Inference Report

Performance and Simplification Benchmark between SymPy and StanLogic

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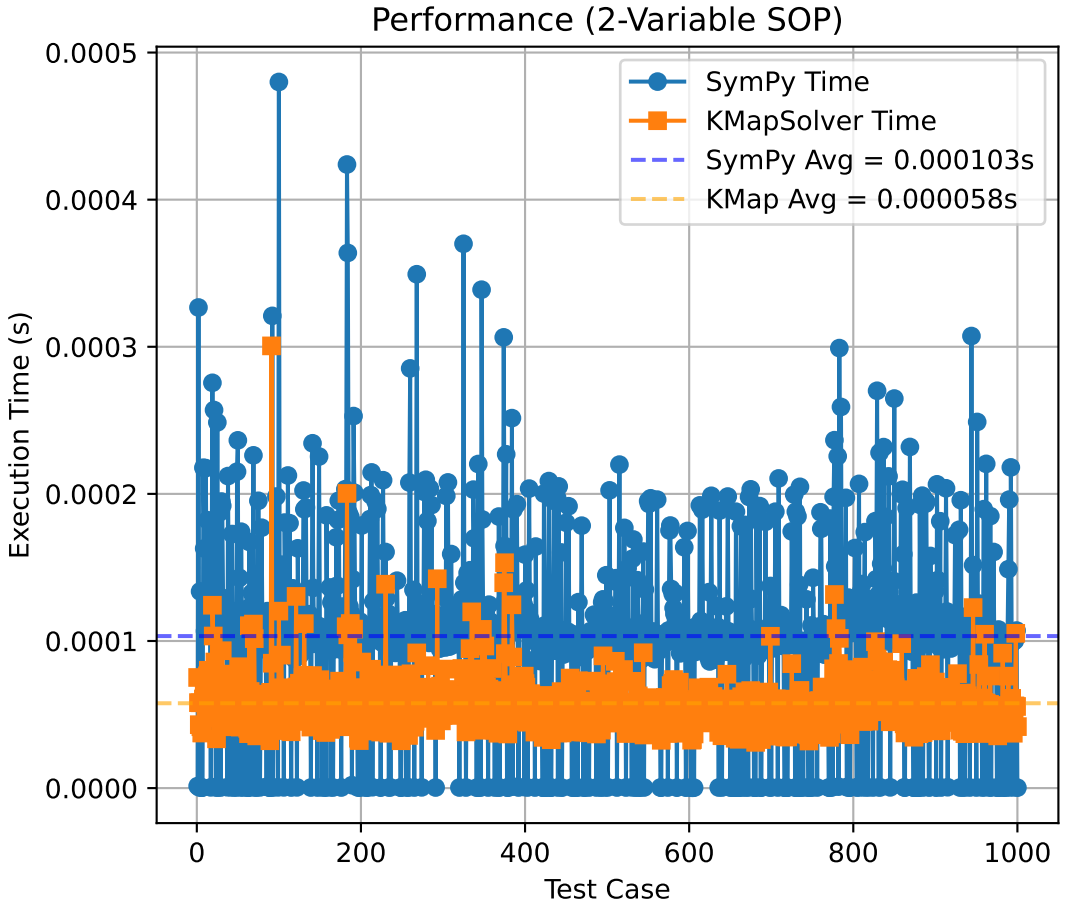
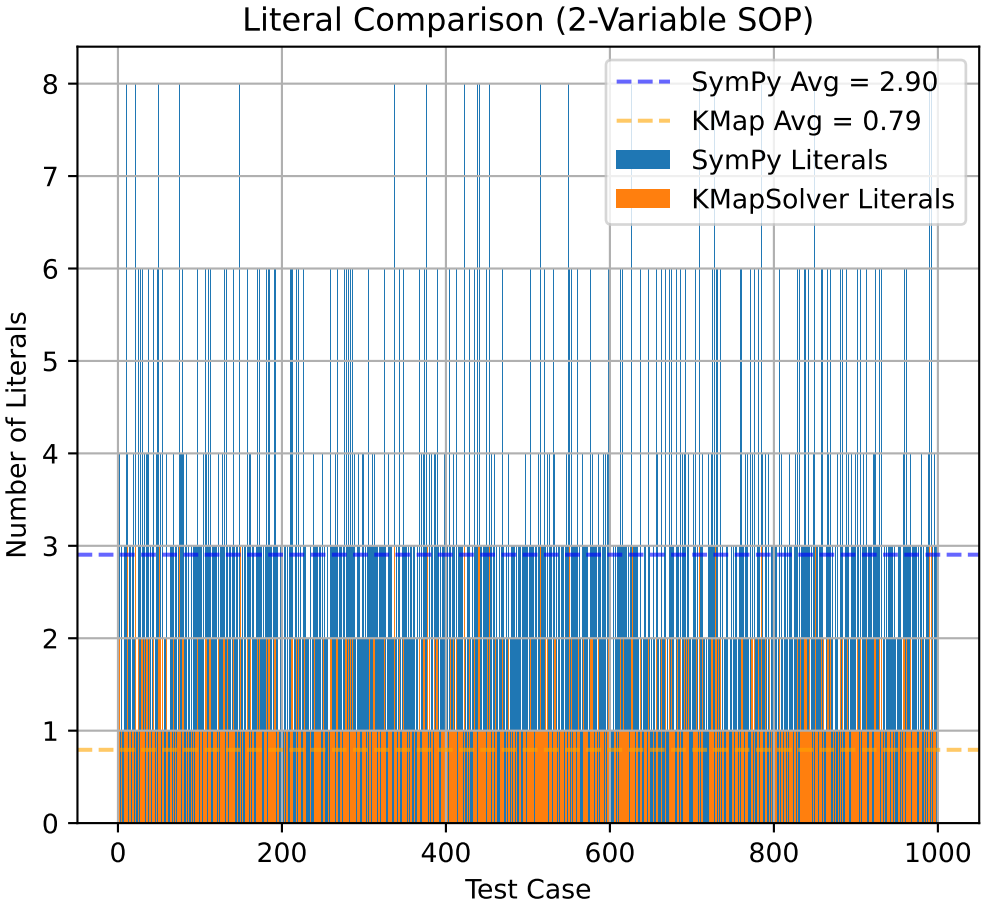
Generated on November 10, 2025


