(aind) C:\Users\Yazhuo\Documents\Courses\AIND\artificial-intelligence\Projects\2\_Classical Planning>pypy3 run\_search.py -p 1 2 -s 1 2 3 4 5 6 7 8 9 10 11

Solving Air Cargo Problem 1 using breadth\_first\_search...

# Actions Expansions Goal Tests New Nodes

20 43 56 178

Plan length: 6 Time elapsed in seconds: 0.0244752

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 1 using depth\_first\_graph\_search...

# Actions Expansions Goal Tests New Nodes

20 21 22 84

Plan length: 20 Time elapsed in seconds: 0.007693199999999997

Fly(P1, SFO, JFK)

Fly(P2, JFK, SFO)

Load(C2, P1, JFK)

Fly(P1, JFK, SFO)

Fly(P2, SFO, JFK)

Unload(C2, P1, SFO)

Fly(P1, SFO, JFK)

Fly(P2, JFK, SFO)

Load(C2, P2, SFO)

Fly(P1, JFK, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, JFK)

Fly(P1, SFO, JFK)

Unload(C2, P2, JFK)

Unload(C1, P2, JFK)

Fly(P2, JFK, SFO)

Load(C2, P1, JFK)

Fly(P1, JFK, SFO)

Fly(P2, SFO, JFK)

Unload(C2, P1, SFO)

Solving Air Cargo Problem 1 using uniform\_cost\_search...

# Actions Expansions Goal Tests New Nodes

20 60 62 240

Plan length: 6 Time elapsed in seconds: 0.021975099999999997

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Load(C1, P2, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 1 using greedy\_best\_first\_graph\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

20 7 9 29

Plan length: 6 Time elapsed in seconds: 0.0023007000000000027

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 1 using greedy\_best\_first\_graph\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

20 6 8 28

Plan length: 6 Time elapsed in seconds: 0.6586825000000001

Load(C1, P1, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Solving Air Cargo Problem 1 using greedy\_best\_first\_graph\_search with h\_pg\_maxlevel...

# Actions Expansions Goal Tests New Nodes

20 6 8 24

Plan length: 6 Time elapsed in seconds: 0.1375267

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Fly(P1, SFO, JFK)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 1 using greedy\_best\_first\_graph\_search with h\_pg\_setlevel...

# Actions Expansions Goal Tests New Nodes

20 6 8 28

Plan length: 6 Time elapsed in seconds: 0.5684556000000001

Load(C1, P1, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Solving Air Cargo Problem 1 using astar\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

20 50 52 206

Plan length: 6 Time elapsed in seconds: 0.01750800000000008

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 1 using astar\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

20 28 30 122

Plan length: 6 Time elapsed in seconds: 0.3158291

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 1 using astar\_search with h\_pg\_maxlevel...

# Actions Expansions Goal Tests New Nodes

20 43 45 180

Plan length: 6 Time elapsed in seconds: 0.15952850000000018

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Load(C1, P2, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 1 using astar\_search with h\_pg\_setlevel...

# Actions Expansions Goal Tests New Nodes

20 33 35 138

Plan length: 6 Time elapsed in seconds: 0.5809979999999997

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 2 using breadth\_first\_search...

# Actions Expansions Goal Tests New Nodes

72 3343 4609 30503

Plan length: 9 Time elapsed in seconds: 0.4909454000000002

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Load(C3, P3, ATL)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Fly(P3, ATL, SFO)

Unload(C3, P3, SFO)

Solving Air Cargo Problem 2 using depth\_first\_graph\_search...

