

Heuristic Analysis

•Problem 1

Search Strategy	Optimal	Path Length	Execution Time (s)	Node Expansions
Breadth First Search	Yes	6	0.065	43
Breadth First Tree Search	Yes	6	1.357	1458
Depth First Graph Search	No	12	0.019	12
Depth Limited Search	No	50	0.154	101
Uniform Cost Search	Yes	6	0.074	55
Recursive Best First Search	Yes	6	3.956	4229
Greedy Best First Graph Search	Yes	6	0.013	7
A* Search with h1 heuristic	Yes	6	0.077	55
A* Search with Ignore Preconditions heuristic	Yes	6	0.078	41
A* Search with h_pg_level heuristic	Yes	6	2.22	55

•Problem 2

Search Strategy	Optimal	Path Length	Execution Time (s)	Node Expansions
Breadth First Search	Yes	9	34.286	3346
Breadth First Tree Search	--	--	Longer than 10 min	--
Depth First Graph Search	No	1085	19.336	1124
Depth Limited Search	--	--	Longer than 10 min	--
Uniform Cost Search	Yes	9	78.178	4853
Recursive Best First Search	--	--	Longer than 10 min	--
Greedy Best First Graph Search	No	21	3.848	998
A* Search with h1 heuristic	Yes	9	29.946	4853
A* Search with Ignore Preconditions heuristic	Yes	9	8.223	1450

Search Strategy	Optimal	Path Length	Execution Time (s)	Node Expansions
A* Search with h_pg_level heuristic	--	--	Took longer than 10 min	--

•Problem 3

Search Strategy	Optimal	Path Length	Execution Time (s)	Node Expansions
Breadth First Search	Yes	12	391.555	14120
Breadth First Tree Search	--	--	Longer than 10 min	--
Depth First Graph Search	No	2031	119.541	5591
Depth Limited Search	--	--	Longer than 10 min	--
Uniform Cost Search	Yes	12	155.174	18223
Recursive Best First Search	--	--	Longer than 10 min	--
Greedy Best First Graph Search	No	26	45.371	5655
A* Search with h1 heuristic	Yes	12	335.881	18223
A* Search with Ignore Preconditions heuristic	Yes	12	53.26	5040
A* Search with h_pg_level heuristic	--	--	Took longer than 10 min	--

Uninformed Search Strategies:

From the heuristic analysis, Breadth First Search and Uniform Cost Search yield consistent and optimal search plans. Both these strategies require more memory usage though. Hence, if the path length needs to be optimal and is an important factor, then we must use **Breadth First Search**, as it takes lesser time and fewer node expansions on average, compared to the Uniform Cost Search.

If memory usage is a constraint, then the Depth First Graph Search relies on fewer node expansions than other strategies. However it does not yield an optimal search plan.

Informed Search Strategies:

Informed Search strategies take advantage of the fact that they know what a problem already is.

Except for the A* Search with h1 heuristic and A* Search with preconditions ignored heuristic, all other search strategies take longer than 10 minutes. Based on the heuristic results from the mentioned two, A* Search with h1 heuristic seems to be the best, yielding optimal results in shorter time compared to the other strategies.

Which one should be used:

Given a choice between the Breadth First Search, Uniform Cost Search and the A* Search with h1 heuristic, the A* Search with h1 heuristic seems to be the best search strategy for our given problems because it is faster and has less memory overhead.