Performance (2-Variable SOP)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000103s
KMap Avg = 0.000058s
Execution Time (s)
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
0
200
400
600
800
1000
Test Case


Literal Comparison (2-Variable SOP)
SymPy Avg = 2.90
KMap Avg = 0.79
SymPy Literals
KMapSolver Literals
Number of Literals
8
7
6
5
4
3
2
1
0
0
200
400
600
800
1000
Test Case

INFERENCE: 2-Variable SOP

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

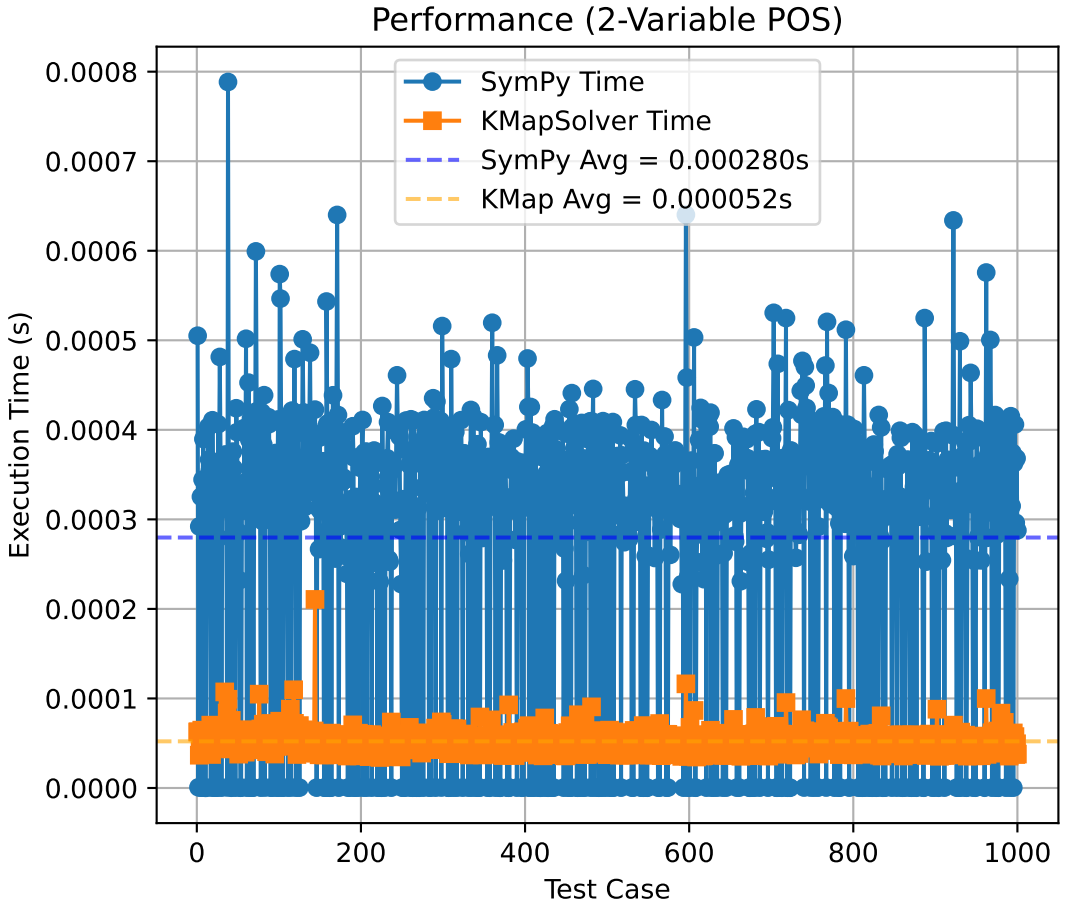
```
  Average SymPy Time:      0.000103 s
  Average KMapSolver Time: 0.000058 s
  Difference:              -0.000046 s (-44.18%)
  Std. Dev (ΔTime):        0.000059 s
  Deviation Ratio:         0.573
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

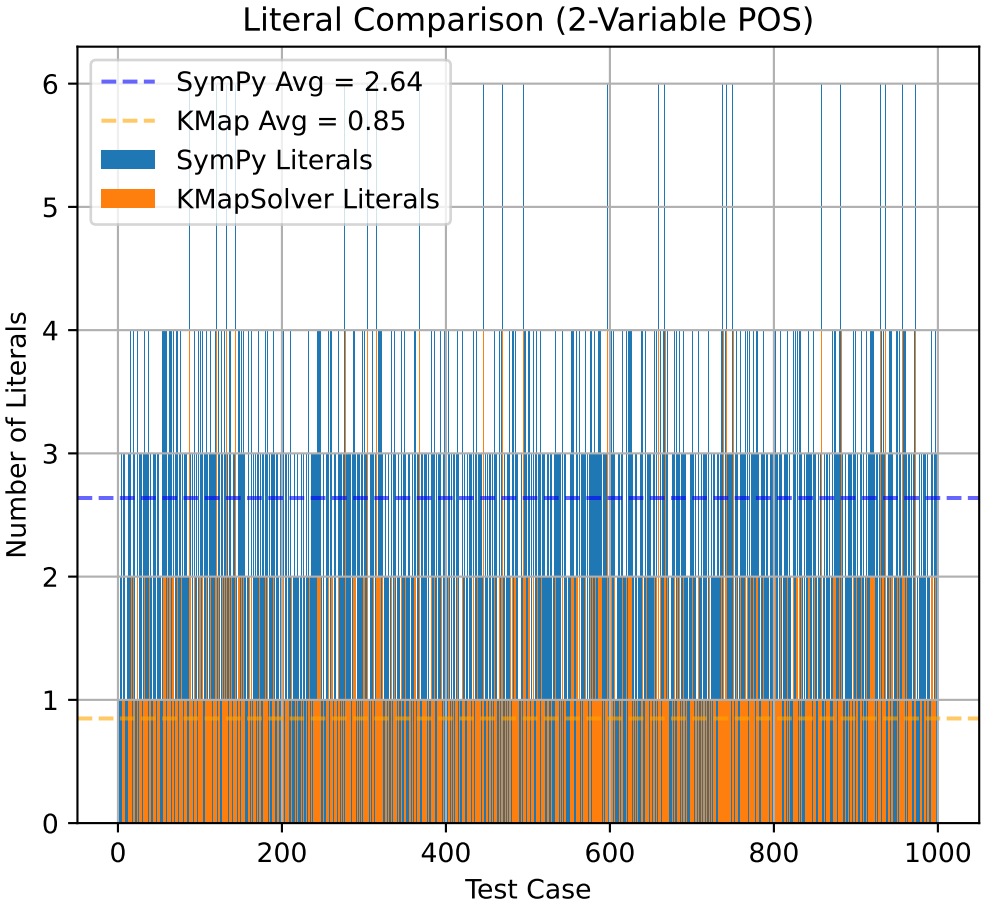
LITERAL COUNT ANALYSIS

