Inference Report

Performance and Simplification Benchmark between SymPy and StanLogic

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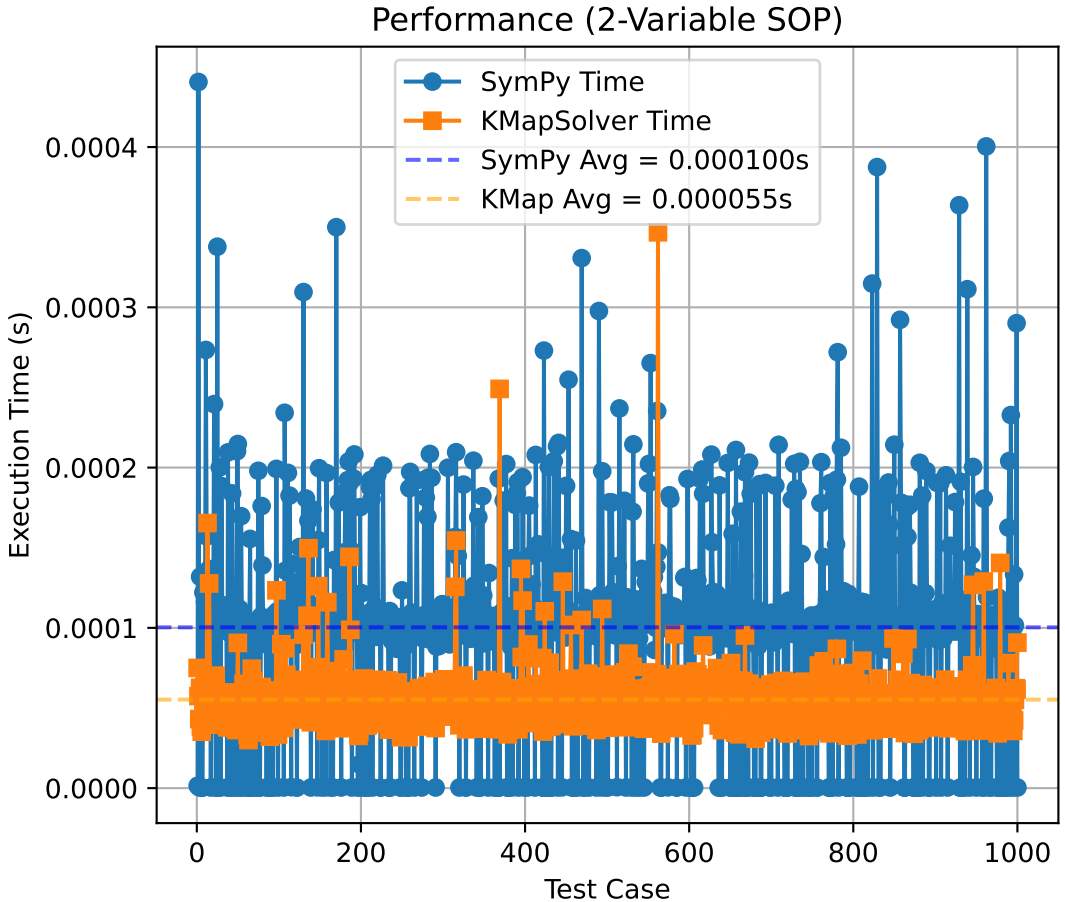
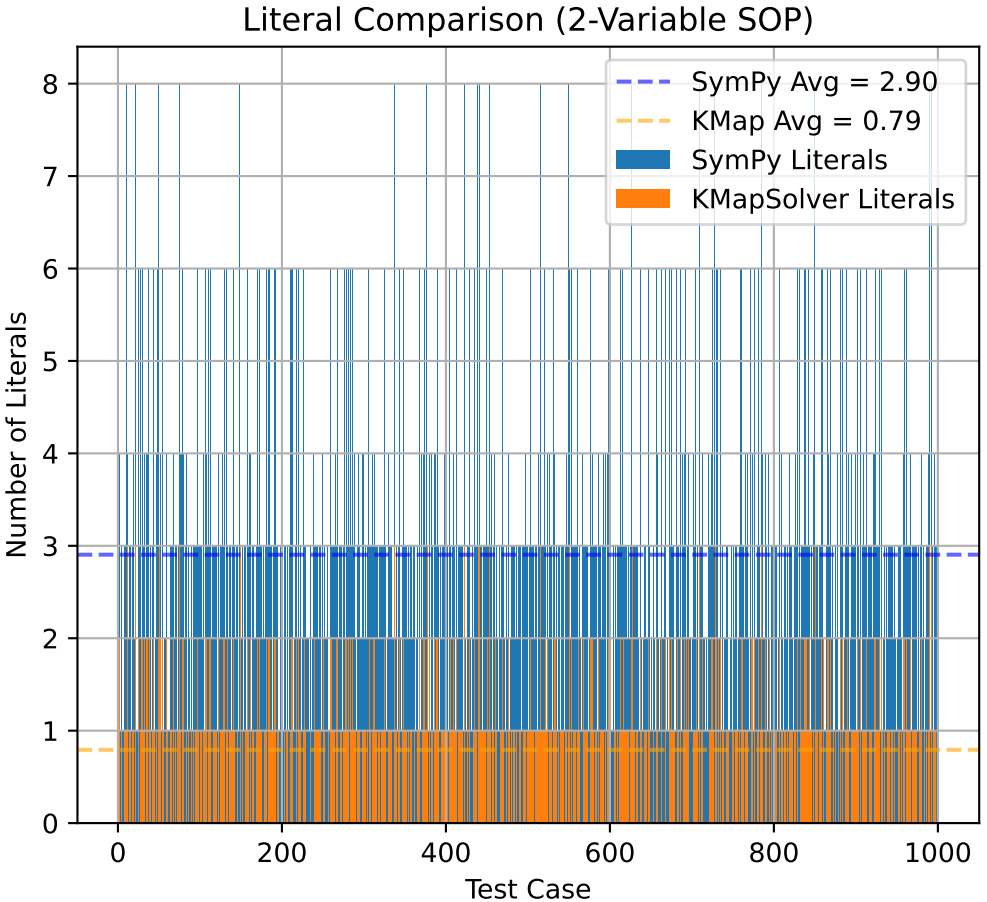
Generated on October 30, 2025


Performance (2-Variable SOP)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000100s
KMap Avg = 0.000055s
Execution Time (s)
0.0000
0.0001
0.0002
0.0003
0.0004
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
0
1
2
3
4
5
6
7
8
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

