 6.75                  | 9.03 | 6.12  | 12.5 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 951 | UNSAT  | 6.71                  | 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  | 6.82                  | 9.20 | 6.11  | 12.5 | -    | 1.47 | 18.0 |
| 2025 Safenlp 2024 | 954 | UNSAT  | 7.58                  | 8.08 | 10.5  | 13.3 | -    | 2.09 | 17.5 |
| 2025 Safenlp 2024 | 955 | UNSAT  | 7.10                  | 8.01 | 7.08  | 12.0 | -    | 1.93 | 17.5 |
| 2025 Safenlp 2024 | 956 | UNSAT  | 6.31                  | 7.99 | 6.35  | 11.9 | 16.3 | 1.07 | 19.0 |
| 2025 Safenlp 2024 | 957 | UNSAT  | 6.81                  | 7.97 | 6.14  | 12.2 | -    | 1.26 | 18.3 |
| 2025 Safenlp 2024 | 958 | UNSAT  | 6.25                  | 7.97 | 6.37  | 12.0 | 16.9 | 1.07 | 18.1 |
| 2025 Safenlp 2024 | 959 | UNSAT  | 6.53                  | 7.96 | 6.10  | 12.2 | -    | 1.26 | 17.6 |
| 2025 Safenlp 2024 | 960 | SAT    | 6.56                  | 6.36 | 6.13  | 12.2 | -    | 1.23 | -    |
| 2025 Safenlp 2024 | 961 | UNSAT  | 6.29                  | 7.94 | 6.40  | 12.0 | 16.5 | 1.07 | 17.7 |
| 2025 Safenlp 2024 | 962 | UNSAT  | 6.26                  | 7.93 | 6.39  | 11.0 | 16.5 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 963 | UNSAT  | 6.76                  | 8.20 | 6.12  | 12.7 | -    | 1.24 | 18.6 |
| 2025 Safenlp 2024 | 964 | UNSAT  | 6.79                  | 8.97 | 6.12  | 16.5 | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 965 | UNSAT  | 6.25                  | 7.96 | 6.38  | 12.0 | 16.7 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 966 | UNSAT  | 6.54                  | 7.99 | 6.09  | 12.2 | -    | 1.27 | 17.9 |
| 2025 Safenlp 2024 | 967 | UNSAT  | 6.78                  | 8.12 | 6.09  | 12.2 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 968 | UNSAT  | 7.84                  | 8.33 | -     | -    | -    | -    | 17.8 |
| 2025 Safenlp 2024 | 969 | UNSAT  | 7.10                  | 8.05 | 7.11  | 13.5 | -    | 1.77 | 17.7 |
| 2025 Safenlp 2024 | 970 | UNSAT  | 6.75                  | 8.03 | 6.10  | 12.2 | -    | 1.25 | 17.7 |
| 2025 Safenlp 2024 | 971 | UNSAT  | 6.81                  | 8.07 | 6.08  | 12.2 | -    | 1.25 | -    |
| 2025 Safenlp 2024 | 972 | UNSAT  | 6.82                  | 7.93 | 6.11  | 11.5 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 973 | SAT    | 6.81                  | 7.21 | 6.09  | 12.2 | -    | 1.25 | 17.6 |
| 2025 Safenlp 2024 | 974 | SAT    | 6.61                  | 7.89 | 6.13  | 11.2 | 14.7 | 1.26 | 18.1 |
| 2025 Safenlp 2024 | 975 | UNSAT  | 6.77                  | 8.97 | 6.11  | 12.3 | -    | 1.28 | 18.0 |
| 2025 Safenlp 2024 | 976 | UNSAT  | 7.31                  | 8.02 | 10.1  | 13.5 | -    | 2.24 | 18.2 |
| 2025 Safenlp 2024 | 977 | UNSAT  | 7.33                  | 8.11 | 14.6  | 16.5 | -    | 3.01 | 17.7 |
| 2025 Safenlp 2024 | 978 | UNSAT  | 6.79                  | 8.94 | 6.11  | 12.1 | -    | 1.24 | 19.6 |
| 2025 Safenlp 2024 | 979 | UNSAT  | 6.81                  | 8.00 | 6.08  | 11.2 | -    | 1.24 | 18.2 |
| 2025 Safenlp 2024 | 980 | UNSAT  | 6.69                  | 7.99 | 6.12  | 12.8 | -    | 1.59 | 19.3 |
| 2025 Safenlp 2024 | 981 | UNSAT  | 6.71                  | 9.09 | 6.10  | 11.2 | -    | 1.43 | 18.2 |
| 2025 Safenlp 2024 | 982 | SAT    | 6.70                  | 7.80 | 6.09  | 12.2 | -    | 1.23 | X    |
| 2025 Safenlp 2024 | 983 | UNSAT  | 6.29                  | 7.91 | 6.35  | 12.0 | 16.7 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 984 | UNSAT  | 6.27                  | 7.95 | 6.39  | 12.0 | 16.3 | 1.10 | 17.5 |
| 2025 Safenlp 2024 | 985 | UNSAT  | 6.73                  | 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  | 6.52                  | 8.00 | 6.11  | 12.2 | -    | 1.25 | 17.8 |