```
  Average SymPy Literals:  2.90
  Average KMap Literals:   0.79
  Difference:              -2.11 (-72.7%)
  Std. Dev (ΔLiterals):    0.90
  Deviation Ratio:         0.311
  → KMapSolver produces more minimal logical forms (fewer literals).
  → Literal simplifications are consistent.
```

OVERALL VERDICT

```
  □ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.
================================================================================
```


Performance (2-Variable POS)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000280s
KMap Avg = 0.000052s
Execution Time (s)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006
0.0007
0.0008
0
200
400
600
800
1000
Test Case


Literal Comparison (2-Variable POS)
SymPy Avg = 2.64
KMap Avg = 0.85
SymPy Literals
KMapSolver Literals
Number of Literals
0
1
2
3
4
5
6
0
200
400
600
800
1000
Test Case

INFERENCE: 2-Variable POS

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================================================================================
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INFERENCE SUMMARY

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================================================================================
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EXECUTION TIME ANALYSIS

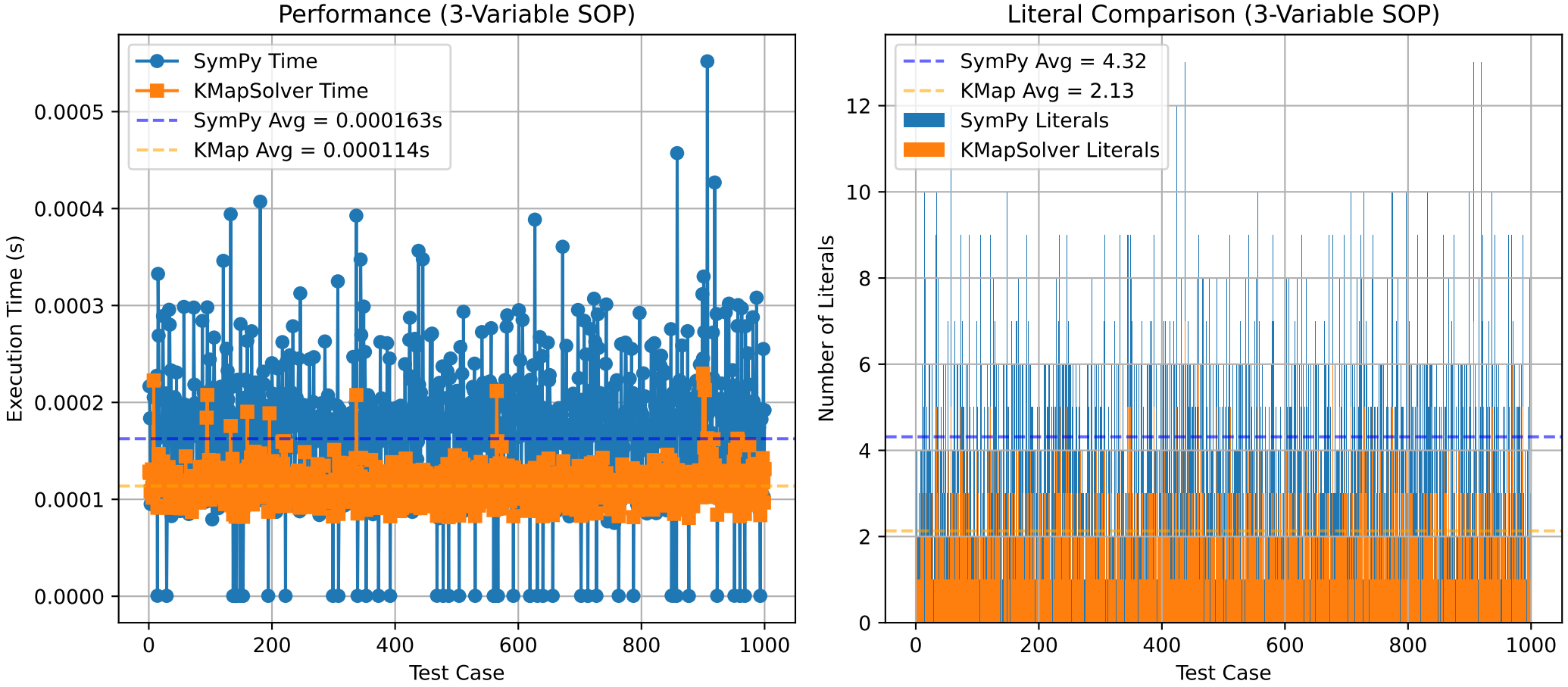
```
  Average SymPy Time:      0.000280 s
  Average KMapSolver Time: 0.000052 s
  Difference:              -0.000228 s (-81.38%)
  Std. Dev (ΔTime):        0.000156 s
  Deviation Ratio:         0.556
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

LITERAL COUNT ANALYSIS

```
  Average SymPy Literals:  2.64
  Average KMap Literals:   0.85
  Difference:              -1.79 (-67.8%)
  Std. Dev (ΔLiterals):    0.41
  Deviation Ratio:         0.155
  → KMapSolver produces more minimal logical forms (fewer literals).
  → Literal simplifications are consistent.
```

OVERALL VERDICT

```
  □ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.
================================================================================
```


Performance (3-Variable SOP)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000163s
KMap Avg = 0.000114s
Execution Time (s)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0
200
400
600
800
1000
Test Case
Literal Comparison (3-Variable SOP)
SymPy Avg = 4.32
KMap Avg = 2.13
SymPy Literals
KMapSolver Literals
Number of Literals
0
2
4
6
8
10
12
0
200
400
600
800
1000
Test Case

