50.021 – Artificial Intelligence

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: 15th Apr 2024, 11:59pm

Submission: via eDimension

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# 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) 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*. The truck can only move between adjacent locations, e.g., *a* to *b*, *b* to *c* (You can assume that these static facts are already modelled/defined).

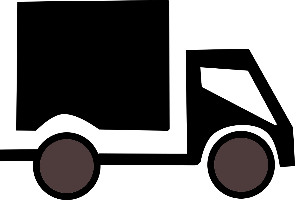
**b**

**a**

**c**

Package

Truck



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:

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

1

*5 GENERIC PLANNING II*

# 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?

1. Make this a delete-relaxed problem. What are the changes to the original STRIPSformulation you made?
2. Based on this delete-related problem, list down all the facts *Fx* and actions *Ax* at levels *x* = {0*,*1*,...,M*}.

# Logistic Problem III

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

1. What is the optimal solution to this delete-relaxed problem? What is this heuristiccalled?
2. What is the value of *hadd*? Explain why.
3. What is the value of *hmax*? Explain why.

# 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 | ∅ |
| 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:

1. What is the value of *h*+? Explain why.
2. What is the value of *hadd*? Explain why.
3. What is the value of *hmax*? Explain why.

# 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:

1. What is the value of *h*+ (if any)? Explain why.
2. What is the value of *hadd* (if any)? Explain why.
3. What is the value of *hmax* (if any)? Explain why.

2