Introduction to Robotics (Fall 2022)

MAE 345 / ECE 345 / COS 346 / MAE 549

Assignment 3

Due Wed, Oct. 5th by midnight

Collaboration on the assignment is permitted (encouraged). But, you must turn in your own solutions for *all* portions of this assignment (theory and coding portions).

Part I: Theory

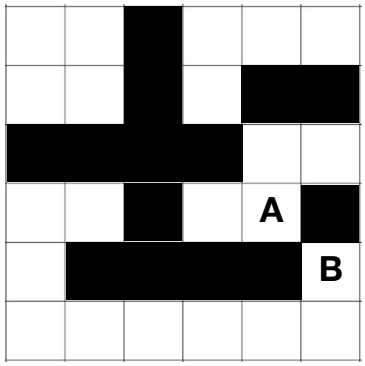

Figure 1: Environment for Problem 1.

Problem 1. Consider the environment shown in Figure 1. Our robot wants to get from cell A to cell B.

(a) (5 pts) Draw a graph (i.e., a set of vertices and edges connecting them) representing the environment shown in Figure 1. You can assume that the robot can only move up/down/left/right (i.e., the robot cannot move diagonally).

(b) (15 pts) Go through up to 5 iterations of Breadth First Search (BFS) on the graph you defined in part (a). For each iteration, write down the current vertex x being explored, its neighbors, and the vertices in Q (just as we did in class in Lecture 6). (Note: If the algorithm terminates before you complete 5 iterations, you can just stop there).

(c) (15 pts) Now go through 5 iterations of Depth First Search (DFS) on the graph you defined in part (a). For each iteration, write down the current vertex x being explored, its neighbors, and the vertices in Q. (Note: If the algorithm terminates before you complete 5 iterations, you can just stop there).

(d) (5 pts) Now suppose the robot can move diagonally as well. Update the graph from part (a) to take this into account.

(e) (10 pts) Repeat part (b) for this new graph.

Part II: Coding

Please follow the link to our GitHub page and follow the instructions in the "Install Instructions" and "Working on Assignments" sections. Please complete the problem in the "Lab3.ipynb" notebook. When you have completed this, please follow the submission instructions below.

Submission Instructions

Part I: Theory Submission You can submit your written work for Part I (Theory) in Gradescope (accessed via Canvas) to "HW3: Theory". You will have the option to submit each problem as individual images or the entire assignment as one PDF. If submitting as one PDF, Gradescope will ask you to identify where problems are located. For more information, watch "For students: submitting PDF homework" from Gradescope's Get Started page https://www.gradescope.com/get_started.

Part II: Coding Submission Please submit your completed Jupyter Notebook (Lab3.ipynb file) for Part II (Coding) in Gradescope to "HW3: Coding".