CPSC390
Spring 2020
In Class Assignment - Planning

Planning

A robot ROBOT operates in an environment made of two rooms R_1 and R_2 connected by a door D. A box B is located in R_1 and the door's key is initially in R_2. The door can be open or closed (and locked). Figure 1 illustrates the initial state described by:

IN(ROBOT,R_2), IN(K,R_2), OPEN(D)

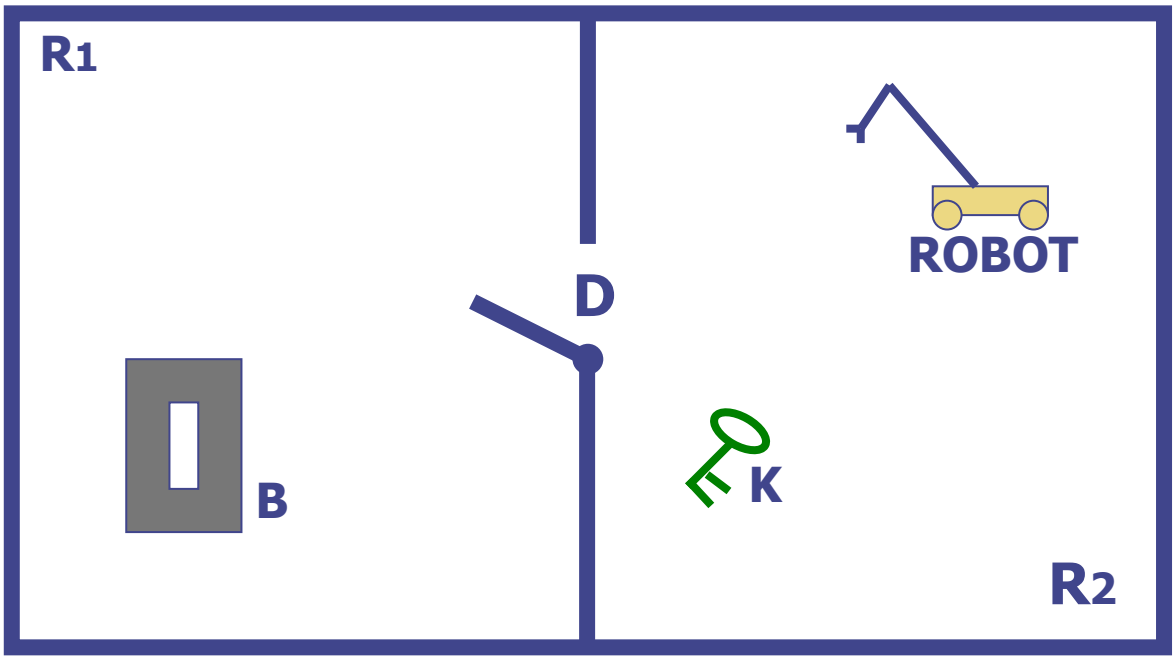

Figure 1

The only actions available to the robot are:

Grasp-Key-In-R_2
Lock-Door
Go-From-R_2-To-R_1-With-Key
Put-Key-In-Box

They are represented as follows, where P stands for "precondition" and E for "effect":

Grasp-Key-In-R_2

P: IN(ROBOT,R_2), IN(K,R_2)
E: HOLDING(ROBOT,K)

Lock-Door

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

Go-From-R_2-To-R_1-With-Key

P: IN(ROBOT,R_2), HOLDING(ROBOT,K), OPEN(D)

E: $\neg$IN(ROBOT,R_2), $\neg$IN(K,R_2), IN(ROBOT,R_1), IN(K,R_1)

Put-Key-In-Box

P: IN(ROBOT,R_1), HOLDING(ROBOT,K)

E: $\neg$HOLDING(ROBOT,K), $\neg$IN(K,R_1), IN(K,B)

The goal is:

IN(K,BOX), LOCKED(D)

1. Give a plan solving this problem. (Just give the sequence of actions, without explanation.)

2. Assume that we try to achieve the two sub-goals separately and successively. That is, we first generate a plan P1 that achieves one of the two sub-goals – IN(K,BOX) or LOCKED(D) – from the initial state and next a plan P2 that achieves the other sub-goal from the state achieved at the end of P1. Explain why this approach does not lead to a solution of the problem?

3. Describe how forward planning generates a solution plan. Show the search tree. Label each arc with the corresponding action and each node with the corresponding state. [If you can't draw the graph, provide the information in a text form, e.g., list the states that can be reached (with their descriptions), give names to these states, and indicate clearly which action transforms a state into another.]

4. Describe how backward planning generates this plan. In this case, only show a solution path of the search tree. Label the nodes and arcs of this path appropriately. [You may present the information in text form.]