INFERENCE: 3-Variable SOP

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

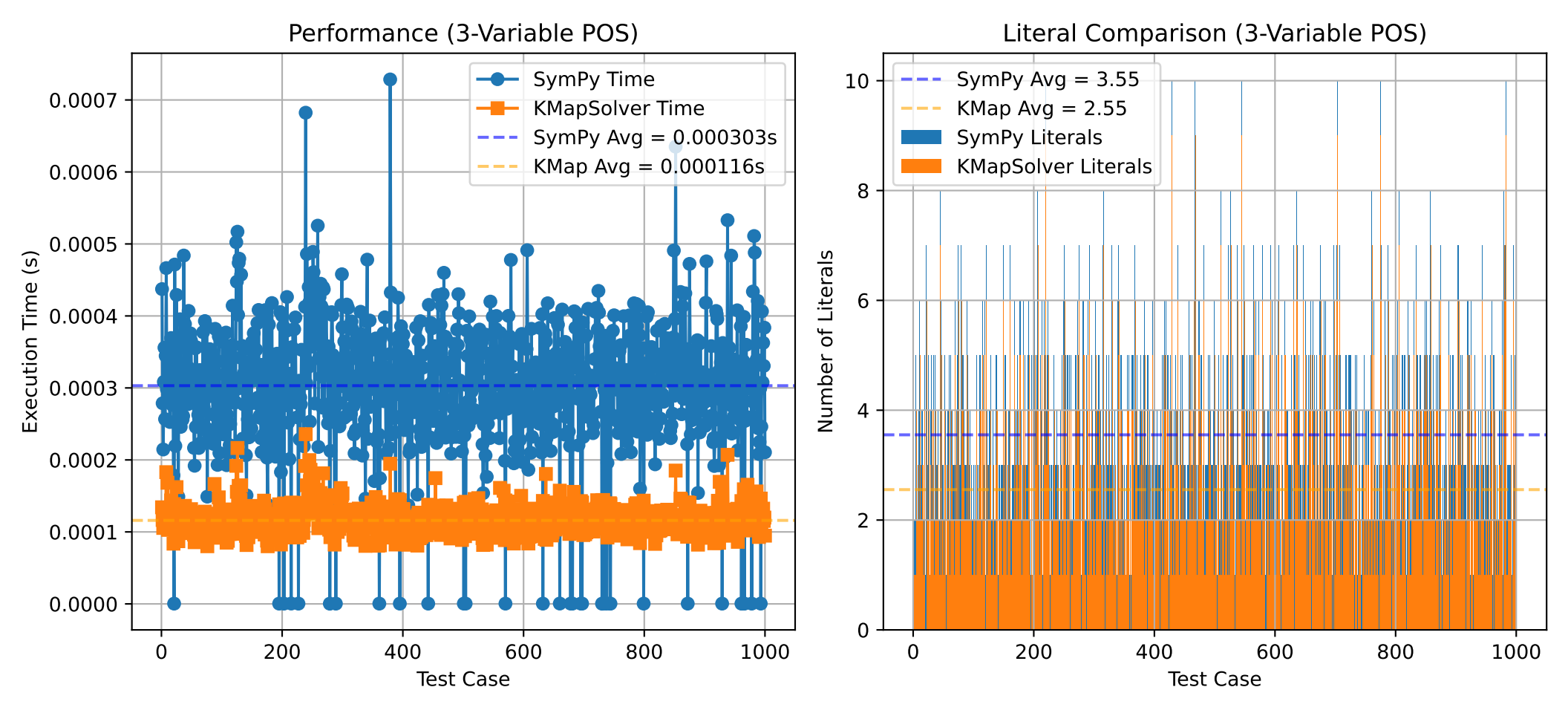
```
  Average SymPy Time:      0.000163 s
  Average KMapSolver Time: 0.000114 s
  Difference:              -0.000049 s (-29.98%)
  Std. Dev (ΔTime):        0.000063 s
  Deviation Ratio:         0.386
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

LITERAL COUNT ANALYSIS

```
  Average SymPy Literals:  4.32
  Average KMap Literals:   2.13
  Difference:              -2.18 (-50.6%)
  Std. Dev (ΔLiterals):    1.10
  Deviation Ratio:         0.255
  → KMapSolver produces more minimal logical forms (fewer literals).
  → Literal simplifications are consistent.
```

OVERALL VERDICT

```
  □ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.
================================================================================
```


Performance (3-Variable POS)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000303s
KMap Avg = 0.000116s
