COS30019 - Introduction to Artificial Intelligence
Tutorial Problems Week 9

Task 1: The monkey-and-bananas problem is faced by a monkey in a laboratory with some bananas hanging out of reach from the ceiling. A box is available that will enable the monkey to reach the bananas if he climbs on it. Initially, the monkey is at *A*, the bananas at *B*, and the box at *C*. The monkey and box have height *Low*, but if the monkey climbs onto the box he will have height *High*, the same as the bananas. The actions available to the monkey include *Go* from one place to another, *Push* an object from one place to another, *ClimbUp* onto or *ClimbDown* from an object, and *Grasp* or *Ungrasp* an object. Grasping results in holding the object if the monkey and object are in the same place at the same height.

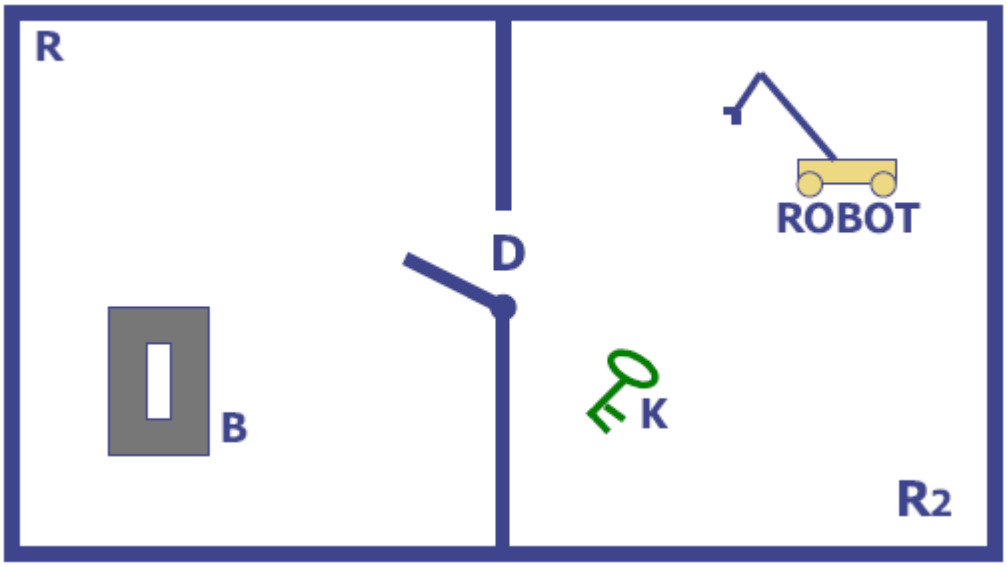
1. Write down the initial state description.
2. Write down STRIPS-style definitions of the six actions.
3. Suppose the monkey wants to fool the scientists, who are off to tea, by grabbing the bananas, but leaving the box in its original place. Can this goal be written and solved by a STRIPS-style system?

Task 2:

1. Extend your wumpus world description of tutorial 7 with STRIPS descriptions for the operators forward (go one square in the current direction) and left (turn 90 degrees left, staying in the same square).
2. Give an outline of how to find a plan for getting the gold.

Task 3: A robot ROBOT operates in an environment made of two rooms R1 and R2 connected by a door D. A box B is located in R2 and the door's key is initially in R2. The door can be open or closed (and locked). The figure illustrates the initial state described by:

IN(ROBOT,R2)
IN(K,R2)
OPEN(D)



The actions are:

Grasp-Key-In-R2
Lock-Door
Go-From-R2-To-R1-With-Key
Put-Key-In-Box

defined as follows:

Grasp-Key-In-R2
P: IN(ROBOT,R2), IN(K,R2)
E: HOLDING(ROBOT,K)

Lock-Door
P: HOLDING(ROBOT,K), OPEN(D)
E: ¬OPEN(D), LOCKED(D)

Go-From-R2-To-R1-With-Key
P: IN(ROBOT,R2), HOLDING(ROBOT,K), OPEN(D)
E: ¬IN(ROBOT,R2), ¬IN(K,R2), IN(ROBOT,R1), IN(K,R1)

Put-Key-In-Box
P: IN(ROBOT,R1), HOLDING(ROBOT,K)
E: ¬HOLDING(ROBOT,K), ¬IN(K,R1), IN(K,B)

The goal is:
IN(K,BOX), LOCKED(D)

Construct a partial order plan to solve this problem. Clearly indicate at each step the modifications made to the plan: the action added, the causal links added and/or the ordering constraints added. Indicate any threats at each step.