Assignment 2
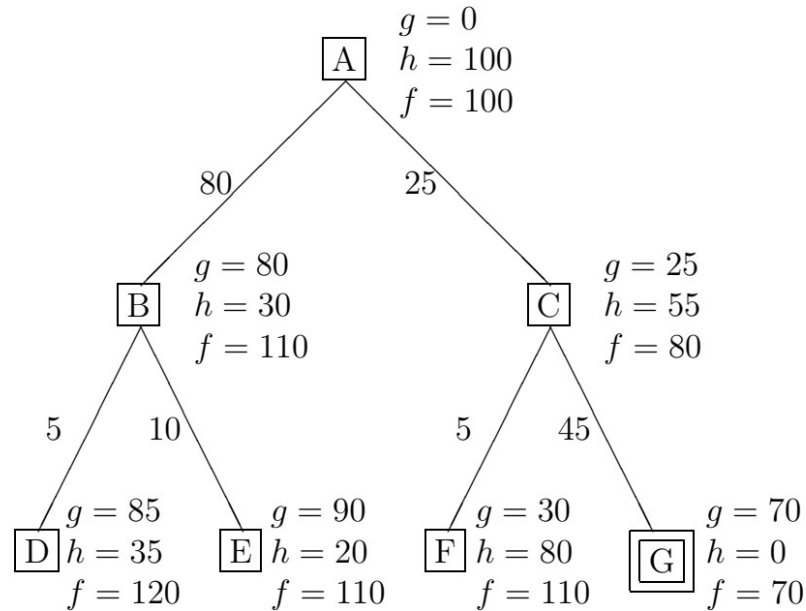**Total points: 30**

1. [10 points] Consider the search tree below. Here g = actual cost to a node from start node (A), h is the heuristic value for the node, and f = g+h is the f-value. Here G is the goal node.

$$g = 0$$
$$\boxed{A} \quad h = 100$$
$$f = 100$$

80   25

$$g = 80$$
$$\boxed{B} \quad h = 30$$
$$f = 110$$

$$g = 25$$
$$\boxed{C} \quad h = 55$$
$$f = 80$$

5   10   5   45

$$g = 85$$
$$\boxed{D} \quad h = 35$$
$$f = 120$$

$$g = 90$$
$$\boxed{E} \quad h = 20$$
$$f = 110$$

$$g = 30$$
$$\boxed{F} \quad h = 80$$
$$f = 110$$

$$g = 70$$
$$\boxed{G} \quad h = 0$$
$$f = 70$$

What order will the nodes be visited according to DFS, BFS, LCFS, IDS, and A* search methods?

2. [20 points] Suppose two robots are positioned in an 8 x 8 maze (see figure 1 below) and they want to meet in the same cell. The black cells in the figure are blocked; one cannot move into that cell. In every step, each robots can move one cell up, down, left, right, or not move at all. Suppose each move costs 1. Also the robots do not alternate turns, they move simultaneously. For example, if the robots are initially at the locations as shown in figure 1 below and chooses to move up and left respectively, at step 1, they will end up at the locations shown in the figure 2.

Robot1

Robot2

figure 1: Initial position of Robot1 and Robot2

figure 2: Position of the robots after step 1

a. [6 points] How would you formulate it as a single agent search problem -
i. How would you represent the states?
ii. What are the possible moves/actions from a state? (Fix an order of the moves to be explored.)
iii. How would you represent the start state in the above example and its children/successor states based of the order of the moves?
iv. How many legal states are there for this particular instance of the problem?
v. How would you test whether the state you have reached is a goal state?
vi. What would be an admissible heuristic for this problem? Justify why it is admissible.

b. [4 points] Which of the following problems will be able to find the optimal solution to the problem – BFS, DFS, LCFS, and A*? Why or why not.

c. [10 points] Show the execution of the above algorithms up to 5 steps: in each step show which path is selected from the frontier, and the contents of the frontier at the end of the step.

Submission Instructions:

You will submit a pdf file containing the solution to problems. The pdf file should be named yourID_assign2.pdf (e.g., 172001001_assign2.pdf). You should write the solution by hand, then scan and create a pdf.