Execution Time (s)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006
0.0007
0
200
400
600
800
1000
Test Case
Literal Comparison (3-Variable POS)
SymPy Avg = 3.55
KMap Avg = 2.55
SymPy Literals
KMapSolver Literals
Number of Literals
0
2
4
6
8
10
0
200
400
600
800
1000
Test Case

INFERENCE: 3-Variable POS

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================================================================================
```

INFERENCE SUMMARY

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================================================================================
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EXECUTION TIME ANALYSIS

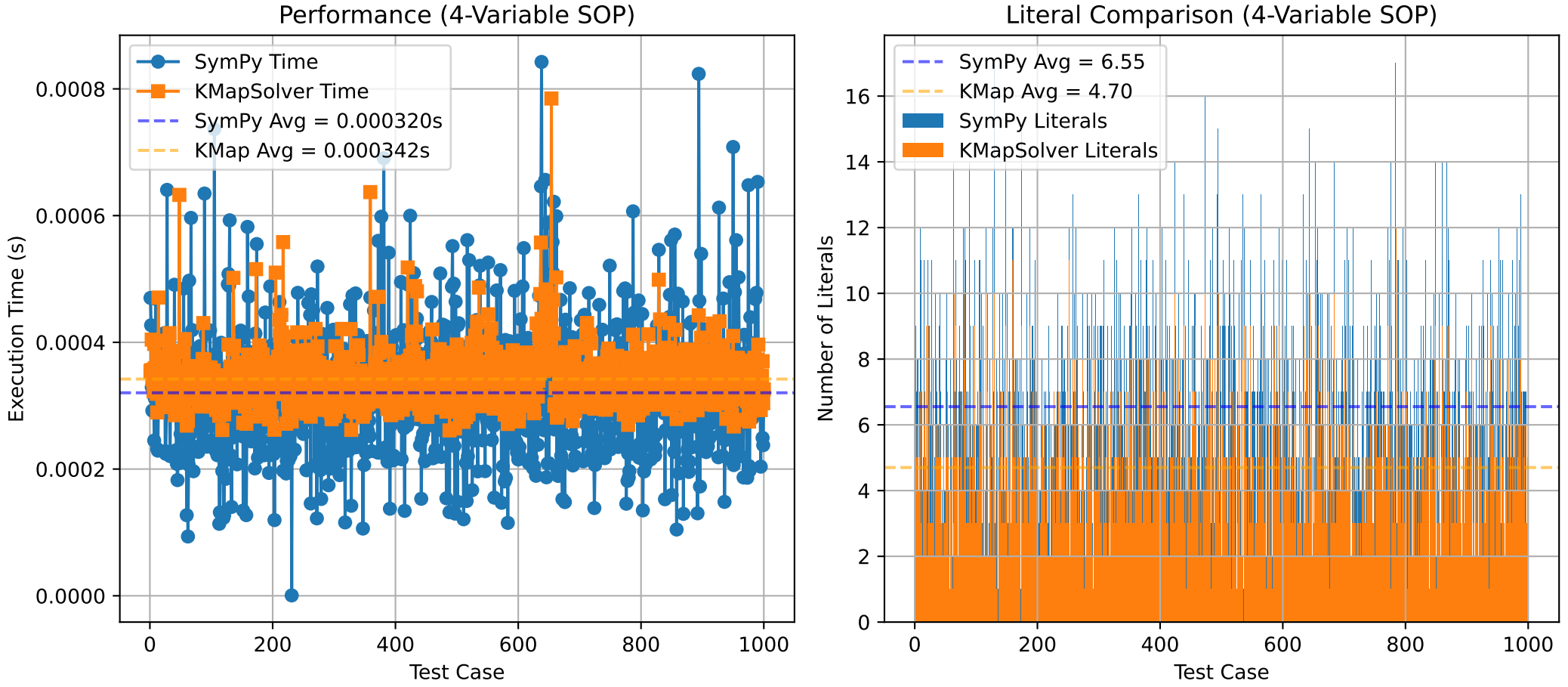
```
  Average SymPy Time:      0.000303 s
  Average KMapSolver Time: 0.000116 s
  Difference:              -0.000187 s (-61.73%)
  Std. Dev (ΔTime):        0.000082 s
  Deviation Ratio:         0.269
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

LITERAL COUNT ANALYSIS