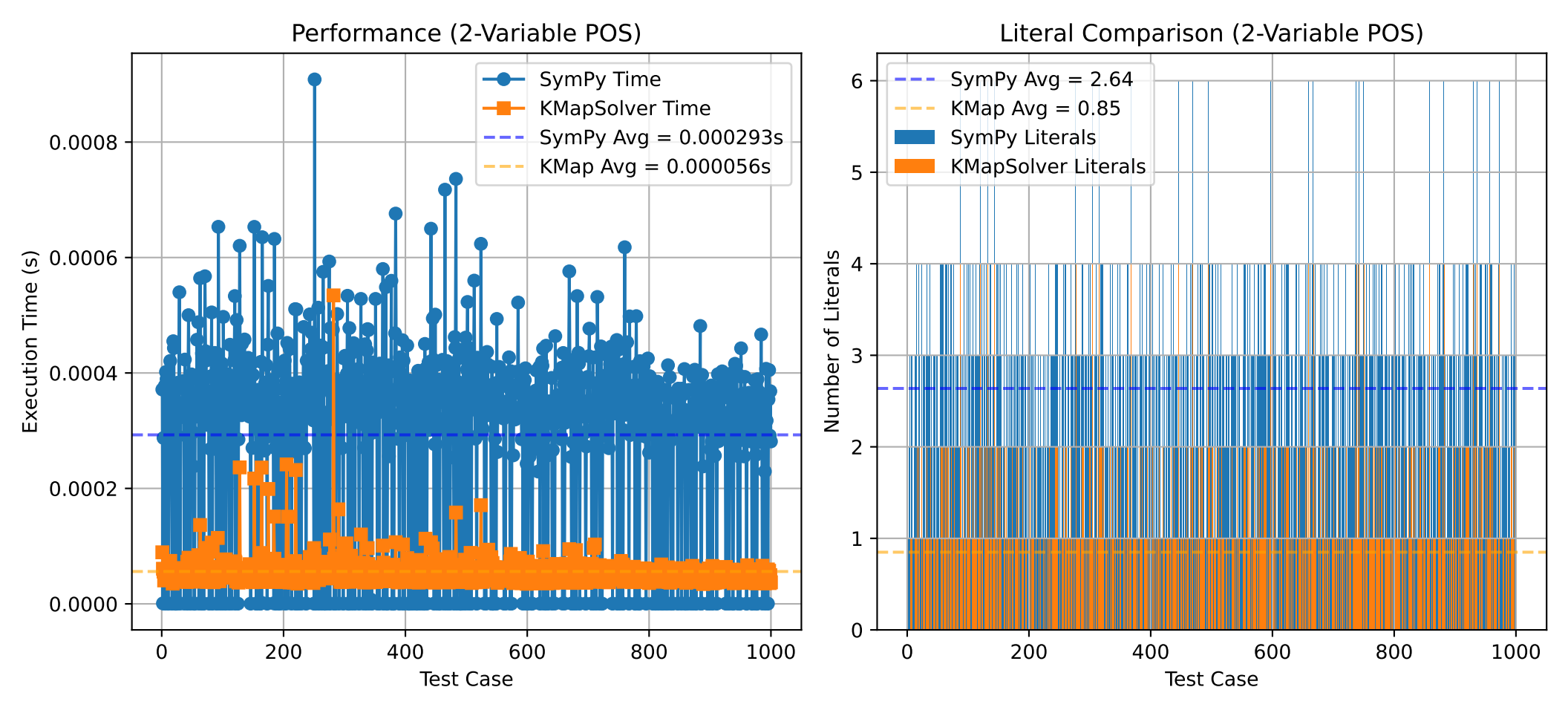
```
  Average SymPy Time:      0.000100 s
  Average KMapSolver Time: 0.000055 s
  Difference:              -0.000045 s (-44.93%)
  Std. Dev (ΔTime):        0.000059 s
  Deviation Ratio:         0.590
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

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 = 0.000293s
KMap Avg = 0.000056s
Execution Time (s)
0.0000
0.0002
0.0004
0.0006
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

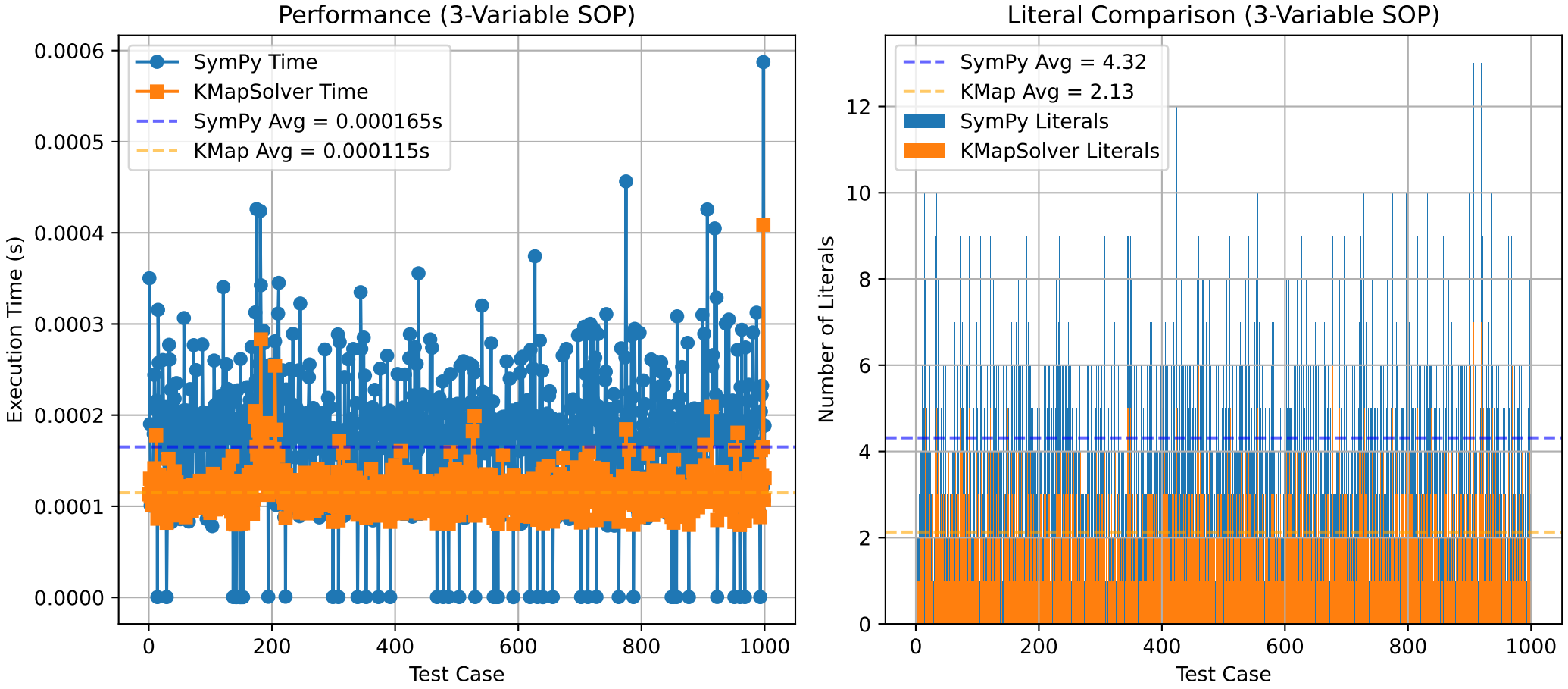
