Stan's Technologies

Inference Report

Performance and Simplification Benchmark between SymPy and StanLogic

Performance (2-Variable SOP)

- SymPy Time
- KMapSolver Time
- SymPy Avg = 0.000094s
- KMap Avg = 0.000076s

Literal Comparison (2-Variable SOP)

- SymPy Avg = 1.40
- KMap Avg = 1.21
- SymPy Literals
- KMapSolver Literals

INFERENCE: 2-Variable SOP

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
Average SymPy Time:      0.000094 s
Average KMapSolver Time: 0.000076 s
Difference:              -0.000018 s (-19.23%)
Std. Dev (ΔTime):        0.000052 s
Deviation Ratio:         0.556
→ KMapSolver is faster than SymPy on average.
→ Execution times are stable and consistent.
```
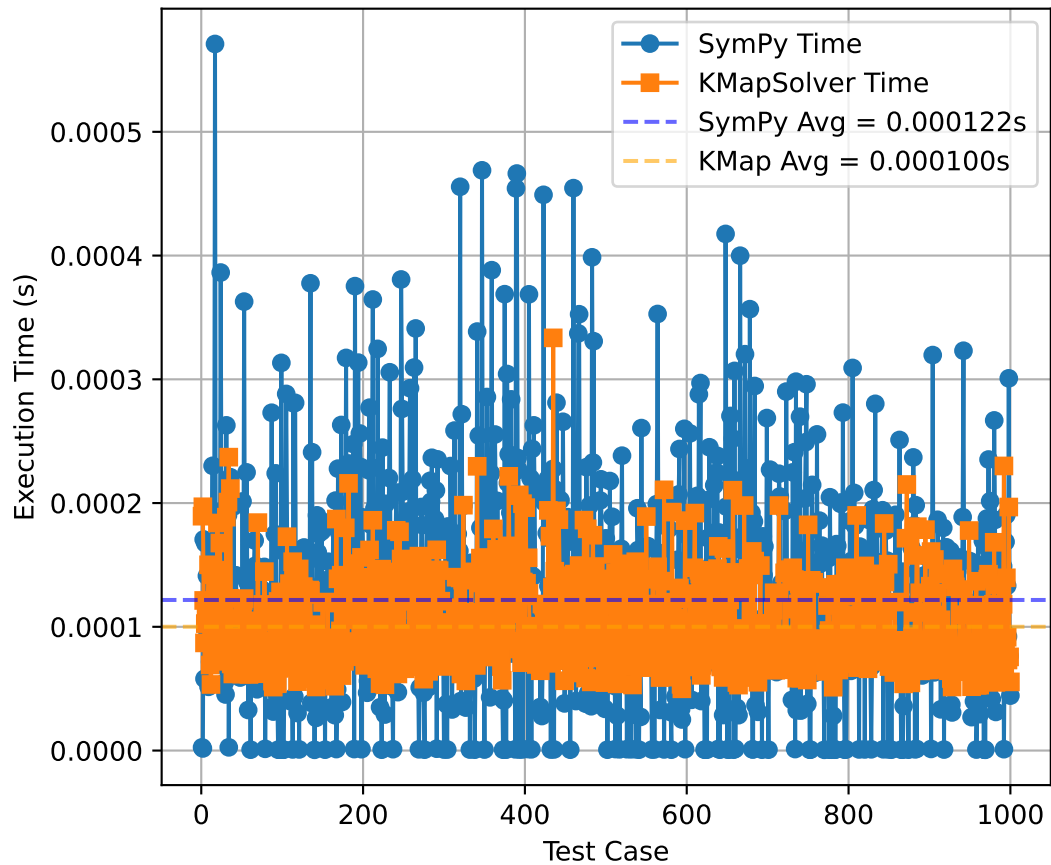
LITERAL COUNT ANALYSIS

