

Problem assignment 5

Due: Wednesday, October 29, 2008

Planning

Problem 1

Consider a simple blocks world problem:



We use predicates $On(x, y)$ and $Clear(x)$ to describe the states of the world. $On(x, y)$ says that block x is directly atop block y and $Clear(x)$ says that the top of the block x is clear. The initial state is:

$$On(B, A), On(A, C), On(C, Table), On(D, Table), Clear(B), Clear(D).$$

The goal condition is:

$$On(C, B), On(B, A), On(A, D).$$

Part a. Write two STRIPS operators that apply to the blocks world:

- **put-on**(x, y) for stacking a block x on another block y , and
- **put-table**(x) to put the block on the table.

Part b. Assume we search for the plan using forward (goal-progression) search. Describe the state we obtain after the operator **put-table**(B) is applied to the initial state.

Part c. An alternative to the forward search is the backward or goal regression search. Assume the operator to be applied just before the goal state is reached is **put-on**(C,B). Describe the new goal that results from the selection of this operator.

Problem 2

Consider a robot whose operation is described by the following STRIPS operators:

- *Action* : $Go(x, y)$, *Precondition* : $At(Robot, x)$, *Add* : $At(Robot, y)$, *Delete* : $At(Robot, x)$,
- *Action* : $Pick(o)$, *Precondition* : $At(Robot, x) \wedge At(o, x)$, *Add* : $Holding(Robot, o)$,
Delete : $At(o, x)$
- *Action* : $Drop(o)$, *Precondition* : $At(Robot, x) \wedge Holding(Robot, o)$, *Add* : $At(o, x)$,
Delete : $Holding(Robot, o)$

Assume the initial state is described as:

$At(Apple, Room1) \wedge At(Orange, Room1) \wedge At(Robot, Room1)$

and the goal state is:

$At(Apple, Room2) \wedge At(Orange, Room2)$.

Part a. Draw a complete partial-order plan the POP algorithm would find. Note that there can be more complete partial order plans that are consistent with the problem. You are asked to give only one of these complete plans. Show clearly all causal and ordering links between operators. Give a list of all threats resolved through ordering.

Part b. List all plans consistent with your partial order plan.