```
  Average SymPy Literals:  3.55
  Average KMap Literals:   2.55
  Difference:              -1.00 (-28.1%)
  Std. Dev (ΔLiterals):    0.06
  Deviation Ratio:         0.018
  → KMapSolver produces more minimal logical forms (fewer literals).
  → Literal simplifications are consistent.
```

OVERALL VERDICT

```
  □ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.
================================================================================
```


Performance (4-Variable SOP)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000320s
KMap Avg = 0.000342s
Execution Time (s)
0.0000
0.0002
0.0004
0.0006
0.0008
0
200
400
600
800
1000
Test Case
Literal Comparison (4-Variable SOP)
SymPy Avg = 6.55
KMap Avg = 4.70
SymPy Literals
KMapSolver Literals
Number of Literals
0
2
4
6
8
10
12
14
16
0
200
400
600
800
1000
Test Case

INFERENCE: 4-Variable SOP

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

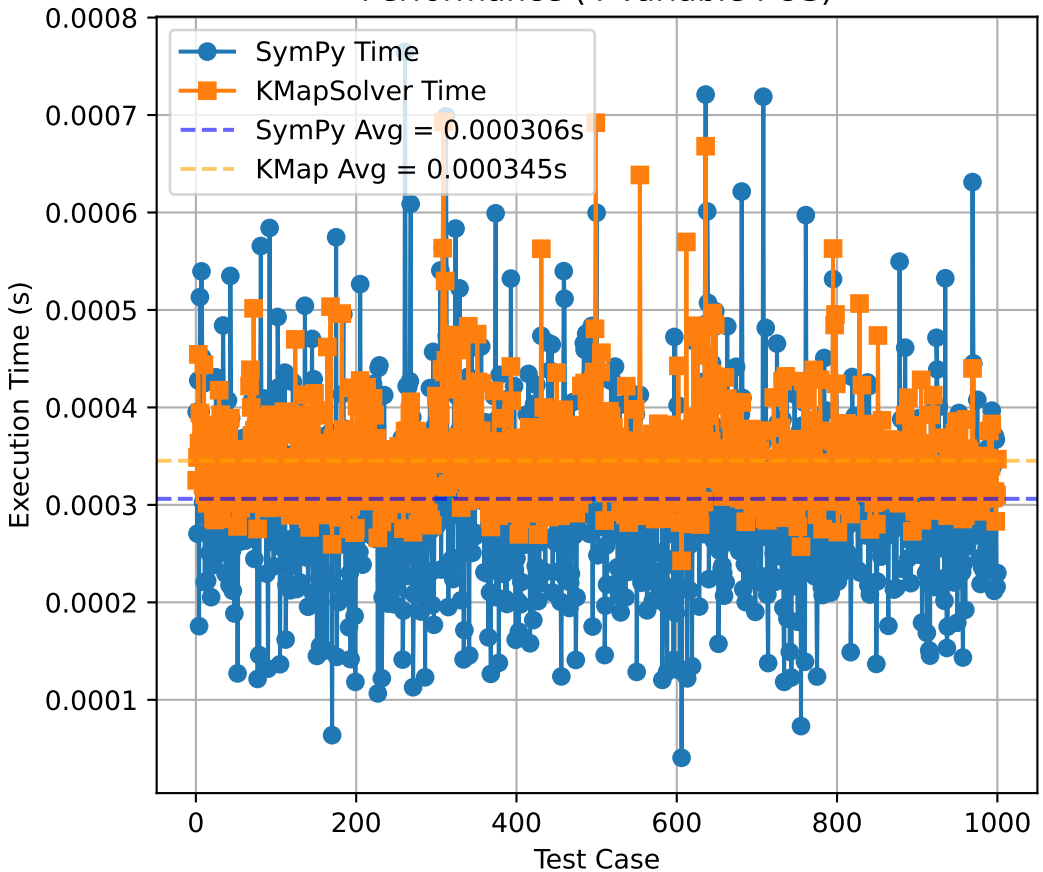
```
  Average SymPy Time:      0.000320 s
  Average KMapSolver Time: 0.000342 s
  Difference:              +0.000022 s (+6.75%)
  Std. Dev (ΔTime):        0.000091 s
  Deviation Ratio:         0.285
  → Both algorithms exhibit nearly identical runtimes.
  → Execution times are stable and consistent.
```

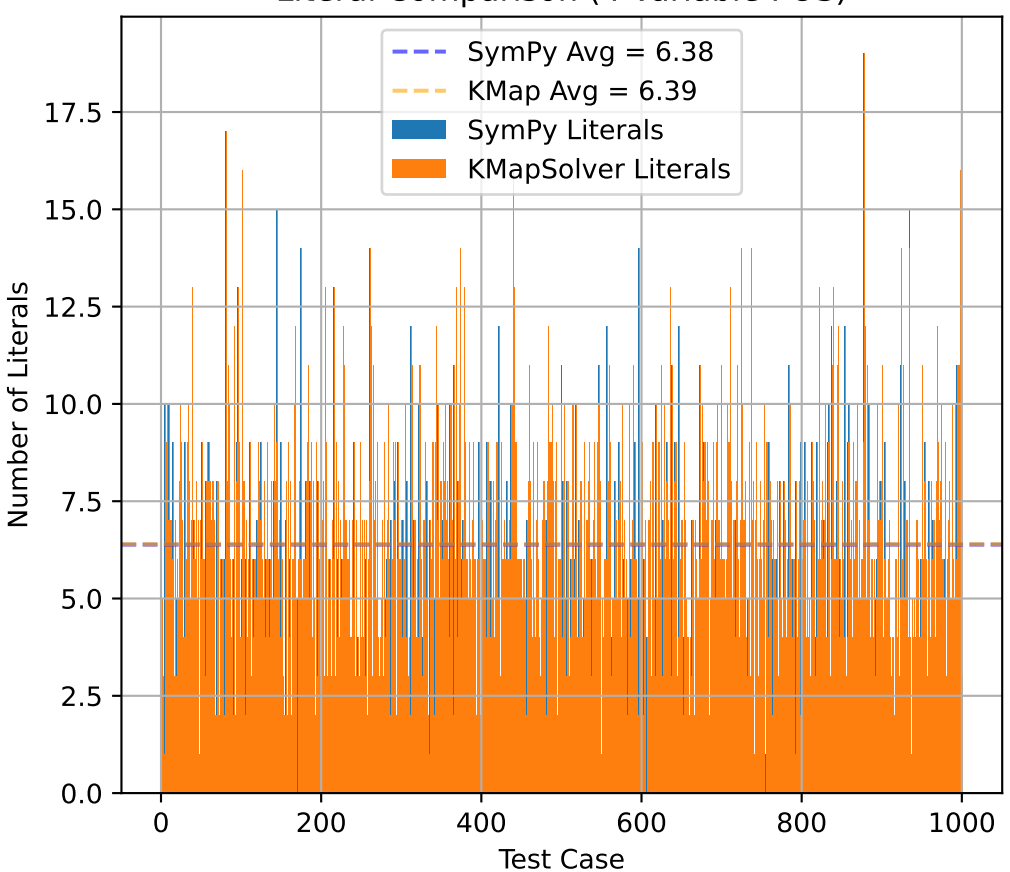
LITERAL COUNT ANALYSIS

```
  Average SymPy Literals:  6.55
  Average KMap Literals:   4.70
  Difference:              -1.85 (-28.3%)
  Std. Dev (ΔLiterals):    1.27
  Deviation Ratio:         0.194
