

AIND Planning – Written Analysis

Overall performance of search algorithms

Non-heuristic search						
Problem	Search Algorithm	Node Expansions	Goal tests	New nodes	Time taken (s)	Plan length
Air_cargo_p1	Breadth-first	43	56	180	0.1199	6
	Depth-first graph	12	13	48	0.03399	12
	Uniform	55	57	224	0.1389	6
Air_cargo_p2	Breadth-first	3346	4612	30534	46.34	9
	Depth-first graph	859	860	7745	14.11	846
	Uniform	4853	4855	4401	58.24	9
Air_cargo_p3	Breadth-first	14120	17673	124926	262.29	12
	Depth-first graph	1401	1402	11649	24.45	1345
	Uniform	18223	18225	159618	253.23	12
Heuristic search						
Air_cargo_p1	AStar with h_1	55	57	224	0.144	6
	AStar with ignore_precondition	41	43	170	0.1163	6
	AStar with level_sum	11	13	50	0.4697	6
Air_cargo_p2	AStar with h_1	4853	4855	44041	57.25	9
	AStar with ignore_precondition	1450	1452	13303	18.07	9
	AStar with level_sum	86	88	841	35.75	9
Air_cargo_p3	AStar with h_1	18223	18225	159618	259.07	12
	AStar with ignore_precondition	5040	5042	44944	80.29	12
	AStar with level_sum	325	327	3002	185.09	12

As a whole, the best heuristic search schemes outperform the best non-heuristic ones, with the level sum heuristic giving the overall best performance, especially in the more complicated search problems. However, the worst performing heuristic search (AStar with h1) performs worse than some of the non-heuristic searches.

For non-heuristic search, we can see that overall, a depth-first search returns us the results very quickly compared to breadth-first or uniform search. This could be due to the fact that going deep down a branch is much faster than expanding the network at each level, as with breadth-first search. However, the overall plan length is extremely long as not always the best move is made.

For heuristic search, we can see that all schemes return the shortest possible plan length. The level sum heuristic explores the least number of nodes compared to all other schemes, suggesting that the estimation is a rather good estimation of the problem. However, it takes a considerable amount of time compared to the ignore preconditions heuristic. The ignore preconditions heuristic, however, explores much more nodes compared to the level sum. This could be due to the fact that we essentially “add” edges to the graphical model, meaning that we need to visit more nodes in order to find the optimal solution.

The best heuristic search is the AStar with level sum heuristic search. It performs much better than the best performing non-heuristic search, the depth-first graph. It also manages to return an optimal plan length. It appears as since each move is independent from each other, the level sum gives a good estimate of the cost to the overall goal. However, in terms of search speed, it is unable to match the depth-first search.