Breadth first search returned accurate results but seemed to not scale very well with more complicated problems as problem 2 and 3 took quite a while to run with this. Depth first search was even worse. Not only would it take long periods of time but it would also fail to find a solution of the shortest possible path, instead returning very long paths to the goal state. Uniform cost search and Astar both appeared to be better ways of searching the problem space efficiently.

Based on trial runs I had with the three problems. The algorithm that performed the best in terms of time to solve the problem with an accurate answer was the ignore preconditions A star search. The level sum heuristic with A star search was not only worse then the ignore preconditions heuristic, it also was worse then a non heuristic search with A star path finding across the board.

Why did ignore preconditions seem to work so well? The two problems with this heuristic outlined in the chapter on classical planning is that 1) some actions may achieve multiple goals and 2) some actions may undo the effects of others. In the problems looked at, none of the actions were capable of achieving multiple goals in one step so that problem with the heuristic was not a consideration, making it more effective then it would otherwise be.

Astar ignore preconditions paths for the 3 problems:

Problem 1	Problem 2	Problem 3
Load(C1, P1, SFO)	Load(C3, P3, ATL)	Load(C2, P2, JFK)
Fly(P1, SFO, JFK)	Fly(P3, ATL, SFO)	Fly(P2, JFK, ORD)
Unload(C1, P1, JFK)	Unload(C3, P3, SFO)	Load(C4, P2, ORD)
Load(C2, P2, JFK)	Load(C1, P1, SFO)	Fly(P2, ORD, SFO)
Fly(P2, JFK, SFO)	Fly(P1, SFO, JFK)	Unload(C4, P2, SFO)
Unload(C2, P2, SFO)	Unload(C1, P1, JFK)	Load(C1, P1, SFO)
	Load(C2, P2, JFK)	Fly(P1, SFO, ATL)
	Fly(P2, JFK, SFO)	Load(C3, P1, ATL)
	Unload(C2, P2, SFO)	Fly(P1, ATL, JFK)
		Unload(C3, P1, JFK)
		Unload(C1, P1, JFK)
		Unload(C2, P2, SFO)

Problem 1

	Expansions	Goal Tests	New Nodes	Time	Plan length
Breadth first	43	56	180	0.12	6
Bf tree search	1458	1459	5960	2.61	6
depth first gra	12	13	48	0.02	12
depth limited s	101	271	414	0.188	50
uniform cost s	55	57	224	0.128	6
recursive best	4229	4230	17029	6.77	6
greedy_bestfir	7	9	28	0.014	6
Astar h_1	55	57	224	0.128	6
Astar ignore pi	41	43	170	0.078	6
Astar level su	11	13	50	1.56	6

Problem2

	Expansions	Goal Tests	New Nodes	Time	Plan length
Breadth first	3343	4609	30509	26.69	9
Bf tree search	TOO LONG **				
depth first gra	1669	1670	14863	27.19	1444
depth limited s	222719	2053741	2054119	2093	50
uniform cost s	4835	4837	43877	23.95	9
recursive best	TOO LONG **				
greedy_bestfir	958	960	8622	4.98	17
Astar h_1	4835	4837	43877	23.93	9
Astar ignore pi	1450	1452	13303	8.5	9
Astar level su	86	88	841	262.28	9

Problem 3

	Expansions	Goal Tests	New Nodes	Time	Plan length
Breadth first	14663	18098	129631	203.3	12
Bf tree search					
depth first graph search					
depth limited search					
uniform cost s	18155	18157	159055	112.99	12
recursive best first search h1					
greedy_bestfir	5353	5355	47275	30.633	22
Astar h_1	18155	18157	159055	103.41	12
Astar ignore pi	5034	5036	44887	33.455	12
Astar level su	318	320	2934	1354.53	12