| 2025 Safenlp 2024 | 989 | UNSAT  | 7.43                  | 7.98 | 7.80  | 13.3 | -    | 2.27 | 17.7 |
| 2025 Safenlp 2024 | 990 | UNSAT  | 6.84                  | 8.99 | 6.08  | 12.3 | -    | 1.23 | 17.6 |
| 2025 Safenlp 2024 | 991 | UNSAT  | 6.78                  | 9.02 | 6.10  | 12.2 | -    | 1.25 | 18.2 |
| 2025 Safenlp 2024 | 992 | UNSAT  | 7.22                  | 8.03 | 9.21  | 14.3 | -    | 1.78 | -    |
| 2025 Safenlp 2024 | 993 | SAT    | 6.55                  | 5.96 | 6.06  | 12.2 | 15.0 | 1.23 | 17.6 |
| 2025 Safenlp 2024 | 994 | UNSAT  | 6.28                  | 7.90 | 6.37  | 12.0 | 16.7 | 1.08 | 17.6 |
| 2025 Safenlp 2024 | 995 | UNSAT  | 6.84                  | 8.00 | 6.11  | 12.7 | -    | 1.43 | 17.9 |
| 2025 Safenlp 2024 | 996 | UNSAT  | 6.27                  | 7.98 | 6.39  | 11.9 | 16.4 | 1.09 | 17.6 |
| 2025 Safenlp 2024 | 997 | UNSAT  | 6.55                  | 9.07 | 6.11  | 12.4 | -    | 1.76 | 17.6 |
| 2025 Safenlp 2024 | 998 | UNSAT  | 6.79                  | 8.09 | 6.11  | 12.2 | -    | 1.24 | 18.1 |
| 2025 Safenlp 2024 | 999 | UNSAT  | 6.59                  | 8.00 | 6.14  | 12.7 | -    | 1.29 | 17.7 |



Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id   | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|------|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 1000 | SAT    | 6.51                  | 5.96 | 6.08  | 12.2 | 14.9 | 1.27 | 19.2 |
| 2025 Safenlp 2024 | 1001 | UNSAT  | 6.28                  | 7.93 | 6.36  | 11.0 | 16.7 | 1.13 | 17.7 |
| 2025 Safenlp 2024 | 1002 | UNSAT  | 6.60                  | 8.94 | 6.11  | 11.6 | -    | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 1003 | UNSAT  | 6.65                  | 8.04 | 6.11  | 12.2 | -    | 1.27 | 17.7 |
| 2025 Safenlp 2024 | 1004 | UNSAT  | 6.25                  | 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  | 6.67                  | 8.11 | 6.09  | 12.9 | -    | 1.98 | 17.9 |
| 2025 Safenlp 2024 | 1007 | UNSAT  | 6.78                  | 8.92 | 6.10  | 12.2 | -    | 1.31 | 17.9 |
| 2025 Safenlp 2024 | 1008 | UNSAT  | 6.76                  | 8.03 | 6.11  | 12.7 | -    | 1.24 | -    |
| 2025 Safenlp 2024 | 1009 | SAT    | 6.76                  | 8.90 | 6.09  | 11.2 | -    | 1.27 | 17.8 |
| 2025 Safenlp 2024 | 1010 | UNSAT  | 6.26                  | 7.89 | 6.39  | 11.9 | 16.5 | 1.07 | 17.6 |
| 2025 Safenlp 2024 | 1011 | UNSAT  | 7.42                  | 8.27 | -     | 16.5 | -    | 19.3 | 17.8 |
| 2025 Safenlp 2024 | 1012 | UNSAT  | 6.85                  | 8.96 | 6.11  | 12.2 | -    | 1.22 | 17.8 |
| 2025 Safenlp 2024 | 1013 | UNSAT  | 6.79                  | 7.99 | 6.10  | 12.2 | -    | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 1014 | UNSAT  | 6.81                  | 7.95 | 6.09  | 12.2 | -    | 1.24 | 17.7 |
| 2025 Safenlp 2024 | 1015 | UNSAT  | 7.33                  | 8.04 | 17.4  | 14.3 | -    | 13.8 | 17.8 |
| 2025 Safenlp 2024 | 1016 | UNSAT  | 6.61                  | 7.96 | 6.09  | 12.2 | -    | 1.25 | 17.5 |
| 2025 Safenlp 2024 | 1017 | SAT    | 6.70                  | 7.30 | 6.06  | 11.2 | -    | 1.23 | X    |
| 2025 Safenlp 2024 | 1018 | SAT    | 6.79                  | 6.27 | 6.08  | 12.3 | -    | 1.27 | 18.0 |
| 2025 Safenlp 2024 | 1019 | UNSAT  | 6.76                  | 7.97 | 6.06  | 12.2 | -    | 1.24 | 17.7 |
| 2025 Safenlp 2024 | 1020 | UNSAT  | 7.30                  | 8.02 | 7.73  | 13.8 | -    | 2.16 | 17.6 |
| 2025 Safenlp 2024 | 1021 | UNSAT  | 6.55                  | 9.03 | 6.09  | 12.2 | -    | 1.25 | 17.5 |
| 2025 Safenlp 2024 | 1022 | UNSAT  | 6.66                  | 8.01 | 6.09  | 13.0 | -    | 1.26 | 19.3 |