```
Average SymPy Literals:  1.40
Average KMap Literals:   1.21
Difference:              -0.18 (-13.3%)
Std. Dev (ΔLiterals):    0.39
Deviation Ratio:         0.278
→ KMapSolver produces more minimal logical forms (fewer literals).
→ Literal simplifications are consistent.
```
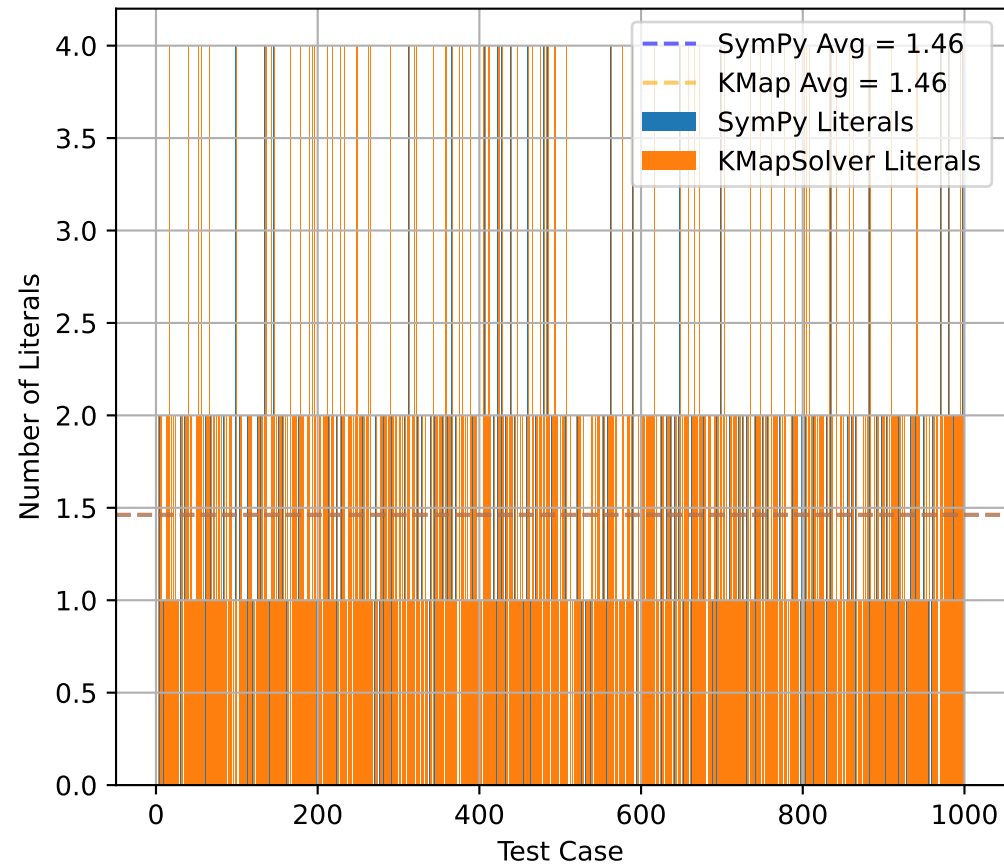
OVERALL VERDICT

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

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Performance (2-Variable POS) and **Literal Comparison (2-Variable POS)**

Performance (left): Execution Time (s) vs Test Case
- SymPy Time
- KMapSolver Time
- SymPy Avg = 0.000122s
- KMap Avg = 0.000100s

Literal Comparison (right): Number of Literals vs Test Case
- SymPy Avg = 1.46
- KMap Avg = 1.46
- SymPy Literals
- KMapSolver Literals

INFERENCE: 2-Variable POS

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
Average SymPy Time:      0.000122 s
Average KMapSolver Time: 0.000100 s
Difference:              -0.000022 s (-17.79%)
Std. Dev (ΔTime):        0.000082 s
Deviation Ratio:         0.671
→ KMapSolver is faster than SymPy on average.
→ Execution times are stable and consistent.
```
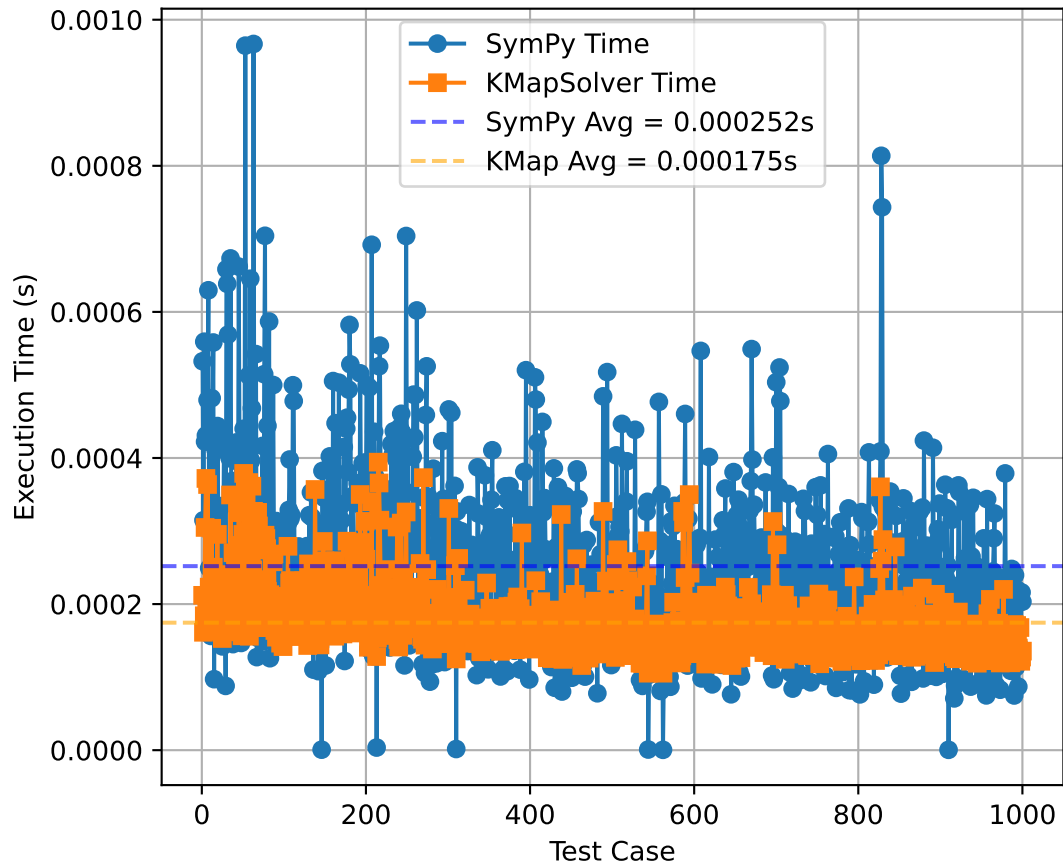
LITERAL COUNT ANALYSIS

```
Average SymPy Literals:  1.46
Average KMap Literals:   1.46
Difference:              +0.00 (+0.0%)
Std. Dev (ΔLiterals):    0.00
Deviation Ratio:         0.000
→ Both solvers yield nearly identical simplifications.
→ Literal simplifications are consistent.
```
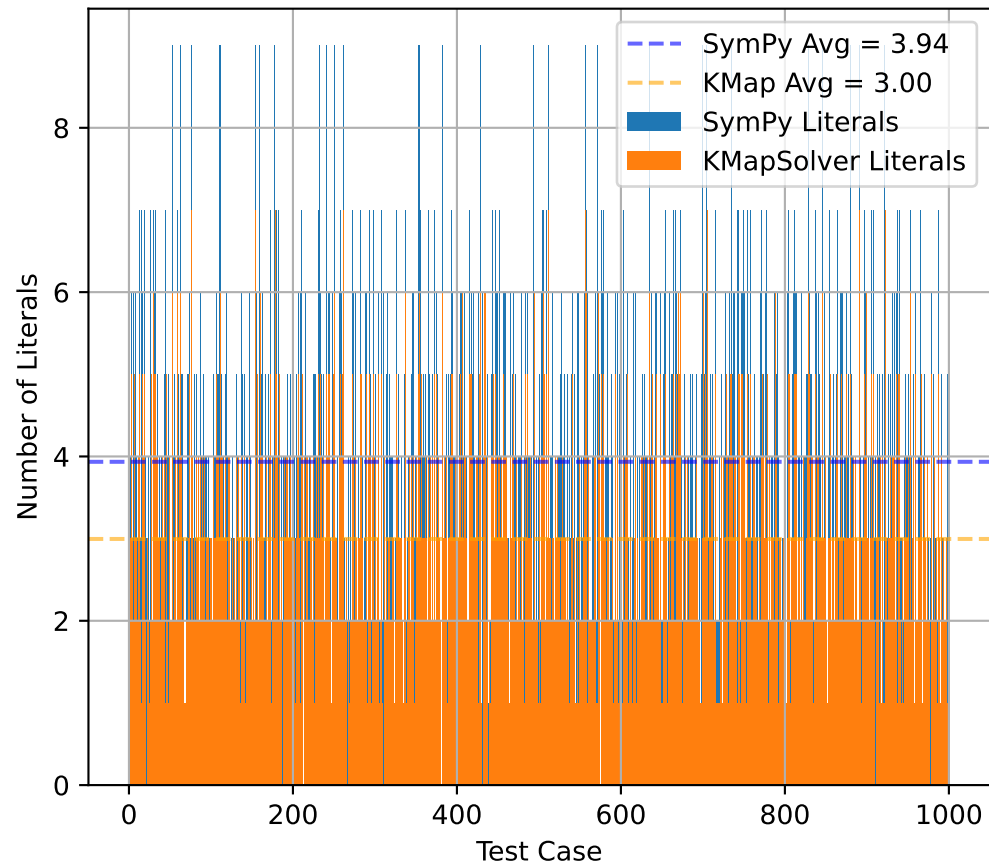
OVERALL VERDICT

