CLASSICAL SEARCH – A REPORT

TABLE 1. Actions, plan length, new node expansions and time taken by problems 1 & 2.

Search type	Heuristics	Actions in the domain/Plan length		New node expansions		Time taken in seconds.	
		Problem 1	Problem 2	Problem 1	Problem 2	Problem 1	Problem 2
Breadth first search	NA	20/6	72/9	43	3343	0.02788	0.475575
Depth first graph search	NA	20/20	72/619	21	624	0.00732	0.72637
Uniform cost search	NA	20/6	72/9	60	5154	0.0225	0.753
Greedy best first graph search	Unmet goals	20/6	72/9	7	17	0.0027838	0.0131
Greedy best first graph search	Levelsum	20/6	72/9	6	9	0.5673237	0.90786
Greedy best first graph search	Maxlevel	20/6	72/9	6	27	0.19	1.8068
Greedy best first graph search	Setlevel	20/6	72/9	6	9	0.7354877	8.9
A-star search	Unmet goals	20/6	72/9	50	2467	0.0172451	1.90
A-star search	Levelsum	20/6	72/9	28	357	0.27277	45.05
A-star search	Maxlevel	20/6	72/9	43	2887	0.28	268.3467
A-star search	Setlevel	20/6	72/9	33	1037	0.67867	440.607

UNINFORMED SEARCH

The depth first graph search where the nodes are expanded to the deepest level of the search tree has the least new node expansions against the number of actions in the domain. It might not be optimal for complex ones with its increased plan length.

The breadth first graph search where the nodes are expanded at a given depth at a time has more new node expansions against the number of actions in the domain. It seems a better alternative for complex problems requiring less time to any other uninformed search.

The uniform cost search is similar to the breadth first search when all path costs are equal. It might be useful when the path cost of each cost is variable. In the four air cargo problems, if the cost of moving from between airports is variable then the uniform cost search will give the

In the current case the breadth first graph search seems the optimal uninformed search in terms of plan length, time and number of nodes expanded.

INFORMED SEARCH

All the informed searches give the same plan length for the problems 1 & 2.

- Greedy best first graph search

The greedy best first graph search with unmet goals heuristics shows the best performance in terms of time taken for problems 1 & 2 which is validated while running it for problem 3 & 4.

The levelsum heuristics give about similar performance for the greedy best first graph search for the four problems with levelsum being slightly better.

The performance of the greedy best first graph search with setlevel heuristics is the least optimal, especially in the case of complex problems.

- A* search

The A* search with unmet goals heuristics shows the best performance for A* in terms of time taken for problems 1 & 2 which is validated while running it for problem 3 & 4.

The levelsum heuristics result in better performance for the A* search for the four problems then the maxlevel and setlevel heuristics.

The maxlevel heuristic causes longer runtime for A* search than greedy best first graph search.

The performance of the A* search with setlevel heuristics is the least optimal, especially in the case of complex problems, which result in longer runtimes. (Tried running it but it is still running after around 4+ hours)

- 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?

  - Greedy best first graph search with unmet goals.

- 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)

  - Greedy best first graph search with unmet goals.

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

  - Greedy best first graph search with unmet goals.

TABLE 1. Actions, plan length, new node expansions and time taken by problems 3 & 4.

Search type	Heuristics	Actions in the domain/Plan Length		New node expansions		Time taken in seconds.	
		Problem 3	Problem 4	Problem 3	Problem 4	Problem 3	Problem 4
Breadth first search	NA	88/12	104/14	14663	99736	1.99	6.11
Depth first graph search	NA	88/392	104/ 24132	408	25174	0.594	1168.01
Uniform cost search	NA	88/12	104/14	18510	113339	3.268	10.494
Greedy best first graph search	Unmet goals	88/15	104/18	25	29	0.0184	0.0479
Greedy best first graph search	Levelsum	88/14	104/17	14	17	5.466	4.9673
Greedy best first graph search	Maxlevel	88/13	104/17	21	56	3.95	8.187
Greedy best first graph search	Setlevel	88/17	104/23	35	107	29.94	63.1
A-star search	Unmet goals	88/12	104/14	7388	34330	3.455	6.1885
A-star search	Levelsum	88/12	104/15	369	1208	75.87	194.76
A-star search	Maxlevel	88/12	104/14	9580	62077	1348.88	8169.44
A-star search	Setlevel	88/12	XX/XX	3423	XX	1718.15	XX