```
  Average SymPy Time:      0.000293 s
  Average KMapSolver Time: 0.000056 s
  Difference:              -0.000237 s (-80.85%)
  Std. Dev (ΔTime):        0.000166 s
  Deviation Ratio:         0.567
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

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 = 0.000165s
KMap Avg = 0.000115s
Execution Time (s)
0.0000
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006
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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================================================================================
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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

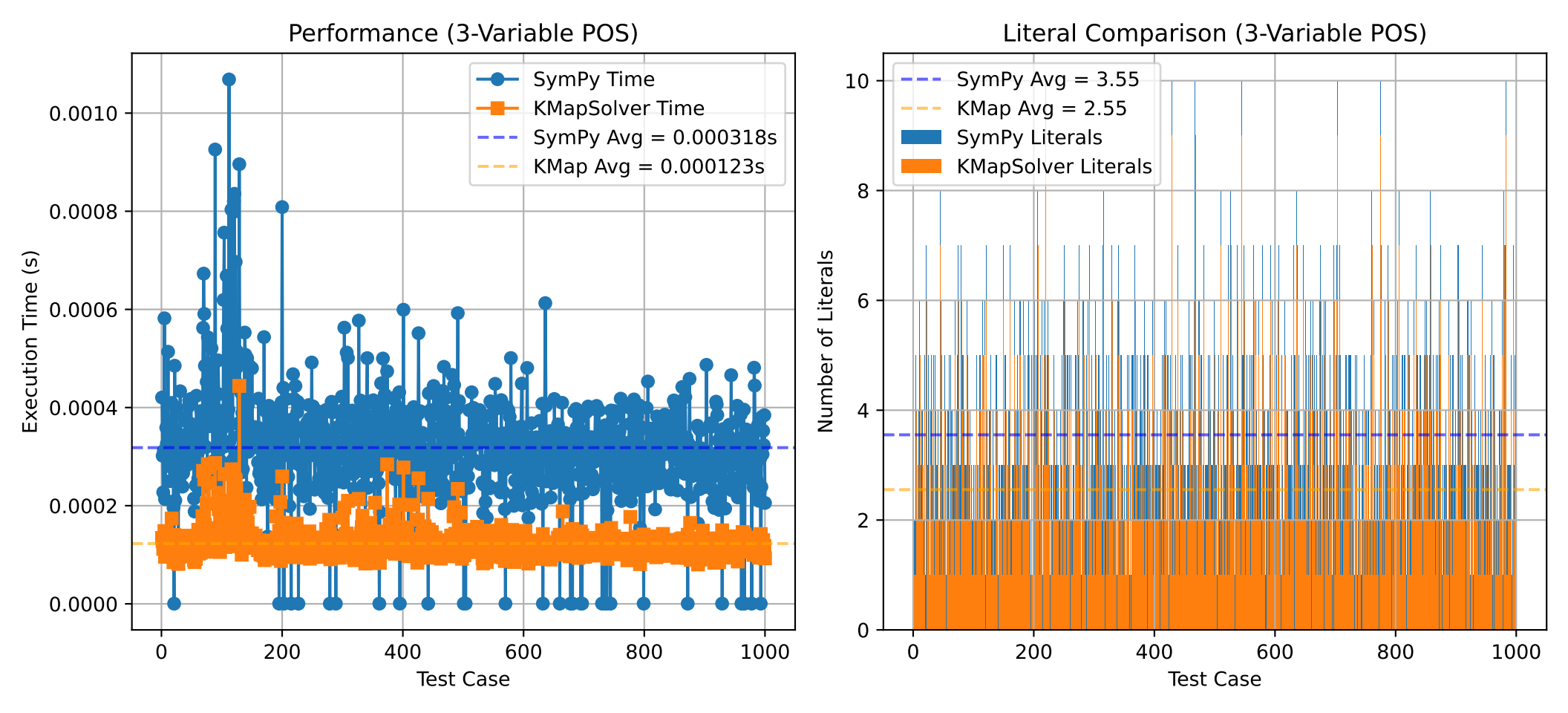
```
  Average SymPy Time:      0.000165 s
  Average KMapSolver Time: 0.000115 s
  Difference:              -0.000050 s (-30.43%)
  Std. Dev (ΔTime):        0.000062 s
  Deviation Ratio:         0.376
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

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 = 0.000318s
