CS 440: Introduction to AI

Homework 3 (not collected, not graded)

September 30, 2010

For problems 1 and 2 refer to Figure 10.14 in our text (this is Figure 11.17 in the second edition). It shows a robot (Shakey), four boxes, five rooms (1-4 and a corridor), and four doors connecting some of the rooms. Ignore the light switches. Shakey is quite strong and can carry up to two boxes at a time.

1 Planning States

Call the initial state illustrated in the figure, S0. Use the relations ROOM(x), ROBOT(x), BOX(x), DOOR(x), IN_ROOM(x,y) [meaning x is in room y], IS_CARRYING(x,y) [box y is being carried by x], CONNECTS(x,y,z) [door x connects rooms y to z]. You may invent other relations only if you justify why they are required.

1. Give a situation calculus specification for S0 noting which elements must necessarily be treated as fluents.
2. Give a Strips specification for S0 noting which elements must necessarily be treated as fluents.

2 Planning Actions

Shakey can can change the world in three ways. He can PICKUP any box that is in the same room provided he is not already carrying two boxes. He can PUTDOWN a box being carried. He can MOVE from one room to another using the doorways.

1. What is the fewest number of situation calculus operators needed in this world? Justify your answer.
2. What is the fewest number of Strips operators needed in this world? Justify your answer.
3. What is the fewest number of PDDL operators needed in this world? Justify your answer.

4. Write one frame and one change axiom of your choice for situation calculus (choose wisely to show how much rather than how little you know).

5. Write one Strips operator of your choice.

3 Incompleteness of linear planning

In the Sussman anomaly we have three blocks: A, B, C with the initial state A and B on the table and C on A. The goal is the conjunction ON(A,B) and ON(B,C). Use backward chaining with the Strips operators from class: MoveToBlock and MoveToTable.

1. Describe what happens when the ON(A,B) goal conjunct is chosen at the backward-chaining search root.

2. Describe what happens when the ON(B,C) goal conjunct is chosen at the root.

3. Briefly discuss the implications.