# Actions Expansions Goal Tests New Nodes

72 624 625 5602

Plan length: 619 Time elapsed in seconds: 0.6691266999999996

Fly(P3, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P3, SFO, JFK)

Fly(P1, ATL, JFK)

Fly(P2, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, SFO)

Load(C2, P1, JFK)

Fly(P2, SFO, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P1, SFO, JFK)

Load(C3, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P3, SFO, JFK)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, SFO)

Unload(C3, P3, JFK)

Fly(P1, SFO, JFK)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P3, SFO, ATL)

Fly(P1, ATL, SFO)

Unload(C2, P1, SFO)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Fly(P3, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Load(C3, P3, JFK)

Fly(P1, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, JFK)

Fly(P3, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Fly(P3, SFO, ATL)

Unload(C3, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P3, SFO, JFK)

Fly(P2, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, JFK)

Fly(P3, ATL, JFK)

Fly(P1, SFO, JFK)

Fly(P2, JFK, SFO)

Unload(C3, P2, SFO)

Fly(P2, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, JFK)

Fly(P3, ATL, SFO)

Load(C2, P3, SFO)

Fly(P3, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, SFO)

Unload(C2, P3, JFK)

Fly(P1, SFO, JFK)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P3, SFO, ATL)

Fly(P1, ATL, SFO)

Load(C3, P2, SFO)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Fly(P3, SFO, ATL)

Load(C2, P2, JFK)

Fly(P3, ATL, JFK)

Fly(P2, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C3, P2, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P2, ATL, JFK)

Fly(P3, JFK, ATL)

Fly(P1, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P1, SFO, JFK)

Fly(P2, JFK, ATL)

Fly(P3, SFO, ATL)

Fly(P2, ATL, SFO)

Load(C1, P2, SFO)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P3, SFO, JFK)

Fly(P2, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, SFO)

Fly(P3, ATL, SFO)

Unload(C2, P2, JFK)

Fly(P1, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P3, SFO, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, JFK)

Fly(P1, JFK, ATL)

Load(C3, P2, SFO)

Fly(P1, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, JFK)

Fly(P3, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C3, P2, JFK)

Fly(P3, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P2, SFO, JFK)

Unload(C1, P2, JFK)

Fly(P1, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, SFO)

Fly(P3, JFK, ATL)

Fly(P2, SFO, JFK)

Fly(P3, ATL, SFO)

Load(C3, P2, JFK)

Fly(P2, JFK, ATL)

Fly(P3, SFO, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P2, SFO, ATL)

Fly(P1, ATL, SFO)

Unload(C3, P2, ATL)

Fly(P2, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, JFK)

Fly(P3, JFK, ATL)

Fly(P2, JFK, SFO)

Fly(P3, ATL, SFO)

Load(C2, P1, JFK)

Fly(P2, SFO, ATL)

Fly(P3, SFO, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, ATL, JFK)

Fly(P2, SFO, ATL)

Unload(C2, P1, SFO)

Fly(P2, ATL, JFK)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Load(C2, P3, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C1, P3, JFK)

Fly(P2, SFO, JFK)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Unload(C2, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Fly(P3, SFO, JFK)

Fly(P2, JFK, ATL)

Unload(C1, P3, JFK)

Fly(P2, ATL, SFO)

Fly(P3, JFK, ATL)

Fly(P2, SFO, JFK)

Fly(P3, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P3, SFO, JFK)

Fly(P1, ATL, SFO)

Load(C1, P2, JFK)

Fly(P1, SFO, JFK)

Fly(P2, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P2, SFO, ATL)

Fly(P1, ATL, SFO)

Unload(C1, P2, ATL)

Fly(P2, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P3, SFO, ATL)

Fly(P1, ATL, JFK)

Fly(P3, ATL, JFK)

Fly(P2, SFO, JFK)

Fly(P1, JFK, ATL)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P2, SFO, JFK)

Fly(P1, SFO, JFK)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Unload(C3, P2, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P1, SFO, ATL)

Load(C3, P3, SFO)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, JFK)

Load(C2, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P3, SFO, JFK)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, SFO)

Unload(C3, P3, JFK)

Fly(P1, SFO, JFK)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P3, SFO, ATL)

Fly(P1, ATL, SFO)

Unload(C2, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Load(C3, P1, JFK)

Fly(P3, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Load(C2, P1, ATL)

Fly(P1, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, JFK)

Fly(P3, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C3, P1, SFO)

Fly(P3, SFO, ATL)

Fly(P1, SFO, JFK)

Fly(P3, ATL, JFK)

Fly(P2, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P3, JFK, ATL)

Load(C3, P2, SFO)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P3, SFO, ATL)

Fly(P2, ATL, JFK)

Fly(P3, ATL, JFK)