    ⬡ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.

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Performance (3-Variable SOP)

- SymPy Time
- KMapSolver Time
- SymPy Avg = 0.000252s
- KMap Avg = 0.000175s

Literal Comparison (3-Variable SOP)

- SymPy Avg = 3.94
- KMap Avg = 3.00
- SymPy Literals
- KMapSolver Literals

INFERENCE: 3-Variable SOP

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
Average SymPy Time:     0.000252 s
Average KMapSolver Time: 0.000175 s
Difference:             -0.000077 s (-30.72%)
Std. Dev (ΔTime):       0.000103 s
Deviation Ratio:        0.410
→ KMapSolver is faster than SymPy on average.
→ Execution times are stable and consistent.
```
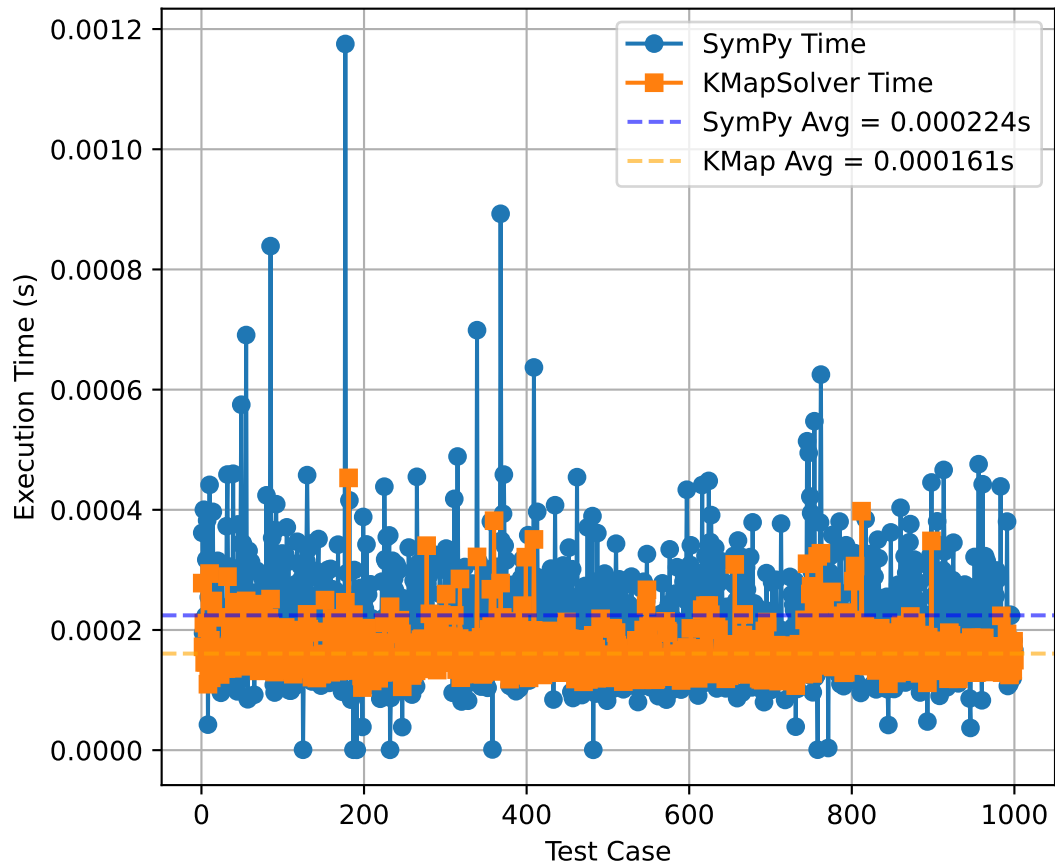
LITERAL COUNT ANALYSIS