KMap Avg = 0.000123s
Execution Time (s)
0.0000
0.0002
0.0004
0.0006
0.0008
0.0010
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

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

INFERENCE SUMMARY

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

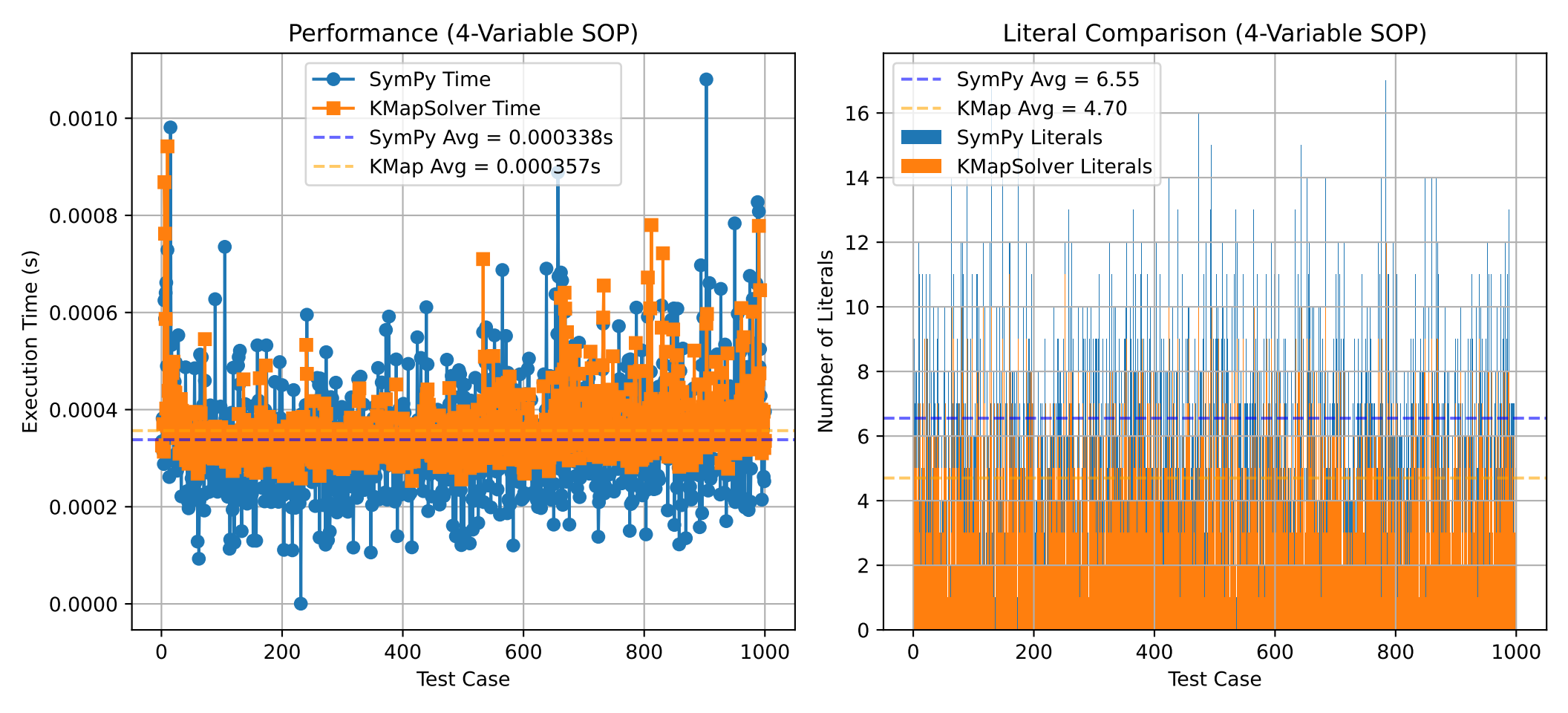
```
  Average SymPy Time:      0.000318 s
  Average KMapSolver Time: 0.000123 s
  Difference:              -0.000195 s (-61.42%)
  Std. Dev (ΔTime):        0.000095 s
  Deviation Ratio:         0.297
  → KMapSolver is faster than SymPy on average.
  → Execution times are stable and consistent.
```

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 = 0.000338s
KMap Avg = 0.000357s
Execution Time (s)
0.0000
0.0002
0.0004
0.0006
0.0008
0.0010
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:      0.000338 s
  Average KMapSolver Time: 0.000357 s
  Difference:              +0.000019 s (+5.54%)
  Std. Dev (ΔTime):        0.000102 s
  Deviation Ratio:         0.300
  → 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.