Fly(P1, SFO, ATL)

Unload(C3, P2, JFK)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P1, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P1, SFO, ATL)

Load(C1, P1, ATL)

Fly(P1, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P3, SFO, ATL)

Fly(P2, ATL, JFK)

Fly(P1, SFO, JFK)

Fly(P3, ATL, SFO)

Load(C3, P2, JFK)

Fly(P3, SFO, JFK)

Fly(P2, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P1, JFK, SFO)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Unload(C3, P2, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P3, ATL, SFO)

Unload(C2, P1, JFK)

Fly(P2, JFK, ATL)

Fly(P3, SFO, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, JFK)

Fly(P2, SFO, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P2, SFO, JFK)

Fly(P3, JFK, ATL)

Fly(P1, ATL, SFO)

Fly(P3, ATL, SFO)

Unload(C3, P2, JFK)

Fly(P1, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C3, P1, JFK)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P1, SFO, ATL)

Unload(C1, P1, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Unload(C3, P1, SFO)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P2, JFK, ATL)

Load(C1, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, JFK)

Fly(P3, ATL, JFK)

Fly(P1, SFO, ATL)

Fly(P2, JFK, SFO)

Fly(P1, ATL, JFK)

Fly(P2, SFO, ATL)

Unload(C1, P3, JFK)

Fly(P2, ATL, JFK)

Fly(P3, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Load(C3, P1, SFO)

Fly(P3, ATL, JFK)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, JFK)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Load(C2, P2, JFK)

Fly(P3, SFO, ATL)

Fly(P1, SFO, JFK)

Fly(P3, ATL, JFK)

Fly(P2, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C3, P1, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P1, ATL, JFK)

Fly(P2, SFO, ATL)

Unload(C2, P2, ATL)

Fly(P2, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, JFK)

Fly(P3, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P3, JFK, SFO)

Fly(P1, ATL, SFO)

Load(C3, P3, SFO)

Fly(P3, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P1, ATL, JFK)

Fly(P2, JFK, ATL)

Fly(P3, JFK, ATL)

Load(C2, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P3, SFO, JFK)

Fly(P2, SFO, JFK)

Fly(P1, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P1, ATL, SFO)

Load(C1, P3, JFK)

Fly(P2, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P3, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Unload(C2, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P1, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Fly(P3, SFO, JFK)

Fly(P1, JFK, ATL)

Unload(C3, P3, JFK)

Fly(P1, ATL, SFO)

Fly(P2, SFO, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, JFK)

Fly(P3, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C1, P3, SFO)

Fly(P3, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P1, ATL, JFK)

Fly(P2, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, SFO)

Load(C3, P1, JFK)

Fly(P2, SFO, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P1, SFO, JFK)

Load(C2, P3, ATL)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P3, SFO, JFK)

Fly(P2, ATL, SFO)

Fly(P1, JFK, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, SFO)

Fly(P3, ATL, SFO)

Unload(C3, P1, SFO)

Fly(P2, SFO, ATL)

Unload(C2, P3, SFO)

Load(C3, P1, SFO)

Fly(P2, ATL, JFK)

Fly(P3, SFO, ATL)

Fly(P2, JFK, SFO)

Fly(P3, ATL, JFK)

Fly(P1, SFO, ATL)

Fly(P3, JFK, SFO)

Fly(P1, ATL, JFK)

Load(C2, P2, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P3, JFK, ATL)

Unload(C3, P1, ATL)

Fly(P1, ATL, JFK)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Load(C1, P1, SFO)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P2, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Fly(P3, SFO, JFK)

Unload(C2, P2, SFO)

Fly(P2, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P2, ATL, SFO)

Unload(C1, P1, ATL)

Fly(P1, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, JFK)

Fly(P1, SFO, ATL)

Fly(P3, JFK, ATL)

Fly(P1, ATL, JFK)

Fly(P3, ATL, SFO)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, SFO)

Fly(P3, SFO, ATL)

Fly(P2, SFO, JFK)

Fly(P3, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P2, JFK, ATL)

Fly(P3, JFK, ATL)

Load(C1, P3, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Fly(P3, ATL, JFK)

Fly(P2, SFO, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, JFK)