```
Average SymPy Literals:  3.94
Average KMap Literals:   3.00
Difference:              -0.94 (-23.9%)
Std. Dev (ΔLiterals):    0.86
Deviation Ratio:         0.219
→ KMapSolver produces more minimal logical forms (fewer literals).
→ Literal simplifications are consistent.
```
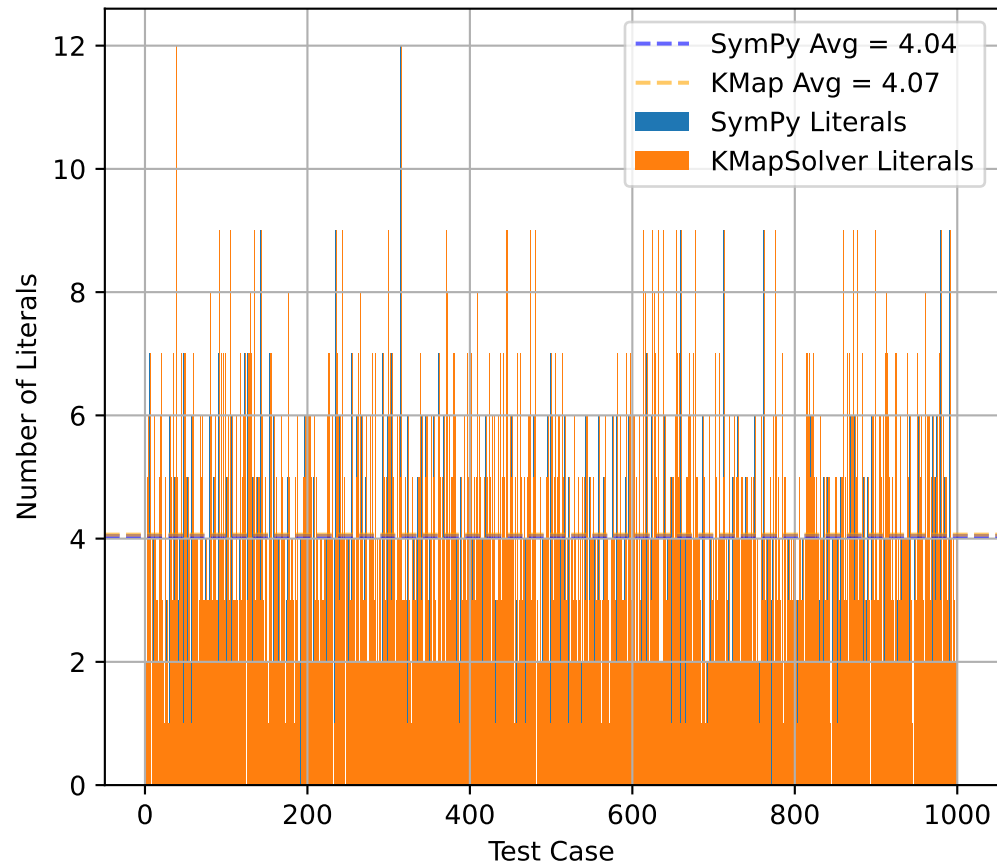
OVERALL VERDICT
    ⬛ KMapSolver achieves comparable or superior simplification efficiency with minimal
time overhead.

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Performance (3-Variable POS) — **Literal Comparison (3-Variable POS)**

Left plot (Performance): X-axis "Test Case", Y-axis "Execution Time (s)". Legend: SymPy Time; KMapSolver Time; SymPy Avg = 0.000224s; KMap Avg = 0.000161s.

Right plot (Literal Comparison): X-axis "Test Case", Y-axis "Number of Literals". Legend: SymPy Avg = 4.04; KMap Avg = 4.07; SymPy Literals; KMapSolver Literals.

