AI Maze Assignment - Eoin Lynch – C16310846

Task 1

In the first section I used the depth-first search algorithm. This is a uniformed search algorithm that is like the depth-first algorithm used for tree structures. It traverses to the deepest note that has not been expanded upon. This can become an issue if the depth of a search is extremely long, as such limits can be put in place to help this if issues are run into. The first Maze I solved using the depth-first search algorithm is map 1 which is a 5x5 maze that can be seen in figure 1 on the following page. In this maze I set my starting point as 3,3 and my end point as 1,5. In the design of the map I defined each white box as empty but connected to the other white boxes surrounding it, excluding the horizontal ones. The walls in this maze were not defined so that the search could not use the wall to travel to another box. The design of this maze was also implemented into Maze 2. The screenshot below shows the output of the depth-first search on Map 1.

```
% c:/Users/sterl/OneDrive/Documents/AssignmentsANDLabWork/Assignments/AI/AI_Q1_M1.pl compiled 0.00 sec, 45 clauses
?- solve((3,3),Solution).
Solution = [(1, 5), (1, 4), (1, 3), (1, 2), (1, 1), (2, 1), (3, 1), (3, 2), (..., ...)]
```

This shows that the depth-first search took the shortest route of 8 steps in this case, although this may not often the case. The longest search that could have took place is 12 steps. Below is a screengrab of the results of running the query on Maze 2 which is a 6x5 maze.

```
% c:/Users/sterl/OneDrive/Documents/AssignmentsANDLabWork/Assignments/AI/AI_Q1_M2.pl compiled 0.00 sec, 58 clauses
?- solve((3,1),Solution).
Solution = [(2, 4), (2, 5), (1, 5), (1, 4), (1, 3), (1, 2), (1, 1), (2, 1), (..., ...)]
```

The goal for this search was to get to 2,4 from 3,1 and the depth-first search managed this in 8 steps which is 2 more steps than the shortest route . The longest route the search could have taken is 17 steps.

Task 2

I was unable to make any progress in the completion of Task 2.

AI Maze Assignment - Eoin Lynch – C16310846

Task 3

The algorithm I used for Task 3 is the A* (A Star) algorithm that is an informed search algorithm.. This algorithm is often used to approximate the shortest path in real life situations such as in maps or games. It is considered a smart search algorithm as it uses a pathfinder to plan before choosing a route. I solved Maze 1 first which is the 5x5 maze. The setup of the maze in prolog code was the same as in the last task except that I had to specify a distance between each square which is something I did not have to do before. Since each square is directly beside each other and horizontal traversal of squares is not allowed the distance between each square was set to 1. I also had to set the H value for each white box. This was set to 1 as the H value is used to measure the distance a box takes. The below is an example of the A* algorithm working on Maze 1. The aim of this was to traverse from 3,3 to 1,5.

```
% c:/Users/sterl/OneDrive/Documents/AssignmentsANDLabWork/Assignments/AI/AI_Q3_M1.pl compiled 0.00 sec, 69 clauses
?- solve_astar((3,3),Path/Cost).
Path = [(3, 3), (3, 2), (3, 1), (2, 1), (1, 1), (1, 2), (1, 3), (1, 4), (..., ...)],
Cost = 8
```

The distance it took the A* algorithm to reach the goal in this case was 8 which is the smallest distance and the same number of steps it took for the depth first algorithm. The main test I was interested in was in Maze 2 which interested me as the depth-first algorithm took an extra 2 steps to reach the goal of getting from 3,1 to 2,4.

```
% c:/Users/sterl/OneDrive/Documents/AssignmentsANDLabWork/Assignments/AI/AI_Q3_M2.pl compiled 0.00 sec, 86 clauses
?- solve_astar((3,1),Path/Cost).
Path = [(3, 1), (2, 1), (1, 1), (1, 2), (1, 3), (1, 4), (2, 4)],
Cost = 6
```

The A* algorithm performed very well in this case and took the least number of steps at 6 steps. This shows that the A* algorithm can do a very good job at finding the most optimal route to a point. In my opinion this is worth the small performance hit that can be caused by the planning phase.

AI Maze Assignment - Eoin Lynch – C16310846

Figure 1 – Mazes that were used.