Fly(P1, JFK, ATL)

Fly(P3, JFK, SFO)

Fly(P1, ATL, SFO)

Unload(C3, P2, JFK)

Fly(P3, SFO, ATL)

Fly(P1, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P3, ATL, JFK)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C1, P3, JFK)

Fly(P2, SFO, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, JFK)

Fly(P3, JFK, ATL)

Fly(P1, JFK, ATL)

Fly(P3, ATL, SFO)

Fly(P1, ATL, SFO)

Load(C3, P2, JFK)

Fly(P3, SFO, ATL)

Fly(P2, JFK, ATL)

Fly(P1, SFO, ATL)

Fly(P2, ATL, SFO)

Fly(P3, ATL, SFO)

Fly(P1, ATL, JFK)

Fly(P3, SFO, JFK)

Unload(C3, P2, SFO)

Solving Air Cargo Problem 2 using uniform\_cost\_search...

# Actions Expansions Goal Tests New Nodes

72 5154 5156 46618

Plan length: 9 Time elapsed in seconds: 0.9044781999999998

Load(C3, P3, ATL)

Fly(P3, ATL, SFO)

Load(C1, P3, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C3, P3, SFO)

Fly(P3, SFO, JFK)

Unload(C2, P2, SFO)

Unload(C1, P3, JFK)

Solving Air Cargo Problem 2 using greedy\_best\_first\_graph\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

72 17 19 170

Plan length: 9 Time elapsed in seconds: 0.0892527000000003

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Load(C3, P3, ATL)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Fly(P3, ATL, SFO)

Unload(C3, P3, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 2 using greedy\_best\_first\_graph\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

72 9 11 86

Plan length: 9 Time elapsed in seconds: 0.8402906999999997

Load(C1, P1, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Load(C3, P3, ATL)

Fly(P3, ATL, SFO)

Unload(C3, P3, SFO)

Solving Air Cargo Problem 2 using greedy\_best\_first\_graph\_search with h\_pg\_maxlevel...

# Actions Expansions Goal Tests New Nodes

72 27 29 249

Plan length: 9 Time elapsed in seconds: 0.6900209000000004

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Load(C3, P3, ATL)

Fly(P2, JFK, SFO)

Fly(P3, ATL, SFO)

Fly(P1, SFO, JFK)

Unload(C3, P3, SFO)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 2 using greedy\_best\_first\_graph\_search with h\_pg\_setlevel...

# Actions Expansions Goal Tests New Nodes

72 9 11 84

Plan length: 9 Time elapsed in seconds: 1.5034598999999993

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Load(C3, P3, ATL)

Fly(P2, JFK, SFO)

Fly(P3, ATL, SFO)

Fly(P1, SFO, JFK)

Unload(C3, P3, SFO)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 2 using astar\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

72 2467 2469 22522

Plan length: 9 Time elapsed in seconds: 0.8905811999999997

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, P3, SFO)

Fly(P3, SFO, JFK)

Unload(C1, P3, JFK)

Solving Air Cargo Problem 2 using astar\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

72 357 359 3426

Plan length: 9 Time elapsed in seconds: 20.4784207

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Load(C3, P3, ATL)

Fly(P3, ATL, SFO)

Unload(C3, P3, SFO)

Load(C1, P3, SFO)

Fly(P3, SFO, JFK)

Unload(C2, P2, SFO)

Unload(C1, P3, JFK)

Solving Air Cargo Problem 2 using astar\_search with h\_pg\_maxlevel...

# Actions Expansions Goal Tests New Nodes

72 2887 2889 26594

Plan length: 9 Time elapsed in seconds: 55.2244369

Load(C1, P1, SFO)

Fly(P1, SFO, JFK)

Load(C2, P1, JFK)

Load(C3, P3, ATL)

Unload(C1, P1, JFK)

Fly(P1, JFK, SFO)

Fly(P3, ATL, SFO)

Unload(C3, P3, SFO)

Unload(C2, P1, SFO)

Solving Air Cargo Problem 2 using astar\_search with h\_pg\_setlevel...

