# 50.021 – AI

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## 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: 10th Aug 2021, 11:59pm
Submission: via eDimension

# 1 Logistic Problem I

Consider the following logistic problem. There are three lcoations $a$, $b$ and $c$, with a truck at $a$ and package at $c$. The truck is able perform the following actions: (i) move(x,y): move from location $x$ to $y$; (ii) load(x): load a package at location $x$; and (iii) unload(x): unload the package at location $x$.
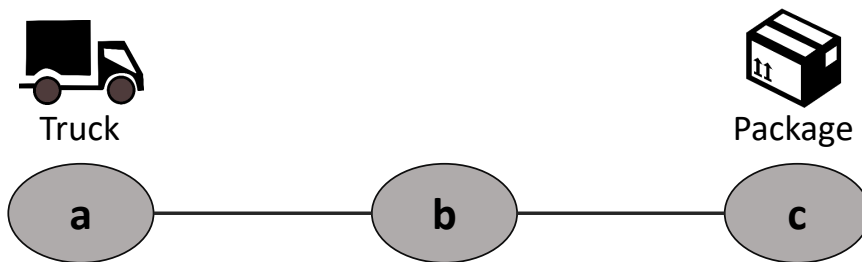


Given the start state in the above diagram, your goal is to get the package to lcoation $b$. Formulate this logistic problem using the STRIPS representation and answer the following:
a.) List down the propositional variables (facts).
b.) Specify the operators (actions), including the pre-conditions and post-conditions.
c.) Specify the initial state.
d.) List down the goal state/specification.

## 2 Logistic Problem II

Based on your STRIPS formulation from Q1 (Logistic Problem I), answer the following:
a.) What is the optimal solution to this problem?
b.) Make this a delete-relaxed problem. What are the changes to the original STRIPS formulation you made?
c.) Based on this delete-related problem, list down all the facts $F_x$ and actions $A_x$ at levels $x = \{0, 1, ..., M\}$.

## 3 Logistic Problem III

Based on your answer from Q2 (Logistic Problem II), answer the following:
a.) What is the optimal solution to this delete-relaxed problem? What is this heuristic called?
b.) What is the value of $h_{add}$? Explain why.
c.) What is the value of $h_{max}$? Explain why.

## 4 Generic Planning I

Consider a STRIPS problem with propoitional 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:
a.) What is the value of $h_+$? Explain why.
b.) What is the value of $h_{add}$? Explain why.
c.) 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:
a.) What is the value of $h_+$ (if any)? Explain why.
b.) What is the value of $h_{add}$ (if any)? Explain why.
c.) What is the value of $h_{max}$ (if any)? Explain why.