INFERENCE: 3-Variable POS

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
Average SymPy Time:      0.000224 s
Average KMapSolver Time: 0.000161 s
Difference:              -0.000064 s (-28.36%)
Std. Dev (ΔTime):        0.000090 s
Deviation Ratio:         0.400
→ KMapSolver is faster than SymPy on average.
→ Execution times are stable and consistent.
```
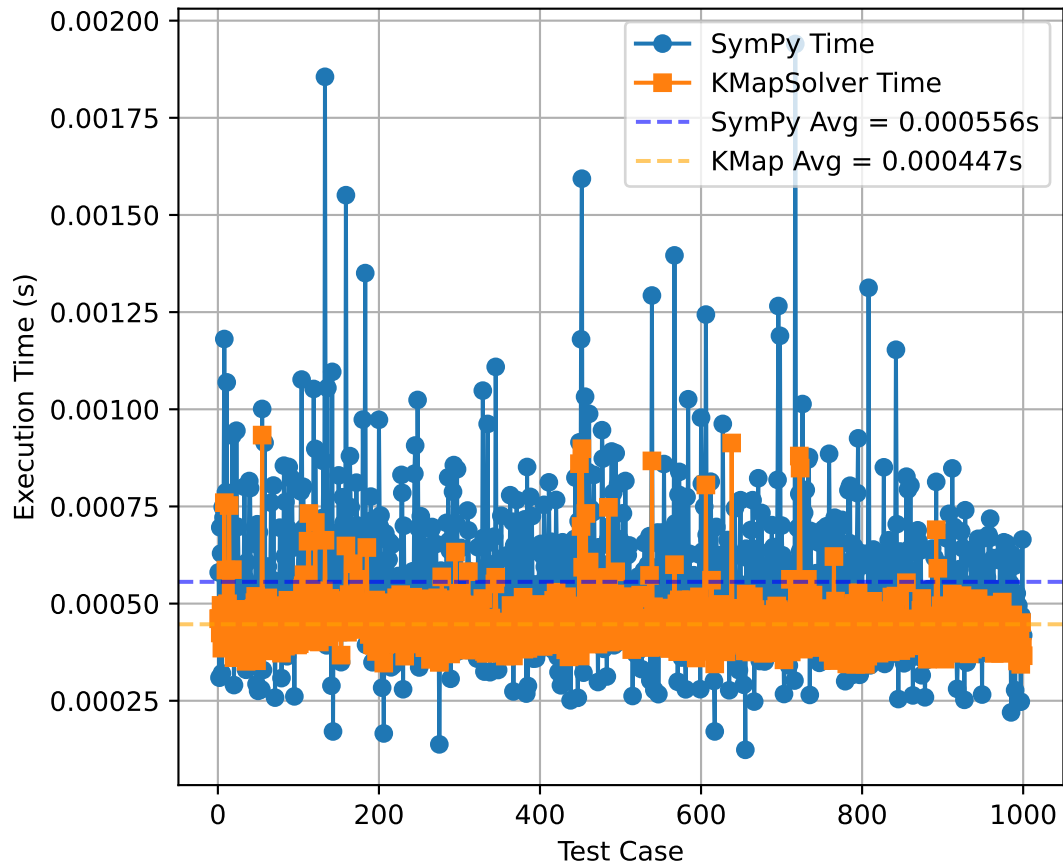
LITERAL COUNT ANALYSIS

```
Average SymPy Literals:  4.04
Average KMap Literals:    4.07
Difference:              +0.02 (+0.5%)
Std. Dev (ΔLiterals):     0.21
Deviation Ratio:         0.052
→ Both solvers yield nearly identical simplifications.
→ Literal simplifications are consistent.
```
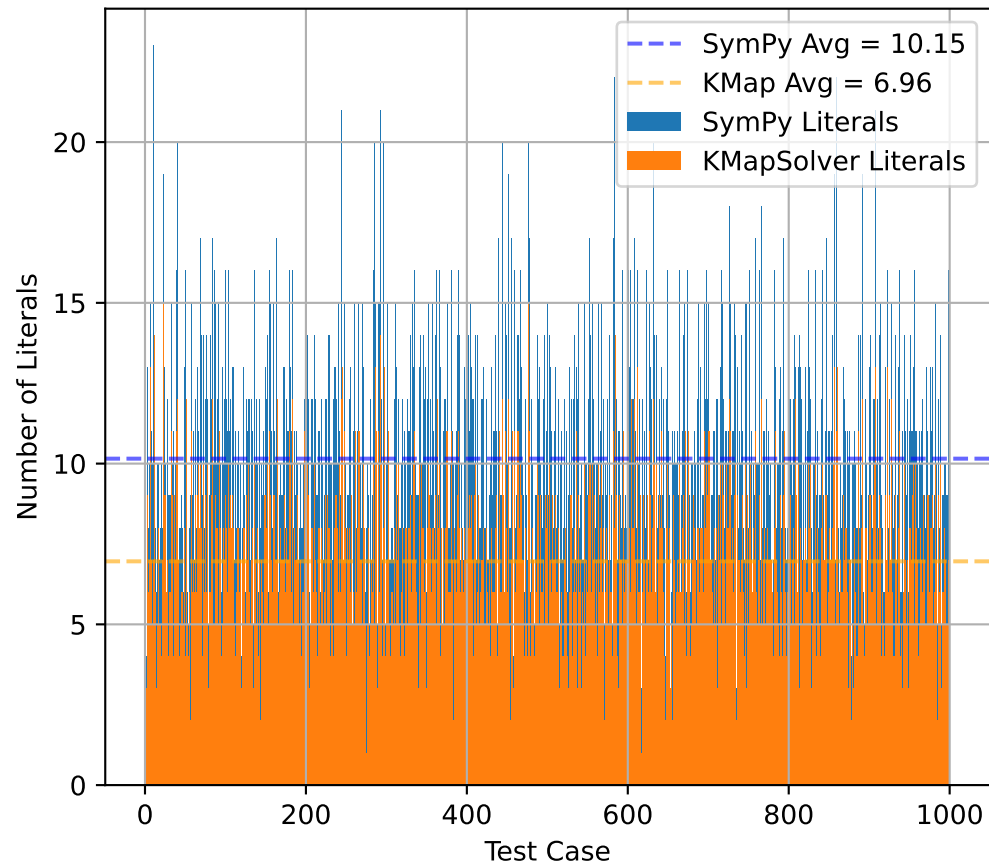
OVERALL VERDICT

```
  KMapSolver outperforms SymPy in runtime while maintaining correctness.
```