| 2025 Safenlp 2024 | 1023 | UNSAT  | 7.45                  | 8.04 | 6.66  | 12.7 | -    | 1.28 | 17.7 |
| 2025 Safenlp 2024 | 1024 | SAT    | 6.57                  | 5.95 | 6.06  | 12.2 | 15.1 | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 1025 | UNSAT  | 7.08                  | 8.00 | 6.60  | 12.7 | -    | 1.28 | 19.5 |
| 2025 Safenlp 2024 | 1026 | UNSAT  | 7.18                  | 8.27 | 13.1  | 14.2 | -    | 2.94 | 17.8 |
| 2025 Safenlp 2024 | 1027 | UNSAT  | 6.80                  | 7.98 | 6.09  | 11.3 | -    | 1.25 | 17.6 |
| 2025 Safenlp 2024 | 1028 | UNSAT  | 6.71                  | 7.94 | 6.11  | 11.2 | -    | 1.25 | 17.7 |
| 2025 Safenlp 2024 | 1029 | SAT    | 6.81                  | 6.02 | 6.16  | 11.1 | 15.1 | 1.28 | 17.9 |
| 2025 Safenlp 2024 | 1030 | UNSAT  | 7.08                  | 7.97 | 6.65  | 12.5 | -    | 1.29 | 17.6 |
| 2025 Safenlp 2024 | 1031 | UNSAT  | 7.05                  | 7.99 | 7.19  | 13.0 | -    | 1.89 | 17.4 |
| 2025 Safenlp 2024 | 1032 | UNSAT  | 6.67                  | 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  | 6.28                  | 7.88 | 6.36  | 11.9 | 16.9 | 1.08 | 19.5 |
| 2025 Safenlp 2024 | 1035 | UNSAT  | 7.76                  | 8.57 | -     | 29.1 | -    | 14.3 | 17.7 |
| 2025 Safenlp 2024 | 1036 | UNSAT  | 6.26                  | 7.90 | 6.38  | 10.9 | 16.6 | 1.08 | 17.8 |
| 2025 Safenlp 2024 | 1037 | UNSAT  | 6.22                  | 7.92 | 6.38  | 12.0 | 16.4 | 1.07 | 17.5 |
| 2025 Safenlp 2024 | 1038 | UNSAT  | 7.61                  | 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    | 6.75                  | 8.97 | 6.08  | 12.2 | 14.8 | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 1042 | SAT    | 6.63                  | 5.95 | 6.04  | 12.2 | 14.8 | 1.25 | 17.9 |
| 2025 Safenlp 2024 | 1043 | UNSAT  | 6.79                  | 9.01 | 6.14  | 12.2 | -    | 1.22 | 19.3 |
| 2025 Safenlp 2024 | 1044 | UNSAT  | 7.04                  | 7.99 | 8.54  | 12.8 | -    | 1.96 | 17.5 |
| 2025 Safenlp 2024 | 1045 | UNSAT  | 6.80                  | 8.90 | 6.06  | 12.3 | -    | 1.24 | 17.6 |
| 2025 Safenlp 2024 | 1046 | UNSAT  | -                     | 8.02 | 6.87  | 12.9 | -    | 1.74 | 17.6 |
| 2025 Safenlp 2024 | 1047 | SAT    | 6.79                  | 6.50 | 6.10  | 12.3 | -    | 1.24 | 19.3 |
| 2025 Safenlp 2024 | 1048 | UNSAT  | 7.71                  | 8.96 | -     | -    | -    | -    | 17.6 |
| 2025 Safenlp 2024 | 1049 | SAT    | 6.76                  | 5.96 | 6.08  | 12.2 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 1050 | UNSAT  | 6.81                  | 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    | 6.81                  | 6.10 | 6.12  | 12.3 | -    | 1.25 | 18.0 |
| 2025 Safenlp 2024 | 1053 | UNSAT  | 6.24                  | 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    | 6.61                  | 6.06 | 6.08  | 12.2 | 14.9 | 1.26 | 17.9 |
| 2025 Safenlp 2024 | 1056 | SAT    | 6.59                  | 6.06 | 6.11  | 11.3 | -    | 1.24 | 17.8 |
| 2025 Safenlp 2024 | 1057 | UNSAT  | 6.80                  | 8.93 | 6.10  | 13.5 | -    | 1.42 | 17.6 |
| 2025 Safenlp 2024 | 1058 | UNSAT  | 7.47                  | 8.28 | 20.3  | 21.0 | -    | 19.4 | 18.4 |
| 2025 Safenlp 2024 | 1059 | UNSAT  | 6.68                  | 7.99 | 6.10  | 12.2 | -    | 1.28 | 17.7 |
| 2025 Safenlp 2024 | 1060 | UNSAT  | 6.57                  | 9.00 | 6.10  | 12.3 | -    | 1.23 | 17.8 |
| 2025 Safenlp 2024 | 1061 | UNSAT  | 6.72                  | 9.20 | 6.07  | 12.5 | -    | 1.70 | 18.0 |
| 2025 Safenlp 2024 | 1062 | UNSAT  | 6.82                  | 7.98 | 6.10  | 12.3 | -    | 1.24 | 19.7 |
| 2025 Safenlp 2024 | 1063 | UNSAT  | 6.31                  | 7.99 | 6.37  | 10.9 | 16.7 | 1.07 | 17.5 |
