[Back to Moodle] [Back to Course at a Glance]

Assignment 1

Due: 2345 T 6 SEP

[Detailed instructions] for completing and submitting.

1. [20 points] Suppose we have an agent that works to make an office building 'intelligent'. This means that the agent is responsible for automatically heating, cooling, and lighting areas of the building where there are people present. Sensors can tell the agent where people are currently. The agent must turn lights on when people enter a room and turn them off again within 2 minutes of the people leaving the room. The agent must keep the areas with people currently present at an appropriate temperature, say within a set four-degree range. If the room is too cold or too hot for more than 20 minutes, people will leave and the company will lose money. Heating and cooling rooms takes some time, depending on the size of the room. Therefore, the room may not be within the four-degree range when a person enters, but should get within the range before the 20-minute time limit. Answer the following questions about the agent.
   a. Define a PEAS specification for the agent.
   b. Is it sufficient for the agent to be simple reflex? Why or why not?
   c. Would it be beneficial for the agent's performance if it randomly heated or cooled rooms where there are no people currently? Identify possible disadvantages to this sort of random action.
   d. Suggest one improvement to the agent design. Since every improvement carries drawbacks, what are the drawbacks to yours?

2. [10 points]
   a. Describe a PEAS (R&N Ch. 2) specification for Watson.
   b. Discuss at least three separate aspects of the Jeopardy problem domain together with the hardware and/or software design choices in Watson that are rational given those problem aspects.
   c. Describe the DeepQA approach developed for Jeopardy and name the six architectural roles that are designed in this model.

3. [20 points] Consider a state space where the start state is labeled 1 to each state k has three successors: labeled (k^2) + 1, (k^2) + 2, and (k^2) + 3 respectively.
   <=""> Draw the portion of the state space for states 1 to 1370.
4. Suppose the goal state is 101. List the order in which states will be visited for the breath-first search.
5. Suppose the goal state is 101. List the order in which states will be visited for the depth-limited search with limit 3.
6. Suppose the goal state is 101. List the order in which states will be visited for the iterative deepening search with initial cutoff 1 and cutoff increment 1.

- [10 points] Fill in the following table with proper description of the agents' environment:
- [40 points] Here is a road map of Romania similar to R&N Fig. 3.2 [map]. (The numbers on the edges indicate the distance between the cities connected, but you don't need these distances until the next assignment.)

In a language of your choice (Java, Python, or C++), implement the Depth-First Search and Breadth-First Search algorithms. Your code should keep track of nodes expanded and should be able to compute the length of this list. Then run your algorithms on the Romanian road map. To save a bit of typing, you may use this file for the cities and roads: [roads.pl]. This is a Prolog source file, and this assignment does not use Prolog, so you will have to modify it for use with your code. Notice also that Assignment 1 does not use the road distances, or the longitude/latitude of the cities.

a. [10 points] Consider the path from Lugoj to Bucharest and the path from Bucharest to Lugoj. Run your algorithms and show the paths returned by DFS and BFS results for each case. How do the solution paths compare for the two algorithms? Give an explanation for what you observe.
b. [10 points] Is there a case where Depth-First performs worse than Breadth-First (in terms of number of cities visited in the path, not the distance)? If yes, what is the case? If not, explain why.
c. [10 points] Is there a case where Breadth-First performs worse than Depth-First (in terms of number of cities visited in the path, not the distance)? If yes, what is the case? If not, explain why.
d. [10 points] For the same graph, perform a hand-execution of Depth-First Iterative Deepening (DFID) with increment and cutoff initialized to 1, starting at Fagaras. List the nodes in the order expanded for the first five iterations of DFID, and the state of the datastructure (stack) after each iteration. Expand the nodes alphabetically and insert them in nondecreasing alphabetical order. How does this list compare with the list of expansions in Breadth-First Search?

Top of Page