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Performance (4-Variable SOP)

- SymPy Time
- KMapSolver Time
- SymPy Avg = 0.000556s
- KMap Avg = 0.000447s

Literal Comparison (4-Variable SOP)

- SymPy Avg = 10.15
- KMap Avg = 6.96
- SymPy Literals
- KMapSolver Literals

INFERENCE: 4-Variable SOP

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
Average SymPy Time:      0.000556 s
Average KMapSolver Time: 0.000447 s
Difference:              -0.000109 s (-19.64%)
Std. Dev (ΔTime):        0.000169 s
Deviation Ratio:         0.304
→ KMapSolver is faster than SymPy on average.
→ Execution times are stable and consistent.
```
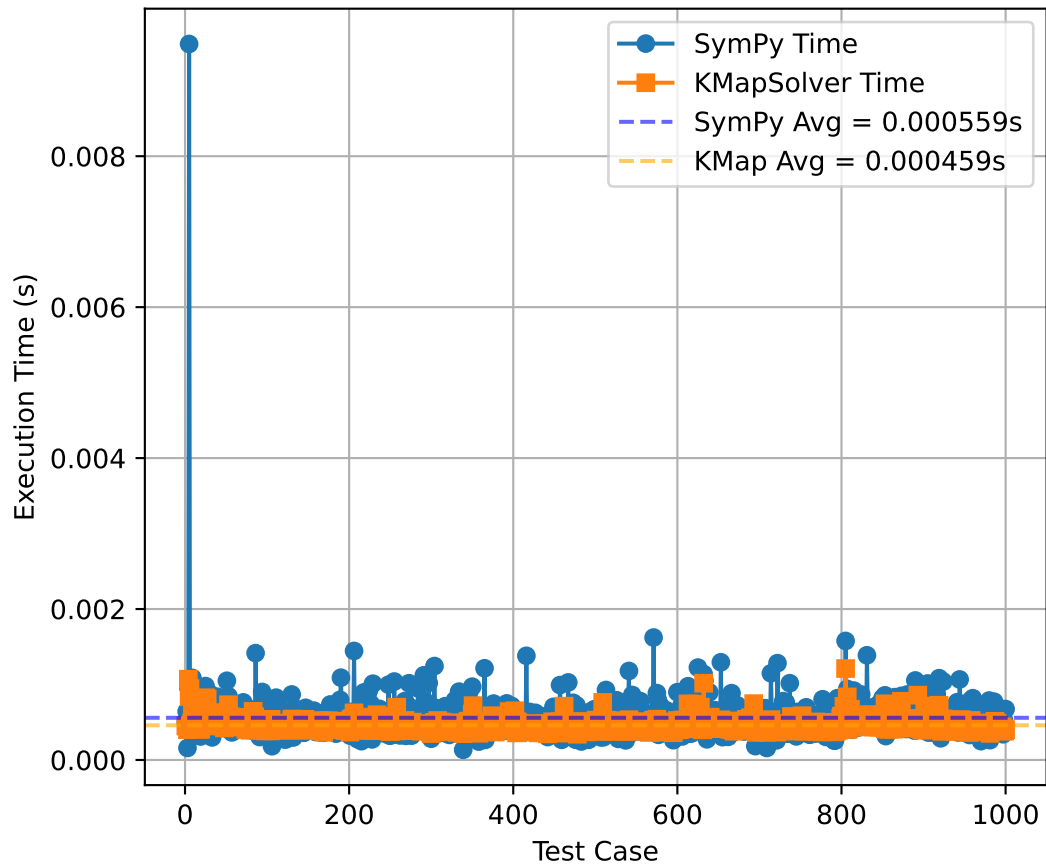
LITERAL COUNT ANALYSIS