  → KMapSolver produces more minimal logical forms (fewer literals).
  → Literal simplifications are consistent.
```

OVERALL VERDICT

```
  □ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.
================================================================================
```


Performance (4-Variable POS)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000306s
KMap Avg = 0.000345s
Execution Time (s)
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
200
400
600
800
1000
Test Case


Literal Comparison (4-Variable POS)
SymPy Avg = 6.38
KMap Avg = 6.39
SymPy Literals
KMapSolver Literals
Number of Literals
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
0
200
400
600
800
1000
Test Case

INFERENCE: 4-Variable POS

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
  Average SymPy Time:      0.000306 s
  Average KMapSolver Time: 0.000345 s
  Difference:              +0.000039 s (+12.75%)
  Std. Dev (ΔTime):        0.000078 s
  Deviation Ratio:         0.253
  → KMapSolver shows a slight runtime overhead compared to SymPy.
  → Execution times are stable and consistent.
```

LITERAL COUNT ANALYSIS

```
  Average SymPy Literals:  6.38
  Average KMap Literals:   6.39
  Difference:              +0.01 (+0.1%)
  Std. Dev (ΔLiterals):    0.19
  Deviation Ratio:         0.030
  → Both solvers yield nearly identical simplifications.
  → Literal simplifications are consistent.
```

OVERALL VERDICT

⚠ KMapSolver maintains correctness but trades slight performance for structural optimization.

