

50.021 – AI

Kwan Hui

Week 11 Theory Homework - Planning

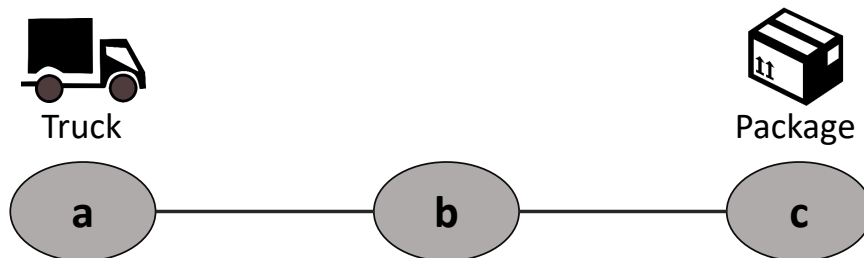
[The following notes are compiled from various sources such as textbooks, lecture materials, Web resources and are shared for academic purposes only, intended for use by students registered for a specific course. In the interest of brevity, every source is not cited. The compiler of these notes gratefully acknowledges all such sources.]

Due: 5th Aug 2022, 11:59pm

Submission: via eDimension

1 Logistic Problem I

Consider the following logistic problem. There are three locations a , b and c , with a truck at a and package at c . The truck is able perform the following actions: (i) $\text{move}(x,y)$: move from location x to y ; (ii) $\text{load}(x)$: load a package at location x ; and (iii) $\text{unload}(x)$: unload the package at location x . The truck can only move between adjacent locations, e.g., a to b , b to c .



Given the start state in the above diagram, your goal is to get the package to location b . Formulate this logistic problem using the STRIPS representation and answer the following:

- List down the propositional variables (facts).
- Specify the operators (actions), including the pre-conditions and post-conditions.
- Specify the initial state.
- List down the goal state/specification.

2 Logistic Problem II

Based on your STRIPS formulation from Q1 (Logistic Problem I), answer the following:

- What is the optimal solution to this problem?
- Make this a delete-relaxed problem. What are the changes to the original STRIPS formulation you made?
- Based on this delete-related problem, list down all the facts F_x and actions A_x at levels $x = \{0, 1, \dots, M\}$.

3 Logistic Problem III

Based on your answer from Q2 (Logistic Problem II), answer the following:

- What is the optimal solution to this delete-relaxed problem? What is this heuristic called?
- What is the value of h_{add} ? Explain why.
- What is the value of h_{max} ? Explain why.

4 Generic Planning I

Consider a STRIPS problem with propositional variables (facts) m, n, o, p , and the below STRIPS actions with their pre/post-conditions.

Action	Pre	Add	Del
A	m	n,o	\emptyset
B	m,o	p	m
C	p	m	p
D	n,o	p	o

Given an initial state $s = \{m\}$ and goal specification $g = \{m, n, o, p\}$, answer the following questions:

- What is the value of h_+ ? Explain why.
- What is the value of h_{add} ? Explain why.
- What is the value of h_{max} ? Explain why.

5 Generic Planning II

Based on the same STRIPS formulation in Q4 (Generic Planning I). Now, based on initial state $s = \{p\}$ and goal specification $g = \{m, n, o, p\}$, answer the following questions:

- What is the value of h_+ (if any)? Explain why.
- What is the value of h_{add} (if any)? Explain why.
- What is the value of h_{max} (if any)? Explain why.