```
Average SymPy Literals:  10.15
Average KMap Literals:   6.96
Difference:              -3.19 (-31.5%)
Std. Dev (ΔLiterals):    1.58
Deviation Ratio:         0.156
→ KMapSolver produces more minimal logical forms (fewer literals).
→ Literal simplifications are consistent.
```
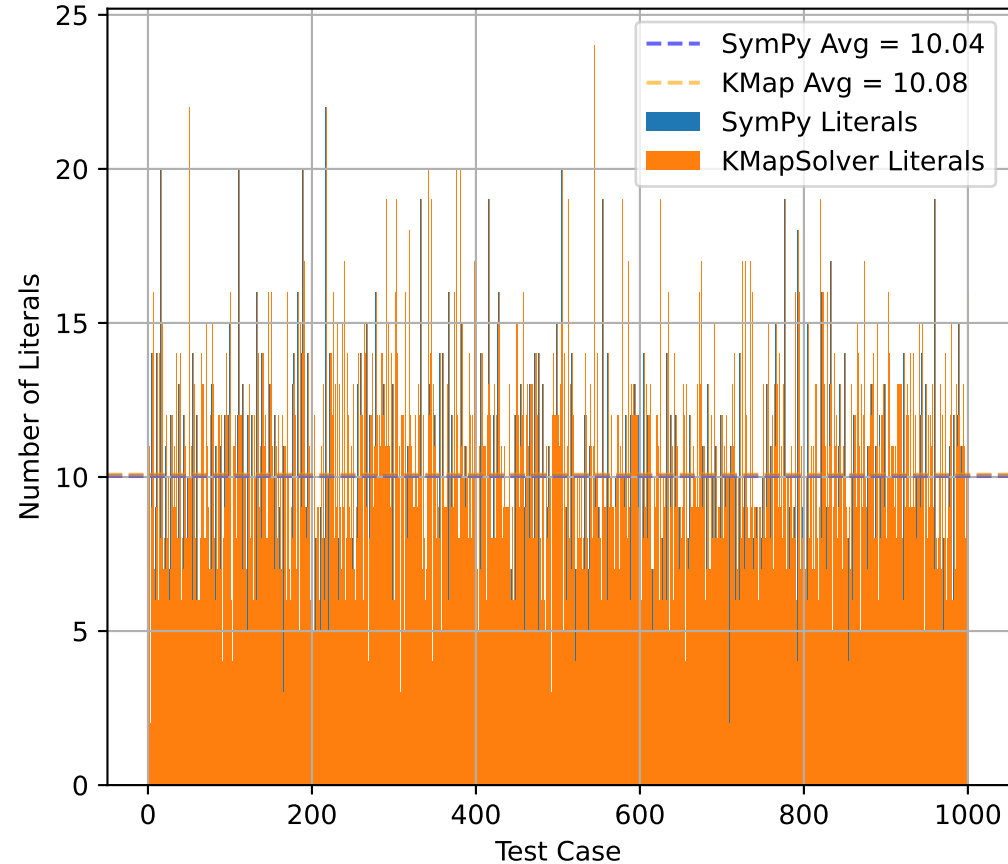
OVERALL VERDICT

  ⬛ 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 = 0.000559s
- KMap Avg = 0.000459s

Literal Comparison (4-Variable POS)

- SymPy Avg = 10.04
- KMap Avg = 10.08
- SymPy Literals
- KMapSolver Literals

INFERENCE: 4-Variable POS

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
Average SymPy Time:      0.000559 s
Average KMapSolver Time: 0.000459 s
Difference:              -0.000099 s (-17.80%)
Std. Dev (ΔTime):        0.000316 s
Deviation Ratio:         0.565
→ KMapSolver is faster than SymPy on average.
→ Execution times are stable and consistent.
```
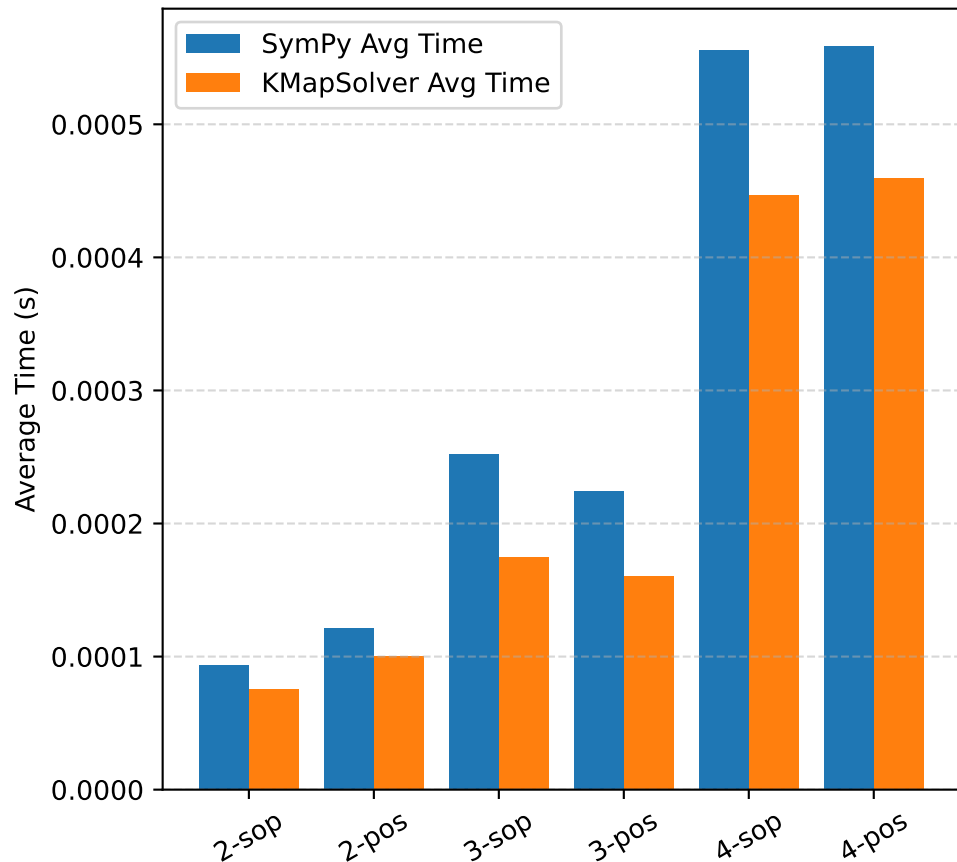
LITERAL COUNT ANALYSIS

```
Average SymPy Literals:  10.04
Average KMap Literals:   10.08
Difference:              +0.03 (+0.3%)
Std. Dev (ΔLiterals):    0.31
Deviation Ratio:         0.031
