

Air Cargo Problem 1

	Actions	Expansions	Goal Tests	New Nodes	Time in seconds
1. breadth_first_search	20	43	56	178	0.005827443
2. depth_first_graph_search	20	21	22	84	0.003159275
3. uniform_cost_search	20	60	62	240	0.009528
4. greedy_best_first_graph_search h_unmet_goals	20	7	9	29	0.0015071
5. greedy_best_first_graph_search h_pg_levelsum	20	6	8	28	0.26626
6. greedy_best_first_graph_search h_pg_maxlevel	20	6	8	24	0.20033
7. greedy_best_first_graph_search h_pg_setlevel	20	13	15	57	0.766
8. astar_search h_unmet_goals	20	50	52	206	0.0085573
9. astar_search h_pg_levelsum	20	28	30	122	0.7279
10. astar_search h_pg_maxlevel	20	43	45	180	0.90604
11. astar_search h_pg_setlevel	20	42	44	176	1.354

Air Cargo Problem 2

	Actions	Expansions	Goal Tests	New Nodes	Time in seconds
1. breadth_first_search	72	3343	4609	30503	1.987757248
2. depth_first_graph_search	72	624	625	5602	3.023512541
3. uniform_cost_search	72	5154	5156	46618	3.792971976
4. greedy_best_first_graph_search h_unmet_goals	72	17	19	170	0.020731999
5. greedy_best_first_graph_search h_pg_levelsum	72	9	11	86	6.242
6. greedy_best_first_graph_search h_pg_maxlevel	72	27	29	249	11.8262
7. greedy_best_first_graph_search h_pg_setlevel	72	35	37	321	43.0966
8. astar_search h_unmet_goals	72	2467	2469	22522	2.0845
9. astar_search h_pg_levelsum	72	357	359	3426	134.014
10. astar_search h_pg_maxlevel	72	2887	2889	26594	793.6871
11. astar_search h_pg_setlevel	72	2671	2673	24523	3284.019

Air Cargo Problem 3

	Actions	Expansions	Goal Tests	New Nodes	Time in seconds
1. breadth_first_search	88	14663	18098	129625	10.30908298
2. depth_first_graph_search	88	408	409	3364	1.131990062
3. uniform_cost_search	88	18510	18512	161936	13.6004154
4. greedy_best_first_graph_search h_unmet_goals	88	25	27	230	0.03348393
5. greedy_best_first_graph_search h_pg_levelsum	88	14	16	126	11.433
6. greedy_best_first_graph_search h_pg_maxlevel	88	21	23	195	14.051
7. greedy_best_first_graph_search h_pg_setlevel	88	68	70	722	175.781
8. astar_search h_unmet_goals	88	7388	7390	65711	8.011880796
9. astar_search h_pg_levelsum	88	369	371	3403	233.958
10. astar_search h_pg_maxlevel	88	9580	9582	86312	4331.2338
11. astar_search h_pg_setlevel	88	10176	10178	90844	14142.456

Air Cargo Problem 4

	Actions	Expansions	Goal Tests	New Nodes	Time in seconds
1. breadth_first_search	104	99736	114953	944130	80.272
2. depth_first_graph_search	104	25174	25175	228849	3174.356
3. uniform_cost_search	104	113339	113341	1066413	109.385
4. greedy_best_first_graph_search h_unmet_goals	104	29	31	280	0.0601
5. greedy_best_first_graph_search h_pg_levelsum	104	17	19	165	25.516

6. greedy_best_first_graph_search h_pg_maxlevel	104	56	58	580	59.767
7. greedy_best_first_graph_search h_pg_setlevel	104	1283	1285	13475	4083.48
8. astar_search h_unmet_goals	104	34330	34332	328509	54.491
9. astar_search h_pg_levelsum	104	1208	1210	12210	1353.763
10. astar_search h_pg_maxlevel	104	62077	62079	599376	47,886
11. astar_search h_pg_setlevel					

Use a table or chart to analyze the number of nodes expanded against number of actions in the domain

The chart shows that for number of actions depth_first graph has less number of nodes expanded than the other uninformed search algorithms for all the air cargo problems. The number of nodes expanded increases significantly as the number of actions increases. The numbers of expanded nodes for the greedy algorithms are almost the same and are less than both the uninformed search as well as astar search.

Use a table or chart to analyze the search time against the number of actions in the domain

The chart shows that for a small number of action (20),depth_first graph takes less time than other two uninformed searches. However, as the actions increases it takes longer to run the search. greedy_best_first_graph_search h_unmet_goals is the quickest to execute in all four air cargo problems. The amount of search time increases significantly as the number of actions increases.

Use a table or chart to analyze the length of the plans returned by each algorithm on all search problems

The chart shows that for number of actions depth_first graph has less number of nodes expanded than the other uninformed search algorithms for all the air cargo problems. The number of new nodes increases significantly as the number of actions increases. The numbers of new nodes for the greedy algorithms are less than the other algorithms.

Which algorithm or algorithms would be most appropriate for planning in a very restricted domain (i.e., one that has only a few actions) and needs to operate in real time?

Breadth First Search, Depth First Graph, Uniform cost search and Greedy best first graph search with unmet goals will be good algorithms because they take the least time to run.

Which algorithm or algorithms would be most appropriate for planning in very large domains (e.g., planning delivery routes for all UPS drivers in the U.S. on a given day)

Astar and Greedy_best_search with the heuristic suitable for the domain will be the appropriate algorithms.

Which algorithm or algorithms would be most appropriate for planning problems where it is important to find only optimal plans?

Breadth First Search, Depth First Graph, Uniform cost search are appropriate to implement when the state space is finite. For searching in a space of partial plans, astar is appropriate.