Comparative Performance Analysis: A Benchmark Study of Clingcon vs Multi-Shot

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1 Experimental Setup

All benchmark experiments were conducted on a unified computational platform featuring an Apple M2 Ultra processor to ensure consistent performance measurements and eliminate hardware-related variability.

Each solver instance was subject to a strict time limit of 900 seconds (15 minutes) per execution.

The evaluation encompasses multiple problem categories organized by:

- **Scenarios**: 26eve, 26morn, 26noon, 30eve, 30morn, 30noon, muse.
- **Problem instances**: p01, p02, p03, p04, p05.

Both encodings were evaluated in **optimal search mode** to ensure fair comparison of solution quality rather than satisficing performance.

2 Results and Analysis

Table 1. Comparative Performance Analysis by Scenario

Scenario		**Encoding**	
		clingcon	**multi-shot**
26eve	Instances Solved	1	1
	Avg. Total Counter	130,327,340	22,037,740
26morn	Instances Solved	0	1
	Avg. Total Counter	—	45,344,420
26noon	Instances Solved	0	1
	Avg. Total Counter	—	51,389,280
30eve	Instances Solved	0	0
	Avg. Total Counter	—	—
30morn	Instances Solved	3	3
	Avg. Total Counter	86,648,640	19,398,627
30noon	Instances Solved	0	0
	Avg. Total Counter	—	—
muse	Instances Solved	2	3
	Avg. Total Counter	130,347,550	34,646,000

Table 2. Comparative Performance Analysis by Problem Instance Type

Problem Instance		**Encoding**	
		clingcon	**multi-shot**
p01	Instances Solved	3	2
	Avg. Total Counter	65,307,213	20,782,570
p02	Instances Solved	2	2
	Avg. Total Counter	151,531,950	23,455,400
p03	Instances Solved	1	4
	Avg. Total Counter	151,982,820	41,688,410
p04	Instances Solved	0	1
	Avg. Total Counter	—	25,675,740
p05	Instances Solved	0	0
	Avg. Total Counter	—	—

The experimental results demonstrate that the multi-shot approach consistently achieves superior termination rates across the evaluated problem set.

Despite the superior termination performance, the multi-shot approach exhibits significantly reduced total counter values. This phenomenon can be attributed to the fundamental architectural differences between the approaches:

- **Clingcon**: Employs comprehensive constraint propagation with extended planning horizons, resulting in exhaustive search strategies that yield high-quality solutions at the cost of computational intensity.
- **Multi-shot**: Utilizes bounded incremental solving with restricted temporal windows, enabling rapid convergence through progressive solution refinement.

3 Conclusions

This comparative analysis reveals distinct performance characteristics between clingcon and multi-shot ASP approaches. The multi-shot methodology demonstrates superior practical applicability through higher termination rates, making it more suitable for time-constrained applications. Conversely, the clingcon approach, while exhibiting lower success rates, provides more thorough problem space exploration when computational resources permit.

The results suggest that the choice between these approaches should be guided by specific application requirements: multi-shot for rapid solution generation in resource-constrained environments, and clingcon for comprehensive optimization in scenarios where solution quality is paramount.