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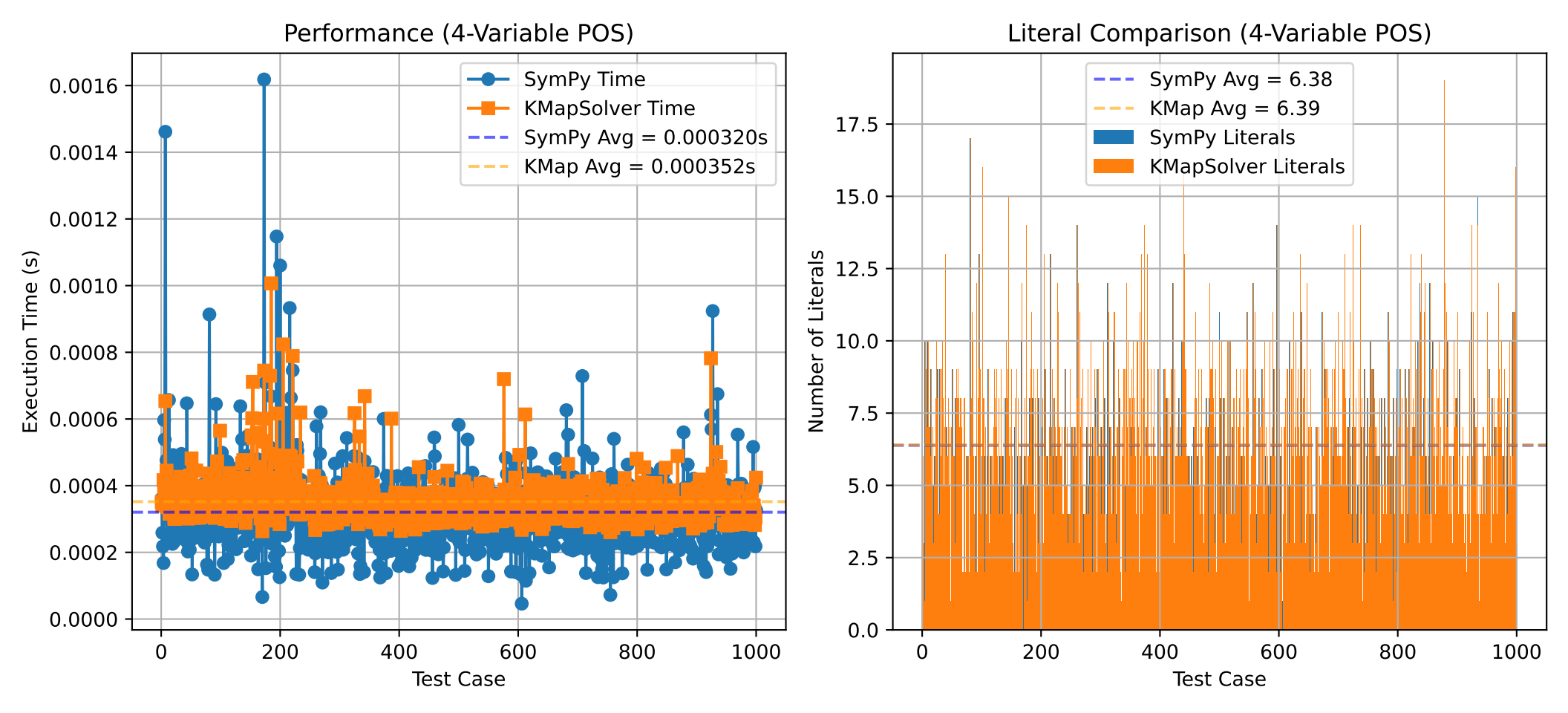
```


Performance (4-Variable POS)
SymPy Time
KMapSolver Time
SymPy Avg = 0.000320s
KMap Avg = 0.000352s
Execution Time (s)
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
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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================================================================================
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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
  Average SymPy Time:      0.000320 s
  Average KMapSolver Time: 0.000352 s
  Difference:              +0.000032 s (+9.89%)
  Std. Dev (ΔTime):        0.000101 s
  Deviation Ratio:         0.315
  → Both algorithms exhibit nearly identical runtimes.