# Actions Expansions Goal Tests New Nodes

72 1037 1039 9605

Plan length: 9 Time elapsed in seconds: 151.1404738

Load(C2, P2, JFK)

Load(C3, P3, ATL)

Fly(P2, JFK, SFO)

Fly(P3, ATL, SFO)

Unload(C3, P3, SFO)

Unload(C2, P2, SFO)

Load(C1, P3, SFO)

Fly(P3, SFO, JFK)

Unload(C1, P3, JFK)

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(aind) C:\Users\Yazhuo\Documents\Courses\AIND\artificial-intelligence\Projects>cd "2\_Classical Planning"

(aind) C:\Users\Yazhuo\Documents\Courses\AIND\artificial-intelligence\Projects\2\_Classical Planning>pypy3 run\_search.py -p 3 -s 1 2 3 4 5 6 7 8 9

Solving Air Cargo Problem 3 using breadth\_first\_search...

# Actions Expansions Goal Tests New Nodes

88 14663 18098 129625

Plan length: 12 Time elapsed in seconds: 1.0795695

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, ORD)

Load(C4, P2, ORD)

Fly(P1, SFO, ATL)

Load(C3, P1, ATL)

Fly(P1, ATL, JFK)

Unload(C1, P1, JFK)

Unload(C3, P1, JFK)

Fly(P2, ORD, SFO)

Unload(C2, P2, SFO)

Unload(C4, P2, SFO)

Solving Air Cargo Problem 3 using depth\_first\_graph\_search...

# Actions Expansions Goal Tests New Nodes

88 408 409 3364

Plan length: 392 Time elapsed in seconds: 0.2736455

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C2, P1, JFK)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Unload(C2, P1, SFO)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C2, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Load(C3, P1, ATL)

Fly(P1, ATL, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, SFO)

Fly(P2, ORD, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, SFO)

Unload(C3, P1, JFK)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Unload(C2, P2, JFK)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C3, P1, JFK)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, SFO)

Fly(P2, ATL, JFK)

Unload(C3, P1, SFO)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C3, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, SFO)

Load(C1, P1, SFO)

Fly(P2, ATL, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, SFO)

Fly(P1, ORD, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, JFK)

Unload(C3, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, SFO)

Unload(C1, P1, ATL)

Fly(P1, ATL, ORD)

Fly(P2, SFO, ORD)

Fly(P1, ORD, SFO)

Fly(P2, ORD, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, JFK)

Load(C3, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Unload(C3, P2, ATL)

Fly(P2, ATL, ORD)

Fly(P1, ATL, ORD)

Fly(P2, ORD, SFO)

Fly(P1, ORD, SFO)

Fly(P2, SFO, JFK)

Fly(P1, SFO, JFK)

Load(C2, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Load(C3, P1, ATL)

Fly(P1, ATL, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, SFO)

Fly(P2, ORD, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, SFO)

Unload(C3, P1, JFK)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Load(C3, P2, JFK)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, SFO)

Fly(P1, ATL, JFK)

Fly(P2, SFO, ATL)

Load(C1, P2, ATL)

Fly(P2, ATL, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, SFO)

Fly(P1, ORD, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, SFO)

Unload(C3, P2, JFK)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, SFO)

Fly(P1, ATL, JFK)

Load(C3, P1, JFK)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Unload(C3, P1, SFO)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Unload(C1, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Load(C3, P1, SFO)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, JFK)

Fly(P2, ORD, ATL)

Unload(C3, P1, JFK)

Fly(P2, ATL, JFK)

Fly(P1, JFK, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Load(C4, P2, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ATL, ORD)

Fly(P2, ATL, SFO)

Fly(P1, ORD, SFO)

Fly(P2, SFO, JFK)

Fly(P1, SFO, JFK)

Unload(C4, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Load(C2, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Unload(C2, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Unload(C1, P2, JFK)

Fly(P2, JFK, ORD)

Load(C4, P1, JFK)

Fly(P2, ORD, ATL)

Fly(P1, JFK, ORD)

Fly(P2, ATL, SFO)

Fly(P1, ORD, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, SFO)

Unload(C4, P1, SFO)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C4, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Load(C3, P2, JFK)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Unload(C4, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Load(C2, P2, JFK)

