Intelligent Systems

Exercise 3. Formulation of a Problem Solving Agent (PSA)

Exercise description

In this exercise, you are requested to formulate a Problem Solving Agent (PSA) for solving a robotic planning task. You can help describing your answers by adding illustrations (drawing), if needed.

Team members

Write the student id, name, and campus of each member in a different line.

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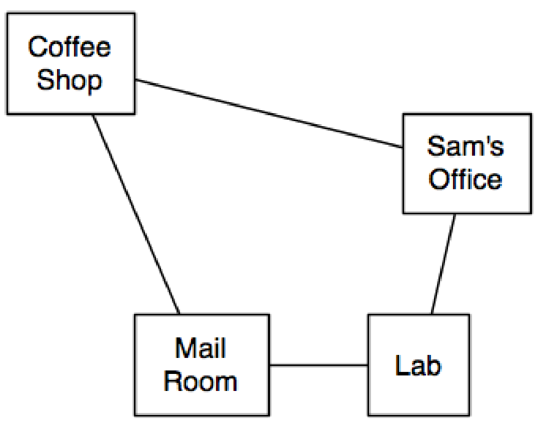
Informal description of the desired agent

Consider a delivery robot world with mail and coffee to deliver. Assume a simplified domain with for locations a shown next:



The robot, called Robbie, can buy coffee at the coffee shop, pick up mail in the mail room, move, and deliver coffee and/or mail. Delivering the coffee to Sam's office will stop Sam from wanting coffee. There can be mail waiting at the mail room to be delivered to Sam's office.

Assume that Robbie cannot carry coffee and mail at the same time. Also, assume that initially, Robbie is at the Lab, Sam is wanting coffee and that there is Sam's mail waiting at the mail room to be delivered. The task for Robbie is to deliver the mail and coffee to Sam's office.

Formal description of the desired agent

1. States description

Language to use for describing the states of the world. Do not forget to fully identify each relevant object (name it).

(0,0,0)

(**0**,0,0). Robbie's Location. Can take values from 0 – 3, where 0 represents the Lab, 1 represents the mail room, 2 represents the coffee shop and 3 represents sam's office.

(0,**0**,0) What Robbie is carrying. Can take values from 0 – 2, where 0 represents Robbie is carrying nothing, 1 represents Robbie carrying coffee and 2 represents Robbie carrying mail.

(0,0,**0**) What has been delivered to Sam's Office. Can take values from 0 – 3, where 0 represents nothing has been delivered, 1 represents only coffee has been delivered, 2 represents only mail has been delivered and 3 represents both coffee and mail have been delivered.

2. Initial state

Use the language that you designed for describing the initial state of the problem.

(0,0,0,0). In the initial state Robbie is at the lab, carrying nothing and nothing has been delivered to Sam's Office.

3. Actions

Name and informally describe the actions (operators) that the agent can use to perform its tasks.

Move. Robbie can move from one location to an adjacent one whether or not he is carrying something.

Grab. Robbie can grab mail or coffee at their corresponding locations.

Deliver. Robbie can deliver coffee or mail at Sam's Office.

4. Transition model

Detailed description of each action, including its name, arguments, preconditions and effects in the description of the result in states.

Operator	Pre-conditions	Previous State	Resulting State
Move(X,Y)	• Robbie is at X • X and Y are adjacent locations	(0,0,0) – Robbie is at the lab, carrying nothing.	(1,0,0) – Robbie is at the mail room, carrying nothing.

Grab(X)	• Robbie is at a location where an item is present (coffee shop for coffee, mail room for mail) • Robbie is carrying nothing.	(1,0,0) – Robbie is at the mail room, carrying nothing.	(1,2,0) – Robbie is at the mail room, carrying mail.
Deliver(X)	• Robbie is carrying either mail or coffee • Robbie is at Sam's Office	(3,2,1) Robbie is at Sam's office, carrying mail and only coffee has been delivered.	(3,0,3) – Robbie is at Sam's Office while carrying nothing, yet both coffee and mail have been delivered.

5. Goal test

How to recognize the end of the task.

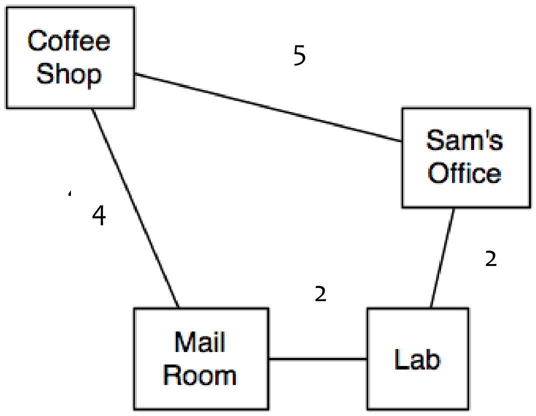
Both coffee and mail have been delivered to Sam's Office.

Goal state example: (3,0,3) – Robbie is at Sam's Office while carrying nothing, yet both coffee and mail have been delivered.

6. Path cost

How to quantify the cost of the sequence of actions performed during the execution of the task.

To quantify the cost of the sequence of actions we could assign values to the distance travelled between locations. As the coffee shop is farther from every other location, it makes sense to make it more expensive to go there. One example of this added costs would be:



To get the total sequence cost, we would need to count the cumulative distance Robbie travels before reaching a goal state.