| 2025 Safenlp 2024 | 1064 | UNSAT  | 6.78                  | 7.93 | 6.06  | 12.2 | -    | 1.25 | 17.6 |
| 2025 Safenlp 2024 | 1065 | UNSAT  | 7.26                  | 7.98 | 7.15  | 12.7 | -    | 1.51 | 17.6 |
| 2025 Safenlp 2024 | 1066 | UNSAT  | 6.69                  | 8.92 | 6.12  | 12.2 | -    | 1.24 | 17.7 |
| 2025 Safenlp 2024 | 1067 | SAT    | 6.47                  | 6.24 | 6.08  | 12.2 | -    | 1.23 | 17.7 |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category          | Id   | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|-------------------|------|--------|-----------------------|------|-------|------|------|------|------|
| 2025 Safenlp 2024 | 1068 | UNSAT  | 6.24                  | 7.93 | 6.36  | 10.9 | 16.5 | 1.07 | 17.8 |
| 2025 Safenlp 2024 | 1069 | UNSAT  | 6.78                  | 8.01 | 6.09  | 11.2 | -    | 1.22 | 17.7 |
| 2025 Safenlp 2024 | 1070 | SAT    | 6.63                  | 6.11 | 6.02  | 12.2 | 15.0 | 1.26 | 17.8 |
| 2025 Safenlp 2024 | 1071 | UNSAT  | 8.06                  | 8.53 | -     | -    | -    | -    | 17.9 |
| 2025 Safenlp 2024 | 1072 | SAT    | 6.74                  | 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    | 6.79                  | 5.93 | 6.02  | 12.2 | 15.0 | 1.26 | 18.3 |
| 2025 Safenlp 2024 | 1075 | UNSAT  | 6.82                  | 8.99 | 6.07  | 11.2 | -    | 1.25 | 17.6 |
| 2025 Safenlp 2024 | 1076 | UNSAT  | 6.62                  | 8.95 | 6.09  | 12.2 | -    | 1.25 | 19.7 |
| 2025 Safenlp 2024 | 1077 | SAT    | 6.68                  | 6.03 | 6.10  | 12.2 | -    | 1.24 | 18.3 |
| 2025 Safenlp 2024 | 1078 | UNSAT  | 6.98                  | 7.88 | 6.76  | 12.7 | -    | 1.38 | 17.6 |
| 2025 Safenlp 2024 | 1079 | UNSAT  | 6.84                  | 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 | X    |
| 2025 Sat Relu     | 3    | UNSAT  | 6.60                  | 16.4 | -     | 13.5 | -    | -    | -    |
| 2025 Sat Relu     | 4    | SAT    | 6.10                  | 8.68 | 6.22  | 12.2 | -    | -    | X    |
| 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 | -    | -    | X    |
| 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 | X    |
| 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 | X    |
| 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 | -    | -    | X    |
| 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 | X    |
| 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 | X    |
| 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 | X    |
| 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 | -    | -    | X    |
| 2025 Sat Relu     | 27   | UNSAT  | 6.68                  | 16.5 | -     | 13.3 | -    | -    | -    |
| 2025 Sat Relu     | 28   | SAT    | 6.06                  | 12.4 | 6.30  | 12.2 | -    | -    | X    |
| 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 | X    |
| 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 | X    |
| 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 | X    |
| 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 | X    |
| 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 | X    |
| 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 | X    |
| 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 | X    |
| 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 | X    |
| 2025 Sat Relu     | 55   | UNSAT  | 6.47                  | 16.2 | 7.31  | 12.7 | -    | 1.20 | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category            | Id | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | N Nen | SB   |
|---------------------|----|--------|-----------------------|------|-------|------|------|-------|------|