Fly(P1, ATL, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, SFO)

Fly(P2, ORD, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, SFO)

Unload(C3, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, SFO)

Unload(C2, P2, JFK)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Load(C2, P1, JFK)

Fly(P2, ATL, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, SFO)

Fly(P1, ORD, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, SFO)

Unload(C2, P1, SFO)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Load(C1, P1, JFK)

Fly(P2, ATL, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, SFO)

Fly(P1, ORD, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, SFO)

Unload(C1, P1, SFO)

Fly(P1, SFO, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, JFK)

Fly(P2, ATL, SFO)

Load(C4, P2, SFO)

Fly(P2, SFO, ATL)

Fly(P1, JFK, ORD)

Fly(P2, ATL, JFK)

Fly(P1, ORD, ATL)

Fly(P2, JFK, ORD)

Fly(P1, ATL, SFO)

Load(C3, P1, SFO)

Fly(P2, ORD, ATL)

Fly(P1, SFO, ORD)

Fly(P2, ATL, SFO)

Fly(P1, ORD, ATL)

Fly(P2, SFO, JFK)

Unload(C4, P2, JFK)

Fly(P1, ATL, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, SFO)

Fly(P2, ORD, ATL)

Fly(P1, SFO, JFK)

Fly(P2, ATL, SFO)

Load(C4, P1, JFK)

Fly(P2, SFO, ORD)

Fly(P1, JFK, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, ORD)

Unload(C3, P1, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ATL, ORD)

Fly(P1, ATL, SFO)

Fly(P2, ORD, SFO)

Fly(P1, SFO, JFK)

Fly(P2, SFO, JFK)

Unload(C4, P1, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, ORD)

Fly(P2, ATL, SFO)

Fly(P1, ORD, SFO)

Load(C2, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Unload(C2, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Unload(C1, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Load(C3, P1, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ATL, ORD)

Fly(P1, ATL, SFO)

Fly(P2, ORD, SFO)

Fly(P1, SFO, JFK)

Load(C4, P1, JFK)

Fly(P2, SFO, JFK)

Fly(P1, JFK, ORD)

Fly(P2, JFK, ORD)

Fly(P1, ORD, ATL)

Fly(P2, ORD, ATL)

Fly(P1, ATL, SFO)

Unload(C4, P1, SFO)

Fly(P2, ATL, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, SFO)

Fly(P1, ORD, ATL)

Fly(P2, SFO, JFK)

Fly(P1, ATL, JFK)

Load(C2, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, JFK, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, SFO)

Fly(P1, ATL, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, ORD)

Fly(P1, SFO, ORD)

Fly(P2, ORD, ATL)

Fly(P1, ORD, ATL)

Fly(P2, ATL, JFK)

Fly(P1, ATL, JFK)

Unload(C3, P1, JFK)

Solving Air Cargo Problem 3 using uniform\_cost\_search...

# Actions Expansions Goal Tests New Nodes

88 18510 18512 161936

Plan length: 12 Time elapsed in seconds: 1.7189185

Load(C2, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, ORD)

Load(C4, P2, ORD)

Fly(P2, ORD, SFO)

Load(C1, P2, SFO)

Unload(C4, P2, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C3, P2, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 3 using greedy\_best\_first\_graph\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

88 25 27 230

Plan length: 15 Time elapsed in seconds: 0.023642000000000163

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, ORD)

Load(C4, P2, ORD)

Fly(P2, ORD, SFO)

Unload(C4, P2, SFO)

Fly(P2, SFO, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, JFK)

Unload(C3, P2, JFK)

Fly(P2, JFK, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 3 using greedy\_best\_first\_graph\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

88 14 16 126

Plan length: 14 Time elapsed in seconds: 2.8456445000000006

Load(C1, P1, SFO)

Fly(P1, SFO, ORD)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, JFK)

Unload(C3, P2, JFK)

Load(C4, P1, ORD)

Fly(P1, ORD, SFO)

Unload(C4, P1, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 3 using greedy\_best\_first\_graph\_search with h\_pg\_maxlevel...

