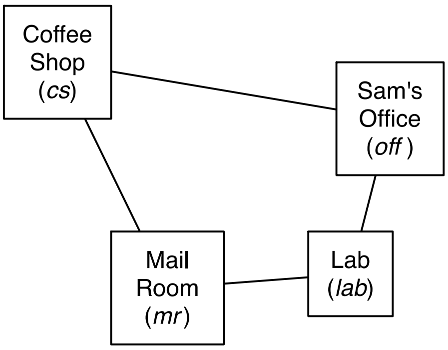
COMP3411 Tutorial - Week 7
Planning

Question 1 (Exercise 6.1 from Poole & Macworth)



Features:
***RLoc* – Rob's location**
***RHC* – Rob has coffee**
***SWC* – Sam wants coffee**
***MW* – Mail is waiting**
***RHM* – Rob has mail**

Actions:
***mc* – move clockwise**
***mcc* – move counterclockwise**
***puc* – pickup coffee**
***dc* – deliver coffee**
***pum* – pickup mail**
***dm* – deliver mail**

Consider the planning problem from the lectures.

(a) Give the STRIPS representations for the pick up mail (*pum*) and deliver mail (*dm*) actions.

(b) Give the feature-based representation of the *MW* and *RHM* features.

Solution

(a) The pickup mail action (*pum*) is defined using STRIPS by:

Preconditions: $RLoc = mr \wedge mw$

Effects: $[\neg mw, rhm]$

The deliver mail action (*dm*) is defined using STRIPS by:

Preconditions: $RLoc = off \wedge rhm$

Effects: $[\neg rhm]$

(b) The *MW* feature can be axiomatised by defining when $MW = true$ (written as *mw*):

$mw' \leftarrow mw \wedge Action \neq pum$

The *RHM* feature can be axiomatised by defining when $RHM = true$ (written as *rhm*):

$rhm' \leftarrow Action = pum$

$rhm' \leftarrow rhm \wedge Action \neq dm$

Question 2

Formulate the blocks world using STRIPS planning operators. The actions are stack (move one block to the top of another) and unstack (move one block to the table). The robot can hold only one block at a time.

To simplify the world, assume the only objects are the blocks and the table, and that the only relations are the on relation between (table and) blocks and the clear predicate on table and blocks. Also assume that it is not possible for more than one block to directly support another block (and vice versa).

Solution

stack(A, B):

> **Preconditions:** clear(A) ∧ clear(B)
>
> **Effects:** on(A, B) ∧ ¬ clear(B)

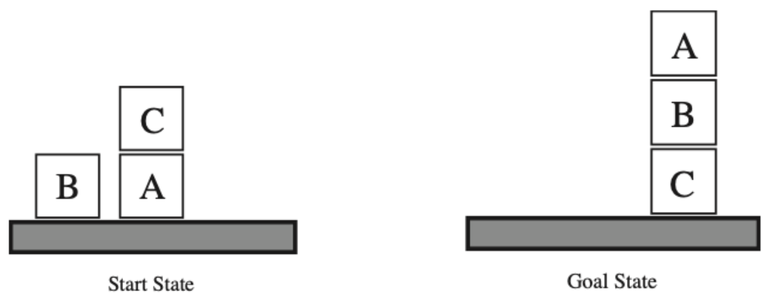
unstack(A):

> **Preconditions:** clear(A) ∧ on(A, B)
>
> **Effects:** on(A, Table) ∧ clear(B) ∧ ¬on(A, B)

Note: The **Effects** could also be written as an addles contain only the positive literals and the delete list, containing only the negative literals.

Question 3

The Sussman anomaly, shown below, is a simple planning problem that could not be solved by the early linear planners. Show how a partial order planner would solve this problem with the blocks world operators defined above.



Solution

- The nonlinear planner introduces the two actions stack(B, C) and stack(A, B).
- The clear(A) precondition of stack(A,B) does not hold in the initial state, so unstack(C) is added to the plan.
- Because stack(A,B) deletes clear(B), which is a precondition of stack(B,C), stack(B,C) must be before stack(A,B).
- For the same reason, unstack(C) must be before move(B, C).
- The plan is therefore unstack(C), stack(B, C), stack(A, B).