Planning

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Planning Heuristic Analysis

The current analysis shows the results obtained on the air cargo problems using uninformed and heuristic based search. The goal on each algorithm is to search the lowest path among all possible combinations to get the final state or goal.

The following tables shows the results of each search algorithm with the optimal plan.

Search	Expansions	Goal Tests	New Nodes	Plan Length	Time	Optimal Plan
Breadth First Search	43	56	180	6	0.0304	
Depth First Graph Search	12	13	48	12	0.0076	
Depth Limited Search	101	271	414	50	0.0946	
Uniform Cost Search	55	57	224	6	0.0361	
Recursive Best First Search with h_1	4229	4230	17029	6	2.9249	
A* Search h_1	55	57	224	6	0.0398	
A* Search h_ignore_preconditions	41	43	170	6	0.0363	
A* Search h_pg_levelsum	11	13	50	6	1.0072	Load(C2, P2, JFK) Load(C1,P1,SFO) Fly(P2, JFK, SFO) Unload(C2,P2,SFO) Fly(P1,SFO, JFK) Unload(C1,P1,JFK)

Air Cargo Problem 1

Search	Expansions	Goal Tests	New Nodes	Plan Length	Time	Optimal Plan
Breadth First Search	3343	4609	30509	9	23.131	
Depth First Graph Search	582	583	5211	517	6.0667	
Depth Limited Search	---	----	----	----	------	
Uniform Cost Search	4761	4763	43206	9	27.640	
Recursive Best First Search with h_1	----	-----	--------	-------	> 10min	
A* Search h_1	4761	4763	43206	9	20.489	
A* Search h_ignore_preconditions	1450	1452	13303	9	9.7388	Load(C3, P3, ATL) Fly(P3, ATL, SFO) Unload(C3, P3, SFO) Load(C2, P2, JFK) Fly(P2, JFK, SFO) Unload(C2, P2, SFO) Load(C1, P1, SFO) Fly(P1, SFO, JFK) Unload(C1, P1, JFK)
A* Search h_pg_levelsum	86	88	841	9	338.61	

Air Cargo Problem 2

Search	Expansions	Goal Tests	New Nodes	Plan Length	Time	Optimal Plan
Breadth First Search	14663	18098	129631	12	217.24	
Depth First Graph Search	627	628	5176	596	7.9497	
Depth Limited Search	--------	---------	----------	------	--------	
Uniform Cost Search	17783	17785	155920	12	95.160	
Recursive Best First Search with h_1	--------	--------	----------	--------	---------	
A* Search h_1	17783	17785	155920	12	105.22	
A* Search h_ignore_preconditions	5003	5005	44586	12	35.409	Load(C2, P2, JFK) Fly(P2, JFK, ORD) Load(C4, P2, ORD) Fly(P2, ORD, SFO) Unload(C4, P2, SFO) Load(C1, P1, SFO) Fly(P1, SFO, ATL) Load(C3, P1, ATL) Fly(P1, ATL, JFK) Unload(C3, P1, JFK) Unload(C2, P2, SFO) Unload(C1, P1, JFK)
A* Search h_pg_levelsum	311	313	2863	12	1831.25	

Air Cargo Problem 3

Analysis

Uninformed Search Strategies: These strategies due to not take into account the location of the goal and also because they don't have additional information about the states cannot be the best option to search into large problems with a huge amount of states. On the air cargo problem we release that most of the strategies demand a lot execution time and also memory; like Depth First Search, which on large problems this search method doesn't get the goal state with an optimal time. The best method that we release on this category was the Breadth First Search.

Heuristic Based Search Strategies: These strategies due to the search has knowledge of the problem itself, can find the path to the goal in an efficiently way, even if the problem has a huge amount of states this algorithms doesn't present the same problems as uninformed search. On the air cargo problem we release that A* search ignore preconditions had the best performance in the problem 2 and 3.

Conclusions

Accordly with the results of the three problems, it's clear the benefits of using heuristic based search strategies, due to we have a knowledge base to get a better decision making with the agent. The performance is even better and also these strategies can handle with large amount of states to search the goal without too much memory consumption and in less time that an uninformed strategy, even though the Breadth First Search can be also a good solution, but instead of using it, this method can be easily supplied by A* search ignore preconditions which gave us a better performance.