# Actions Expansions Goal Tests New Nodes

88 21 23 195

Plan length: 13 Time elapsed in seconds: 0.9229487000000001

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, SFO, ATL)

Load(C3, P1, ATL)

Load(C4, P2, ORD)

Fly(P1, ATL, SFO)

Fly(P2, ORD, SFO)

Fly(P1, SFO, JFK)

Unload(C4, P2, SFO)

Unload(C3, P1, JFK)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 3 using greedy\_best\_first\_graph\_search with h\_pg\_setlevel...

# Actions Expansions Goal Tests New Nodes

88 35 37 345

Plan length: 17 Time elapsed in seconds: 7.5612622

Load(C1, P1, SFO)

Fly(P1, SFO, ORD)

Load(C2, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Load(C4, P1, ORD)

Fly(P1, ORD, SFO)

Fly(P2, ATL, SFO)

Unload(C4, P1, SFO)

Fly(P1, SFO, JFK)

Load(C4, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C3, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C4, P2, SFO)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 3 using astar\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

88 7388 7390 65711

Plan length: 12 Time elapsed in seconds: 1.3864020000000021

Load(C2, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, ORD)

Load(C4, P2, ORD)

Fly(P2, ORD, SFO)

Unload(C4, P2, SFO)

Unload(C2, P2, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C3, P2, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 3 using astar\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

88 369 371 3403

Plan length: 12 Time elapsed in seconds: 28.7985561

Load(C1, P1, SFO)

Fly(P1, SFO, ATL)

Load(C3, P1, ATL)

Fly(P1, ATL, JFK)

Load(C2, P2, JFK)

Fly(P2, JFK, ORD)

Load(C4, P2, ORD)

Fly(P2, ORD, SFO)

Unload(C4, P2, SFO)

Unload(C3, P1, JFK)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

(aind) C:\Users\Yazhuo\Documents\Courses\AIND\artificial-intelligence\Projects\2\_Classical Planning>pypy3 run\_search.py -p 3 -s 10 11

Solving Air Cargo Problem 3 using astar\_search with h\_pg\_maxlevel...

# Actions Expansions Goal Tests New Nodes

88 9580 9582 86312

Plan length: 12 Time elapsed in seconds: 290.9452143

Load(C2, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, ORD)

Load(C4, P2, ORD)

Fly(P2, ORD, SFO)

Load(C1, P2, SFO)

Unload(C4, P2, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C3, P2, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 3 using astar\_search with h\_pg\_setlevel...

# Actions Expansions Goal Tests New Nodes

88 3423 3425 31596

Plan length: 12 Time elapsed in seconds: 949.3443175

Load(C2, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, ORD)

Load(C4, P2, ORD)

Fly(P2, ORD, SFO)

Load(C1, P2, SFO)

Unload(C4, P2, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C3, P2, JFK)

Unload(C1, P2, JFK)

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Solving Air Cargo Problem 4 using breadth\_first\_search...

# Actions Expansions Goal Tests New Nodes

104 99736 114953 944130

Plan length: 14 Time elapsed in seconds: 6.4879660999999995

Load(C1, P1, SFO)

Fly(P1, SFO, ATL)

Load(C3, P1, ATL)

Fly(P1, ATL, ORD)

Load(C4, P1, ORD)

Load(C5, P1, ORD)

Fly(P1, ORD, JFK)

Load(C2, P1, JFK)

Unload(C1, P1, JFK)

Unload(C3, P1, JFK)

Unload(C5, P1, JFK)

Fly(P1, JFK, SFO)

Unload(C2, P1, SFO)

Unload(C4, P1, SFO)

Solving Air Cargo Problem 4 using uniform\_cost\_search...