  → 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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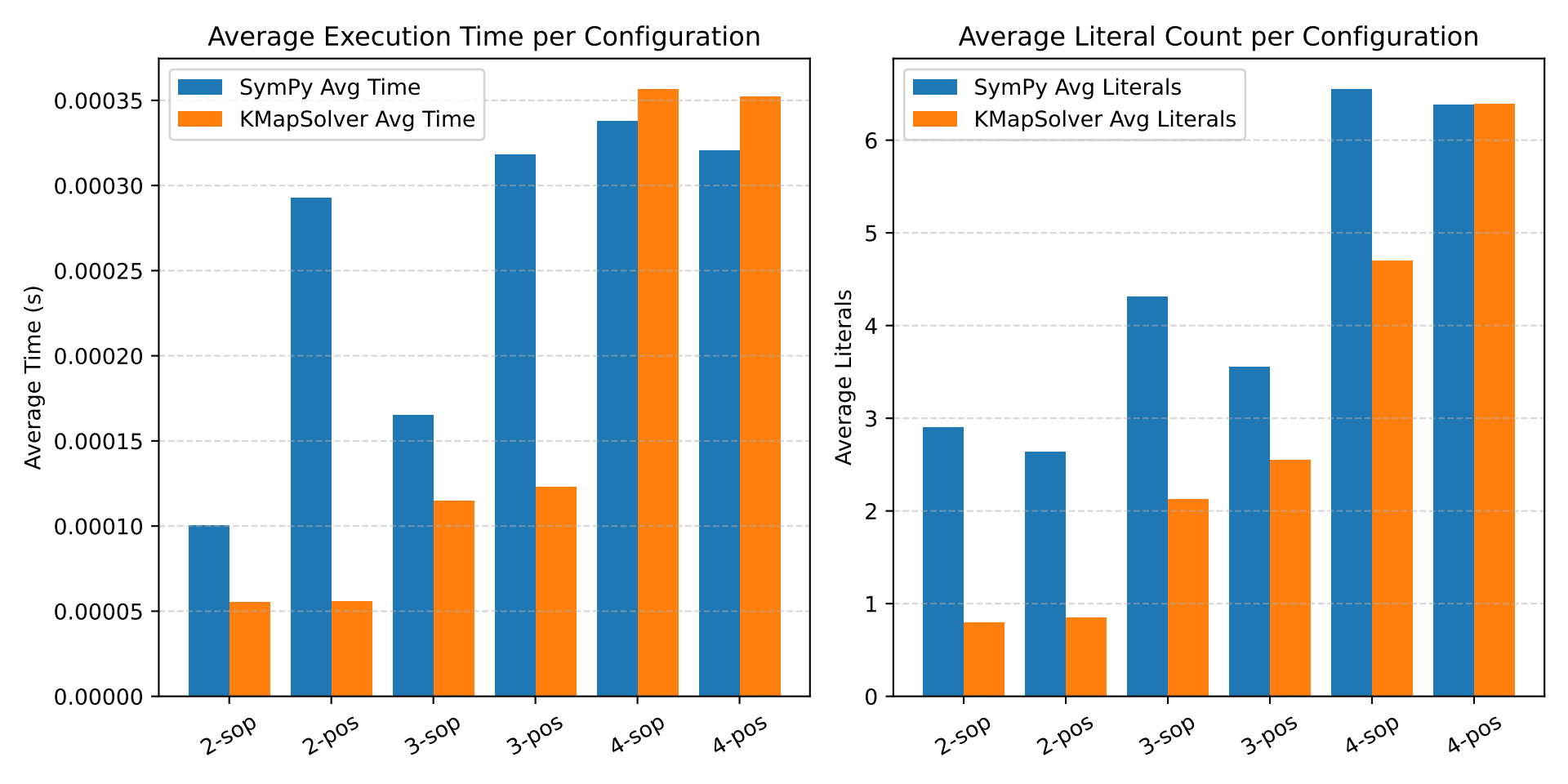
Average Execution Time per Configuration
SymPy Avg Time
KMapSolver Avg Time
Average Time (s)
0.00000
0.00005
0.00010
0.00015
0.00020
0.00025
0.00030
0.00035
2-sop
2-pos
3-sop
3-pos
4-sop
4-pos
Average Literal Count per Configuration
SymPy Avg Literals
KMapSolver Avg Literals
Average Literals
0
1
2
3
4
5
6
2-sop
2-pos
3-sop
3-pos
4-sop
4-pos

OVERALL INFERENCE REPORT

Generated on October 30, 2025

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
  Average SymPy Time:      0.000256 s
  Average KMapSolver Time: 0.000176 s
  Difference:              -0.000080 s (-31.08%)
  Std. Dev (ΔTime):        0.000112 s
  Deviation Ratio:         0.436
  → 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.
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```