The University of Adelaide
School of Computer Science

Artificial Intelligence Workshop 1

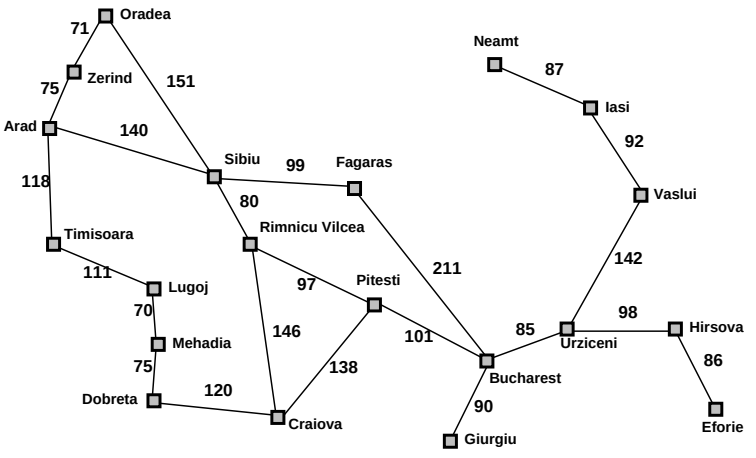
Question 1 (Question 3.8 of AIMA 2ed)
Consider a state space where the start space is 1 and the successor function for state n returns two states: $2n$ and $2n+1$.

(a) Draw a portion of the state space up to state 15.

(b) Suppose the goal state is 11. List the order in which the nodes would be visited for:

1. Breadth-first
2. Depth-limited (to 3)
3. Iterative-deepening
4. Bi-directional search starts the search from the start state and end state, and stops as soon as the two search trees meet. Would bi-directional search work for this problem? If so describe how it would work.

Question 2 (Question 4.1 of AIMA 2ed)
Using Figure 1, show the steps in expanding nodes for an A* search for the shorted path from Lugoj to Bucharest (using the straight line distance heuristic).



Straight−line distance to Bucharest	
Arad	366
Bucharest	0
Craiova	160
Dobreta	242
Eforie	161
Fagaras	178
Giurgiu	77
Hirsova	151
Iasi	226
Lugoj	244
Mehadia	241
Neamt	234
Oradea	380
Pitesti	98
Rimnicu Vilcea	193
Sibiu	253
Timisoara	329
Urziceni	80
Vaslui	199
Zerind	374

Figure 1: Map of Romania with straight-line distances.

Question 3 (Question 4.2 of AIMA 2ed)
A heurisitic path algorithm is a best-first search algorithm with the objective function $f(n) = (2-w)g(n) + wh(n)$. Assuming $h(n)$ is admissible, then:

(a) For what values of w is it guaranteed to be optimal?

(b) What kind of search is performed in the special case $w = 0$?

(c) What kind of search is performed in the special case $w = 1$?

(d) What kind of search is performed in the special case $w = 2$?

Question 4 (Question 3.2 of AIMA 3ed)
Your goal is to navigate a robot through a maze; see Figure 2. The robot enters the maze from the top left facing south. 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 robots orientation now?

(d) Define an appropriate path cost and heuristic function for this problem.

(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.

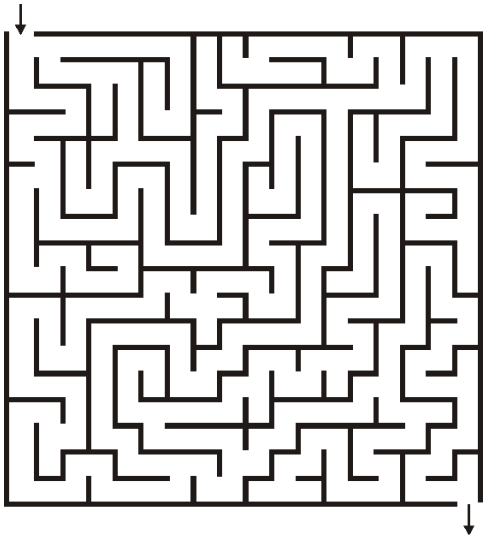


Figure 2: A simple maze.