# Actions Expansions Goal Tests New Nodes

104 113339 113341 1066413

Plan length: 14 Time elapsed in seconds: 155.1363403

Load(C2, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, ORD)

Load(C4, P2, ORD)

Load(C5, P2, ORD)

Fly(P2, ORD, SFO)

Load(C1, P2, SFO)

Unload(C4, P2, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C5, P2, JFK)

Unload(C3, P2, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 4 using greedy\_best\_first\_graph\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

104 29 31 280

Plan length: 18 Time elapsed in seconds: 0.10182380000000535

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C2, P2, SFO)

Fly(P2, SFO, ORD)

Load(C4, P2, ORD)

Load(C5, P2, ORD)

Fly(P2, ORD, SFO)

Unload(C4, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C5, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, JFK)

Unload(C3, P2, JFK)

Fly(P2, JFK, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 4 using greedy\_best\_first\_graph\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

104 17 19 165

Plan length: 17 Time elapsed in seconds: 4.677478999999977

Fly(P2, JFK, ORD)

Load(C1, P1, SFO)

Fly(P1, SFO, JFK)

Unload(C1, P1, JFK)

Load(C2, P1, JFK)

Fly(P1, JFK, SFO)

Unload(C2, P1, SFO)

Fly(P1, SFO, ATL)

Load(C3, P1, ATL)

Fly(P1, ATL, JFK)

Unload(C3, P1, JFK)

Load(C4, P2, ORD)

Load(C5, P2, ORD)

Fly(P2, ORD, SFO)

Unload(C4, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C5, P2, JFK)

Solving Air Cargo Problem 4 using greedy\_best\_first\_graph\_search with h\_pg\_maxlevel...

# Actions Expansions Goal Tests New Nodes

104 56 58 580

Plan length: 17 Time elapsed in seconds: 2.682580800000011

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P2, JFK, ORD)

Fly(P1, SFO, ATL)

Load(C3, P1, ATL)

Load(C4, P2, ORD)

Load(C5, P2, ORD)

Fly(P1, ATL, SFO)

Fly(P2, ORD, SFO)

Unload(C5, P2, SFO)

Load(C5, P1, SFO)

Fly(P1, SFO, JFK)

Unload(C5, P1, JFK)

Unload(C4, P2, SFO)

Unload(C3, P1, JFK)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 4 using greedy\_best\_first\_graph\_search with h\_pg\_setlevel...

# Actions Expansions Goal Tests New Nodes

104 107 109 1164

Plan length: 23 Time elapsed in seconds: 40.53544450000001

Load(C1, P1, SFO)

Fly(P1, SFO, ORD)

Load(C2, P2, JFK)

Load(C4, P1, ORD)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Load(C5, P1, ORD)

Fly(P1, ORD, SFO)

Fly(P2, ATL, SFO)

Unload(C5, P1, SFO)

Load(C5, P2, SFO)

Unload(C4, P1, SFO)

Fly(P1, SFO, JFK)

Load(C4, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C3, P2, JFK)

Load(C3, P1, JFK)

Unload(C5, P2, JFK)

Fly(P2, JFK, SFO)

Unload(C4, P2, SFO)

Unload(C3, P1, JFK)

Unload(C2, P2, SFO)

Unload(C1, P1, JFK)

Solving Air Cargo Problem 4 using astar\_search with h\_unmet\_goals...

# Actions Expansions Goal Tests New Nodes

104 34330 34332 328509

Plan length: 14 Time elapsed in seconds: 7.332852099999997

Load(C2, P2, JFK)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, ORD)

Load(C4, P2, ORD)

Load(C5, P2, ORD)

Fly(P2, ORD, SFO)

Unload(C4, P2, SFO)

Unload(C2, P2, SFO)

Load(C1, P2, SFO)

Fly(P2, SFO, JFK)

Unload(C5, P2, JFK)

Unload(C3, P2, JFK)

Unload(C1, P2, JFK)

Solving Air Cargo Problem 4 using astar\_search with h\_pg\_levelsum...

# Actions Expansions Goal Tests New Nodes

104 1208 1210 12210

Plan length: 15 Time elapsed in seconds: 195.6032502

Load(C1, P1, SFO)

Fly(P1, SFO, ORD)

Load(C4, P1, ORD)

Load(C5, P1, ORD)

Fly(P1, ORD, JFK)

Unload(C5, P1, JFK)

Unload(C1, P1, JFK)

Load(C2, P1, JFK)

Fly(P1, JFK, SFO)

Fly(P2, JFK, ATL)

Load(C3, P2, ATL)

Fly(P2, ATL, JFK)

Unload(C4, P1, SFO)

Unload(C3, P2, JFK)

Unload(C2, P1, SFO)