CMPU4010: ARTIFICIAL INTELLIGENCE

CONTINUOUS ASSESSMENT – MAZE

This CA is worth **30%** of your overall module mark.
Submission deadline is **29th April 2022.**

PROBLEM DESCRIPTION:

You task is to implement in Prolog, and evaluate, three different search algorithms for finding a path in a maze. The algorithms you are asked to implement are:

1. Depth-first OR breath-first search
2. Iterative-deepening search
3. A* - you have to decide on a suitable heuristic for A*.

You are allowed to use and modify the code from the labs.

A sample maze is shown in Figure 1: some squares are free to move to (white), others are blocked with a wall (black), so you have to walk around them. From the current square you can move left, right, up and down (no movement on diagonal).

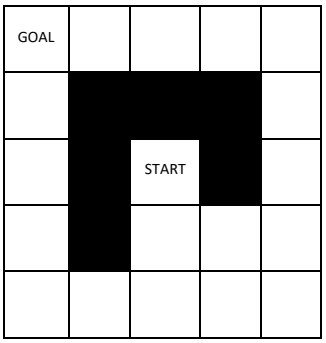

Figure 1 Sample maze.

You don't have to print the maze in Prolog, it's sufficient to print the list of moves from START to GOAL, e.g.

[(3,3), (3,2), (4,2), (5,2), (5,3), (5,4), (5,5), (4,5), (3,5), (2,5), (1,5)]

where the bottom left corner of the maze is (1,1), top left is (1,5), bottom right is (5,1) and top right is (5,5), the start point is (3,3) and the goal is (1,5).

You should be able to run your algorithm for different start and goal positions.

In addition to your Prolog code you should also submit a short document briefly discussing your representation of the maze and any design decisions taken (e.g. do you specify for each square is it empty or it contains a wall, or do record the walls only, and if a square doesn't contain a wall it is therefore empty). In your documentation discuss the solutions for each algorithm when applied to two mazes (you can use the two sample ones included in this document, or you can use another maze that may illustrate your points better). Also include an illustration of the path the algorithm followed through the maze to the goal. Discuss the performance of the different algorithms.

You should write your code to be as flexible as possible and to work for a new maze setup with minimal changes.

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SUBMISSION:
Deadline for submissions 29th April 2022. Marks will be deducted for late submissions.

Submit your assignment through Brightspace, and include your Prolog code and the document describing how you approached the problem and what your findings are.

PLAGIARISM:
Plagiarism is a serious offence – do not use other people's code, as well as do not share your files with others and do not share them online (e.g. public github)!

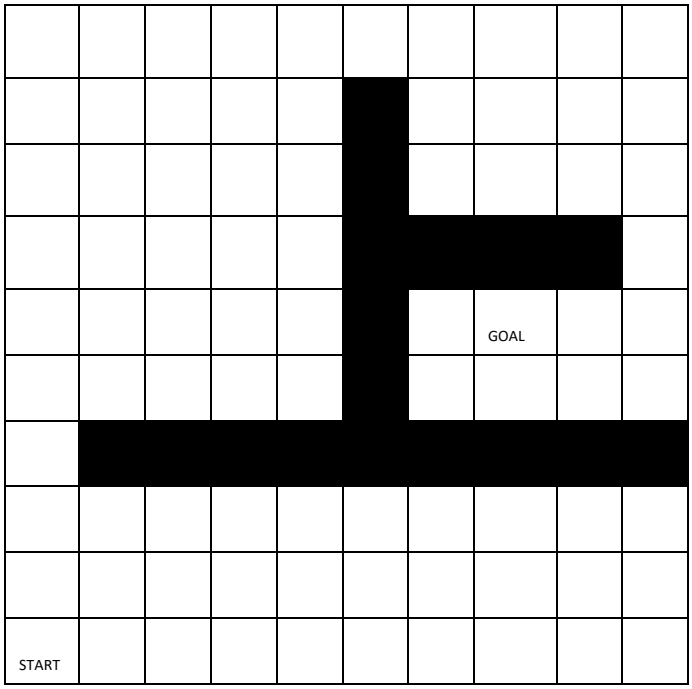

Figure 2 Sample maze 2

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MARKING SCHEME:

Prolog code		70 marks
Encoding a maze		10
Implement DF or BF algorithm		10
Implement IDS algorithm		20
Suitable A* heuristics		10
Implement A*		20
Report		30 marks
20-30 marks	The student has clearly put a lot of thought and effort into the analysis and has discussed representation and illustrated advantages and disadvantages of the different algorithms using two different maze setups.	
10-20 marks	The student has done a good job but hasn't really gone in depth beyond the basic analysis.	
0-10 marks	The report is very basic and minimal.	