Nada Laabid
Imana Guessous
CSC 4301 01
Pr. Tajjeedine Rachidi

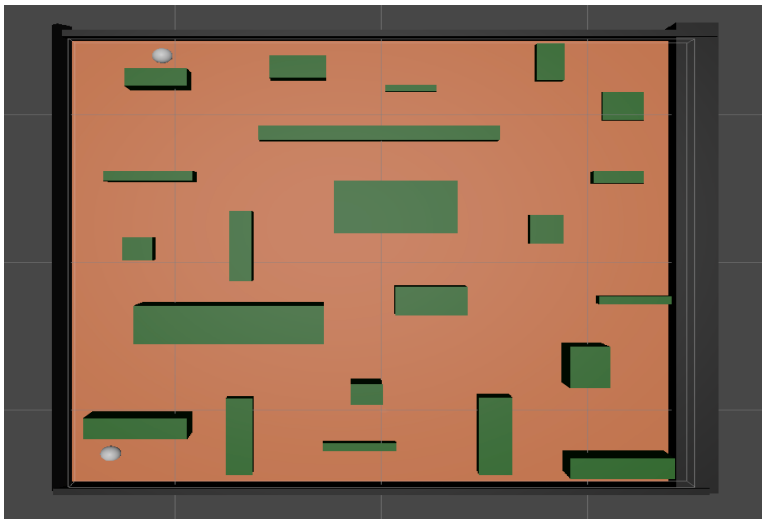
Report of Project 1: Pathfinding Project

Introduction:

In this project, me and my teammate Imana Guessous reproduced the pathfinding project from Sebastian Lague's Youtube videos and GitHub and experiment with different search strategies and heuristics. We first built our own environment with our obstacles, and then added the different codes for the strategies. Sebastian League implemented the A* search algorithm with his own heuristic. The strategies we decided to use are: BFS, DFS, UCS, A* algorithm with Manhattan distance heuristic, A* algorithm with Euclidean distance heuristic as well as A* algorithm from Sebastian Lague's GitHub and videos. We will compare the time that each strategy took to find the solution as well as the length of each solution found.

The Environment:

We built the following environment that you can see on the screenshot below using Unity2d and following Sebastian League's Youtube Tutorial. We decided to have a 3x3 scale for the grid and have 21 obstacles of different sizes and in different locations. The two white spheres are the start point and the end points respectively.



The Comparison between the strategies used:

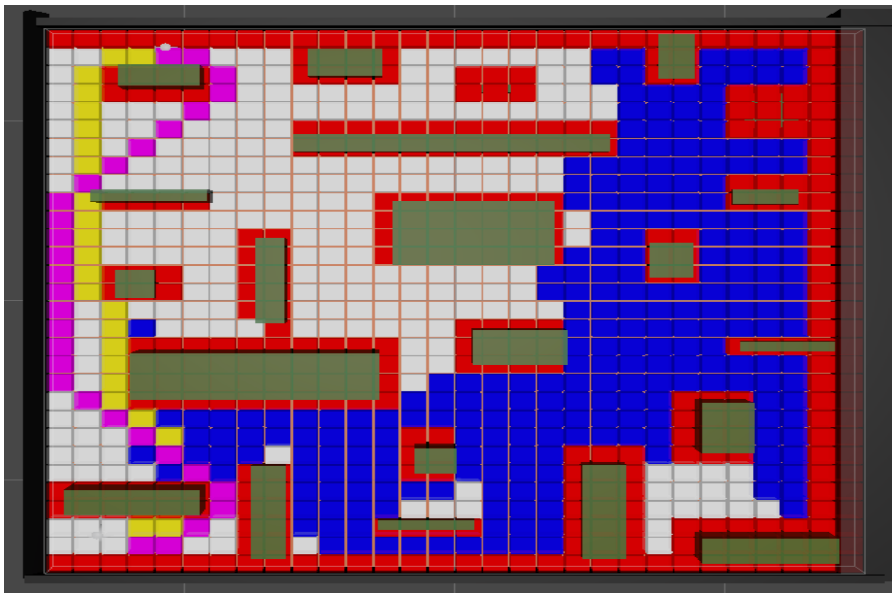
The paths:

After running all the six strategies we search to find a path in our environment, we get the following results.

