CMSC477: Robotics Perception and Planning
Homework 1: Graph-Based Planning

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January 31, 2023

1 Introduction

In this assignment, you will learn to find the shortest valid path for a robot to move from a source to a destination, given a series of obstacles. You will be solving these problem using Graph-Based Search Algorithms:

- Breadth-First Search (BFS)

- Depth-First Search (DFS)

- Djikstra

2 Programming

For this assignment, you will write a planner in Python that generates a path from a given start position to an end position in a known 2D environment. You will be solving the same problem with three different aforementioned algorithms. Djikstra's algorithm is an algorithm for finding the shortest paths between nodes in a graph, which is analogous to creating a road network toward a goal location in Google Maps. *(Keep in mind that you will be using your planner code for future hands-on lab sessions.)*

2.1 Maps

You will be running all three algorithms on three different maps of size $100\times$: `Map1.csv`, `Map2.csv`, `Map3.csv`. You can download the data from here. In each of these files, every cell is assigned an integer value from 0 to 3 that represents:

- 0: Free-Space

- 1: Obstacle

- 2: Robot's Start Position
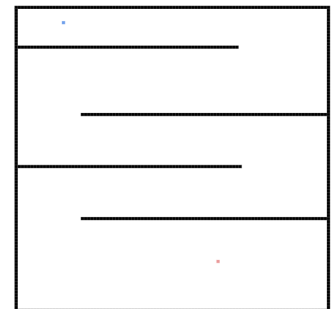
- 3: Robot's Goal Location

Figure 1: `Map1` visual representation

3 Submission Guidelines

You will require to submit `bfs.py`, `dfs.py` and `djikstra.py`, along with its any necessary supporting files if needed. You will also be submitting results in a video (.AVI/.MP4) or GIF format like this (BFS algorithm).

3.1 Grading

All the files must be compressed into a single `.zip` file.

1. 20 pts: `bfs.py` along with results.

2. 20 pts: `dfs.py` along with results.

3. 40 pts: `djikstra.py` along with results.

4. 20 pts: Compare and contrast the speed, number of nodes visited and computational complexity required to search for each algorithm in all three maps. Submit a text/pdf file answering this part. Cite the resources if you have referred any document/online webpages.

4 Collaboration Policy

You can discuss the assignment with any number of people. But the solution you turn in **MUST** be your own. Plagiarism is strictly prohibited. A plagiarism checker will be used to check your submission. Please make sure to cite any references from papers, websites, or any other student's work you might have referred to.