| 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 | -    | -     | X    |
| 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  | X    |
| 2025 Sat Relu       | 61 | UNSAT  | 6.84                  | 16.5 | -     | 12.3 | -    | -     | -    |
| 2025 Sat Relu       | 62 | SAT    | 6.07                  | 8.73 | 6.36  | 12.2 | -    | -     | X    |
| 2025 Sat Relu       | 63 | UNSAT  | 6.78                  | 16.6 | -     | 13.8 | -    | -     | -    |
| 2025 Sat Relu       | 64 | SAT    | 6.11                  | 8.61 | 6.36  | 12.2 | -    | -     | X    |
| 2025 Sat Relu       | 65 | UNSAT  | 6.74                  | 16.5 | -     | 12.8 | -    | -     | -    |
| 2025 Sat Relu       | 66 | SAT    | 6.08                  | 8.62 | 6.23  | 11.2 | -    | -     | X    |
| 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  | X    |
| 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  | X    |
| 2025 Sat Relu       | 71 | UNSAT  | 6.70                  | 16.4 | -     | 13.3 | -    | -     | -    |
| 2025 Sat Relu       | 72 | SAT    | 6.07                  | 8.70 | 6.19  | 12.2 | -    | -     | X    |
| 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  | X    |
| 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  | X    |
| 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  | X    |
| 2025 Sat Relu       | 83 | UNSAT  | 6.60                  | 16.6 | -     | 13.3 | -    | -     | -    |
| 2025 Sat Relu       | 84 | SAT    | 6.08                  | 12.5 | 6.31  | 11.2 | -    | -     | X    |
| 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  | X    |
| 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  | X    |
| 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 | -     | -    | -    | -     | -    |
| 2025 Soundnessbench | 23 | UNSAT  | 37.7                  | 9.16 | -     | -    | -    | -     | -    |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (×).

| Category               | Id | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB |
|------------------------|----|--------|-----------------------|------|-------|------|------|------|----|
| 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  | -    | -    | -    | -  |
| 2025 Tinyimagenet 2024 | 41 | UNSAT  | 23.0                  | 71.4 | -     | -    | -    | -    | -  |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category               | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV | NNen | SB |
|------------------------|-----|--------|-----------------------|------|-------|------|-----|------|----|
| 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  | -    | -   | -    | -  |
| 2025 Tinyimagenet 2024 | 109 | UNSAT  | 18.7                  | 53.1 | -     | -    | -   | -    | -  |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category               | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV | NNen | SB |
|------------------------|-----|--------|-----------------------|------|-------|------|-----|------|----|
| 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                  | X    | -     | -    | -   | -    | -  |
| 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 | -     | -    | -   | -    | -  |
| 2025 Tinyimagenet 2024 | 177 | UNSAT  | 10.0                  | 28.1 | 13.4  | -    | -   | -    | -  |

Table 33: Instance Runtimes. Fastest times are blue. Second fastest are green. Penalties are red crosses (X).

| Category                 | Id  | Result | $\alpha$ - $\beta$ -C | NSAT | PyRAT | CORA | NNV  | NNen | SB   |
|--------------------------|-----|--------|-----------------------|------|-------|------|------|------|------|
| 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 |