→ Both solvers yield nearly identical simplifications.
→ Literal simplifications are consistent.
```
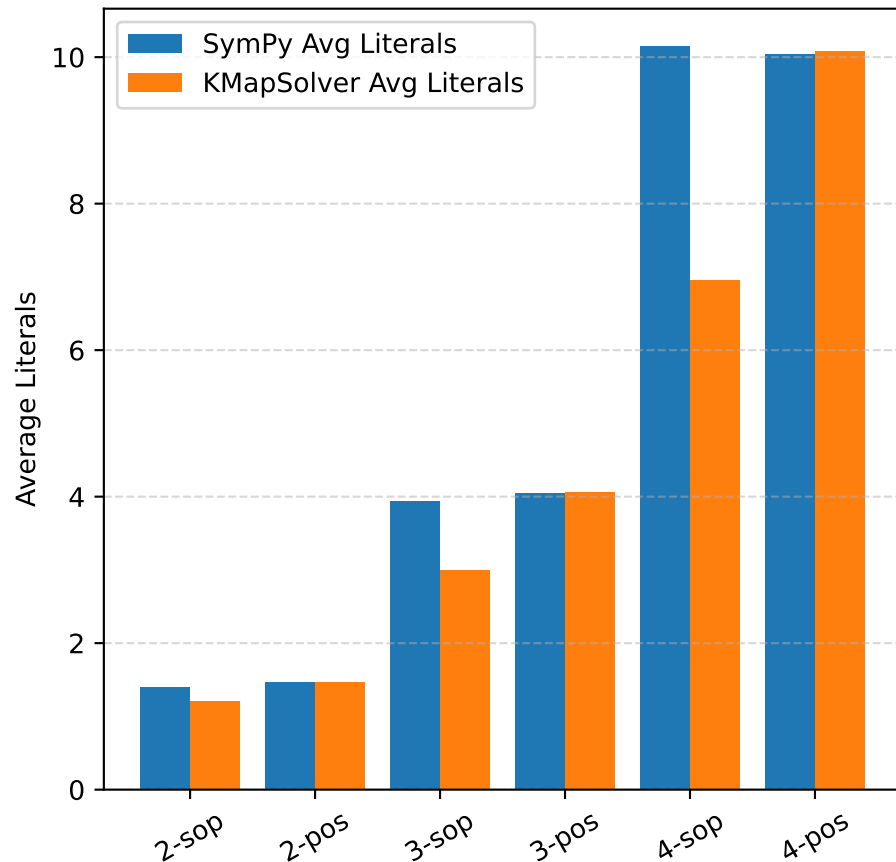
OVERALL VERDICT

```
 KMapSolver outperforms SymPy in runtime while maintaining correctness.
```
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Average Execution Time per Configuration / **Average Literal Count per Configuration**

OVERALL INFERENCE REPORT

Generated on November 12, 2025

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INFERENCE SUMMARY

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EXECUTION TIME ANALYSIS

```
Average SymPy Time:      0.000301 s
Average KMapSolver Time: 0.000236 s
Difference:              -0.000065 s (-21.55%)
Std. Dev (ΔTime):        0.000038 s
Deviation Ratio:         0.128
→ KMapSolver is faster than SymPy on average.
→ Execution times are stable and consistent.
```

LITERAL COUNT ANALYSIS

```
Average SymPy Literals:  5.17
Average KMap Literals:   4.46
Difference:              -0.71 (-13.7%)
Std. Dev (ΔLiterals):    1.27
Deviation Ratio:         0.246
→ 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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