

Problem Session 2

1 RPG and Heuristics

Simplified Air Cargo transport (modified from AIMA 11.1.1)

Init

$At(C_1, JFK) \wedge At(P_1, SFO)$
 $\wedge Cargo(C_1) \wedge Plane(P_1)$
 $\wedge Airport(JFK) \wedge Airport(SFO)$

Goal

$At(C_1, SFO) \wedge At(P_1, JFK)$

Action

Load(c,p,a)

PRECOND: $At(c, a) \wedge At(p, a) \wedge Cargo(c) \wedge Plane(p) \wedge Airport(a)$

EFFECT: $\neg At(c, a) \wedge In(c, p)$

Unload(c, p, a)

PRECOND: $In(c, p) \wedge At(p, a) \wedge Cargo(c) \wedge Plane(p) \wedge Airport(a)$

EFFECT: $At(c, a) \wedge \neg In(c, p)$

Fly(p, from, to)

PRECOND: $At(p, from) \wedge Plane(p) \wedge Airport(from) \wedge Airport(to)$

EFFECT: $\neg At(p, from) \wedge At(p, to)$

1.1 Relaxed Planning Graph(RPG)

Draw the RPG. Unary predicates for type specification can be ignored.

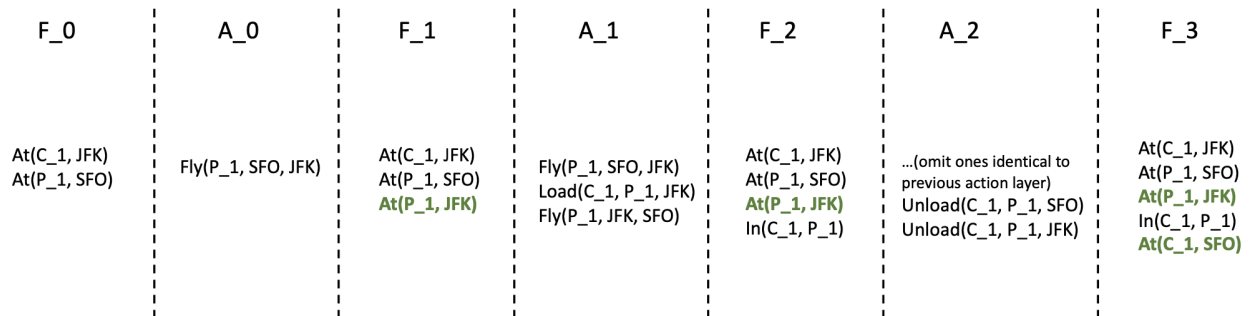


Figure 1: RPG for the simplified air cargo transportation problem

1.2 Heuristics

1.2.1 H_{max}

All goal fluents (highlighted in green) appear in F_3 .

$$h_{max} = 3$$

1.2.2 H_{add}

$At(P_1, JFK)$ appear in F_1 , $At(C_1, SFO)$ appears in F_3 .

$$h_{add} = 4$$

1.2.3 H_{ff}

Initialize goal sets at each level. $G_3 = \{At(C_1, SFO)\}$, $G_1 = \{At(P_1, JFK)\}$.

1. Find an action that make G_3 true : $a_1 = Unload(C_1, P_1, SFO)$
2. Add precondition of a_1 to goal sets in each level : $G_2 = \{In(C_1, P_1)\}$, $G_0 = \{At(P_1, SFO)\}$.
3. Find an action that make G_2 true : $a_2 = Load(C_1, P_1, JFK)$.
4. Add precondition of a_2 to goal sets in each level : $G_1 = \{At(P_1, JFK)\}$, $G_0 = \{At(P_1, SFO), At(C_1, JFK)\}$.
5. Find an action that make G_1 true : $a_3 = Fly(P_1, SFO, JFK)$.

Relaxed plan $p = \{a_3, a_2, a_1\}$.

$$h_{ff} = |p| = 3$$