Optimal Plan

Problem 1:
```
Load(C1, P1, SFO)
Fly(P1, SFO, JFK)
Load(C2, P2, JFK)
Fly(P2, JFK, SFO)
Unload(C1, P1, JFK)
Unload(C2, P2, SFO)
```

Problem 2:
```
Load(C1, P1, SFO)
Fly(P1, SFO, JFK)
Load(C2, P2, JFK)
Fly(P2, JFK, SFO)
Load(C3, P3, ATL)
Fly(P3, ATL, SFO)
Unload(C3, P3, SFO)
Unload(C2, P2, SFO)
Unload(C1, P1, JFK)
```

Problem 3:
```
Load(C2, P2, JFK)
Fly(P2, JFK, ORD)
Load(C4, P2, ORD)
Fly(P2, ORD, SFO)
Load(C1, P1, SFO)
Fly(P1, SFO, ATL)
Load(C3, P1, ATL)
Fly(P1, ATL, JFK)
Unload(C4, P2, SFO)
Unload(C3, P1, JFK)
Unload(C2, P2, SFO)
Unload(C1, P1, JFK)
```

Search Comparison

	Optimality(Length)			Time elapsed			Node expansions		
	Problem 1	Problem 2	Problem 3	Problem 1	Problem 2	Problem 3	Problem 1	Problem 2	Problem 3
Breadth first	6	9	12	0.02	11.55	92.70	43	3343	14663
Depth first	12	575	596	0.007	3.00	3.00	12	582	627
Uniform cost	6	9	12	0.03	10.12	39.40	55	4853	18223
A* ignore precond	6	9	12	0.03	3.31	12.54	41	1450	5040
A* levelsum	6	9	12	0.67	52.92	272.16	11	86	325

Breadth First Search, Depth First Search, A* Search with ignore preconditions heuristic and A* Search with level sum heuristic all return with optimal plan in these three cases. Depth First Search doesn't come up with an optimal search because it didn't put the length of actions as a priority.

A* Search with ignore preconditions heuristic gives the optimal plan. It takes less time than the other search algorithms that come up with optimal plans. And it expands less nodes that the non-heuristic search algorithms. It keeps a balance between time spent and node expanded.

A* Search with level sum heuristic ends up the longest time among these four algorithms. Because it needs to spend time creating the planning graph. But it explores the least number of nodes during search. This heuristic traded time for optimality and times of exploring nodes.

In my opinion, ignore preconditions heuristic is the best heuristic among the heuristics used in this project. It spends reasonable time and explores reasonable number of nodes. And it takes less memory space than level sum heuristic since level sum heuristic need to draw a planning graph each time a node is expanded. For a more complicated problem, level sum heuristic might win over ignore preconditions heuristic because it explores less nodes.