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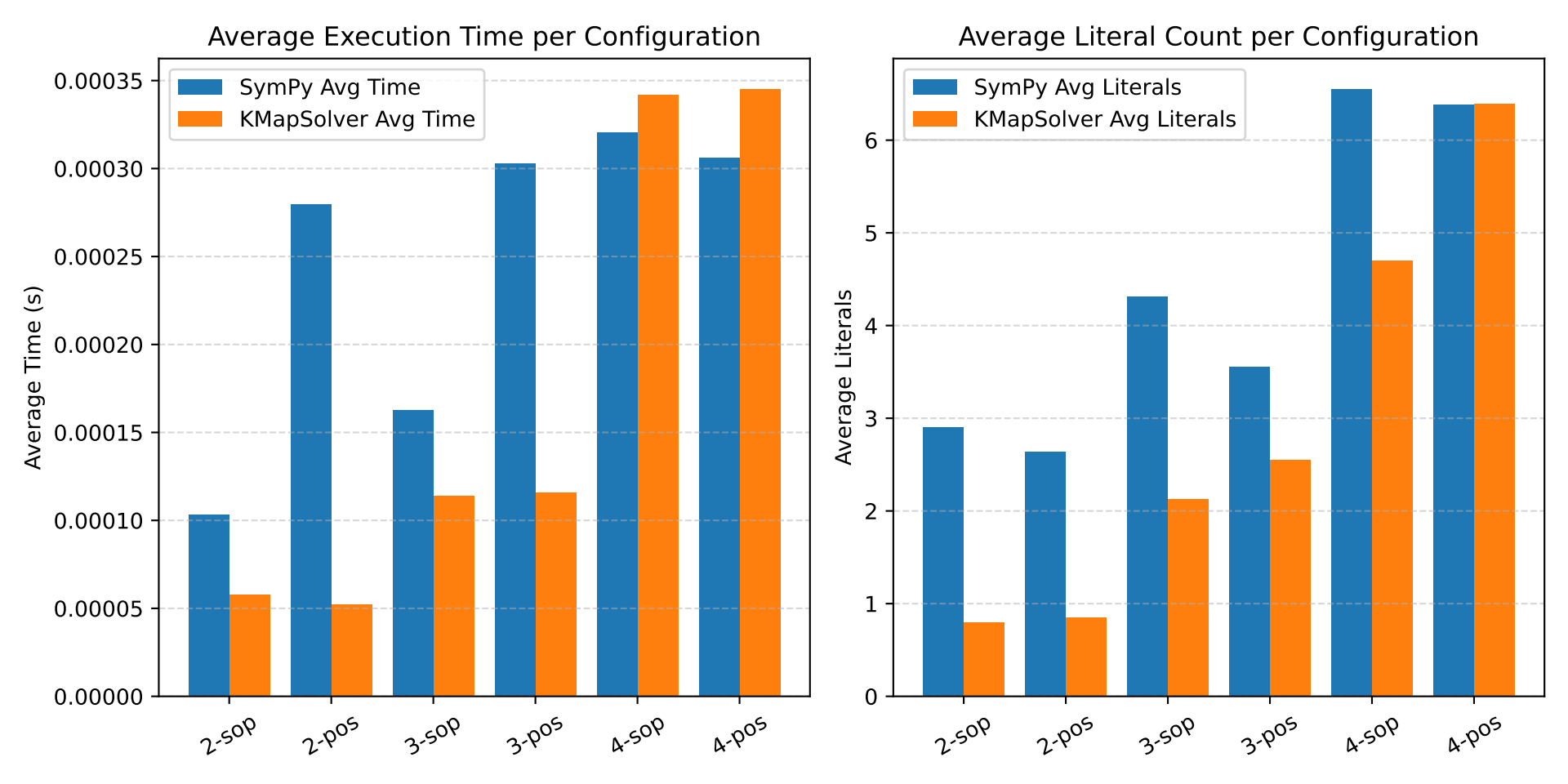
Average Execution Time per Configuration
SymPy Avg Time
KMapSolver Avg Time
Average Time (s)
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00000
2-sop
2-pos
3-sop
3-pos
4-sop
4-pos
Average Literal Count per Configuration
SymPy Avg Literals
KMapSolver Avg Literals
Average Literals
6
5
4
3
2
1
0
2-sop
2-pos
3-sop
3-pos
4-sop
4-pos

OVERALL INFERENCE REPORT

Generated on November 10, 2025

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
  Average SymPy Time:      0.000246 s
  Average KMapSolver Time: 0.000171 s
  Difference:              -0.000075 s (-30.40%)
  Std. Dev (ΔTime):        0.000109 s
  Deviation Ratio:         0.445
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

LITERAL COUNT ANALYSIS

```
  Average SymPy Literals:  4.39
  Average KMap Literals:   2.90
  Difference:              -1.49 (-33.9%)
  Std. Dev (ΔLiterals):    0.85
  Deviation Ratio:         0.193
  → KMapSolver produces more minimal logical forms (fewer literals).
  → Literal simplifications are consistent.
```

OVERALL VERDICT

```
  □ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.
================================================================================
```