

Algorithms and Problem Solving (15B11CI411)

Tutorial 14-15

Week 14-15 (1-11th May, 2018)

Q1. You are given two jugs, a 4-litre one and a 3-litre one. Neither have any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 litres of water into 4-litre jug? Formulate the problem as a state-space problem

1. Define a state space that contains all the possible configurations of the relevant objects.
2. Specify the initial states.
3. Specify the goal states.
4. Specify a set of rules

Represent a state of the problem as a tuple (x, y) where x represents the amount of water in the 4-gallon jug and y represents the amount of water in the 3-gallon jug.

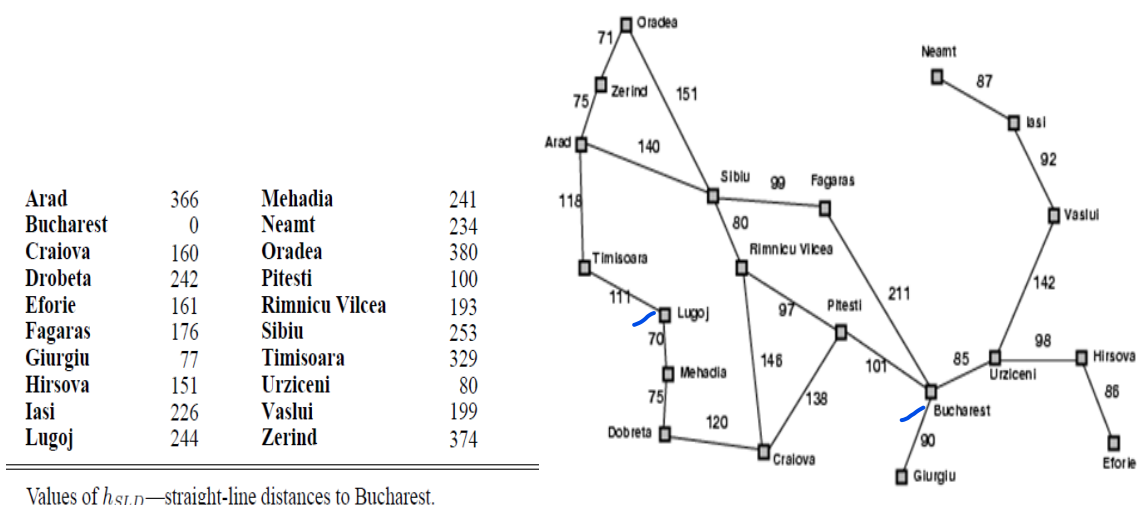
Q2. Your goal is to navigate a robot out of a maze. The robot starts in the center of the *maze* facing north. You can turn the robot to face north, east, south, or west. You can direct the robot to move forward a certain distance, although it will stop before hitting a wall.

- a. Formulate this problem. How large is the state space?
- b. In navigating a maze, the only place we need to turn is at the intersection of two or more corridors. Reformulate this problem using this observation. How large is the state space now?
- c. From each point in the maze, we can move in any of the four directions until we reach a turning point, and this is the only action we need to do. Reformulate the problem using these actions. Do we need to keep track of the robot's orientation now?
- d. In our initial description of the problem we already abstracted from the real world, restricting actions and removing details. List three such simplifications we made.

Q3. Consider a state space where the start state is number 1 and each state k has two successors: numbers $2k$ and $2k + 1$.

- a. Draw the portion of the state space for states 1 to 15.
- b. Suppose the goal state is 11. List the order in which nodes will be visited for breadth-first search, depth-limited search with limit 3, and iterative deepening search.

Q4. Trace the operation of A* search applied to the problem of getting to Bucharest from Lugoj using the straight-line distance heuristic. Show the sequence of nodes that the algorithm will consider.



Q5. Define different Types of Complexity Classes along with 2 suitable examples for each class. Also mention the relation between them.