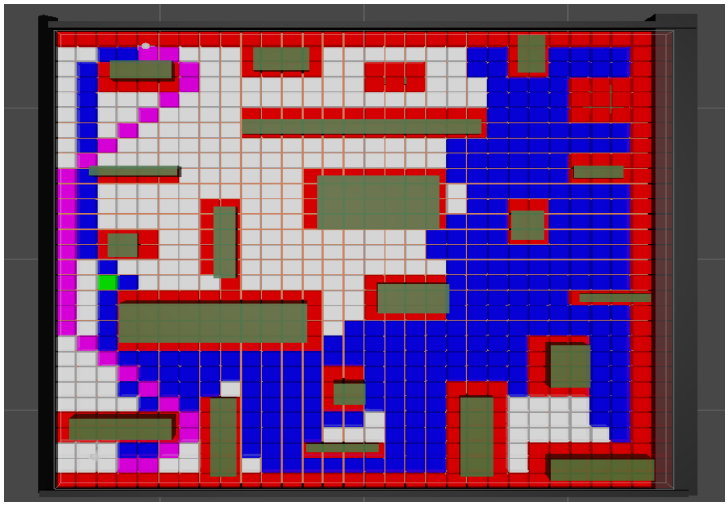
We used six different colors to represent the different paths found by the strategies, which are as follow:

- A* algorithm (Sebastian Lague): black
- A* algorithm with Manhattan distance heuristic: cyan
- A* algorithm with Euclidean distance heuristic: green
- DFS: blue
- BFS: yellow
- UCS: magenta

Not all colors show in the figures because some of the paths found by different strategies overlap. An example of this is show in the following two figures.


(Figure 1)

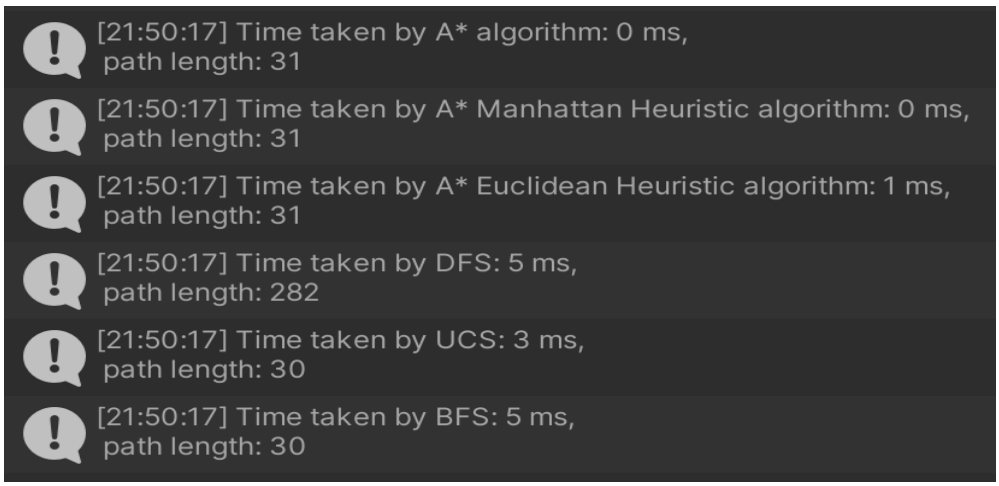
In the figure above, we run the following strategies in the following order:
A* algorithm with Manhattan distance heuristic, A* algorithm with Euclidean distance heuristic, DFS: blue, UCS: magenta, A* algorithm (Sebastian Lague), BFS: yellow.


(Figure 2)

However, in the figure above, we run the following strategies in the following order: A* algorithm (Sebastian Lague), A* algorithm with Manhattan distance heuristic, A* algorithm with Euclidean distance heuristic, DFS: blue, UCS: magenta, BFS: yellow.

The time and path length comparison:

The following figure shows the results of the paths displayed in Figure 2.



(Figure 3)

We notice from the figure that DFS was the slowest and gave us the longest path which proves that it is not optimal. However, UCS algorithm and BFS gave us the shortest path in this case. A* algorithm with all three heuristics performed well as it gave us short paths and in a very short time.