GIFTUNIVERSITY

GUJRANWALA

(Chartered by the Govt. of the Punjab, Recognized by HEC)

School of Engineering and Applied Sciences

Data Structures and Algorithm (CS-242)

Final Assignment

PRACTICAL

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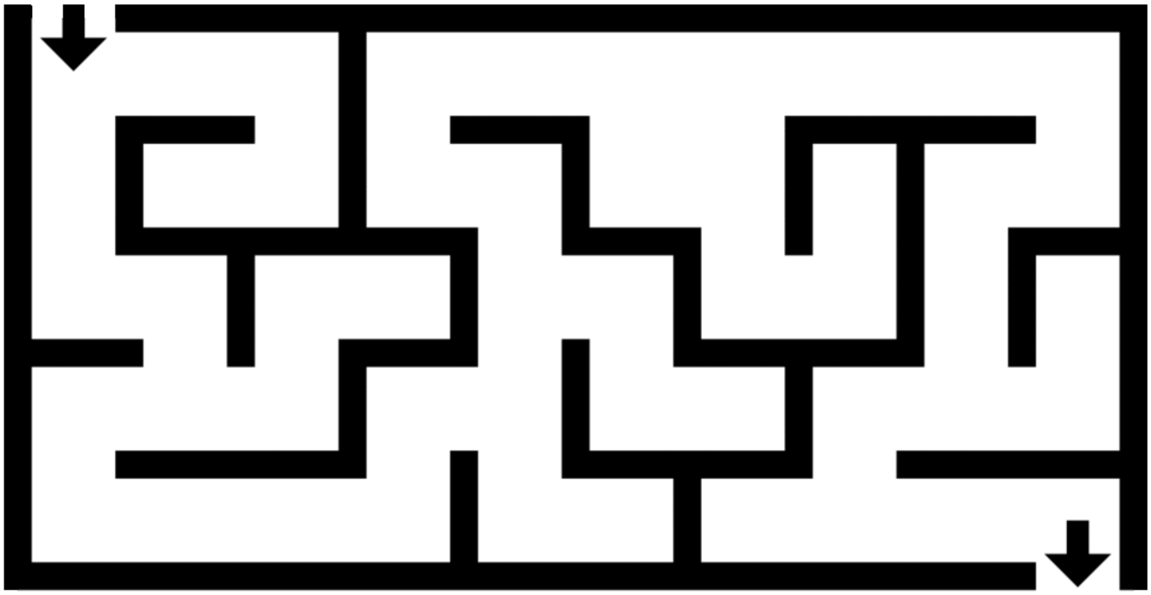
Maze Problem

Maze

A maze is a path or collection of paths, typically from an entrance to a goal. The word is used to refer both to branching tour puzzles through which the solver must find a route, and to simpler non-branching ("unicursal") patterns that lead unambiguously through a convoluted layout to a goal. (The term "labyrinth" is generally synonymous with "maze", but can also connote specifically a unicursal pattern.) The pathways and walls in a maze are typically fixed, but puzzles in which the walls and paths can change during the game are also categorized as mazes or tour puzzles.



Mazes have been built with walls and rooms, with hedges, turf, corn stalks, straw bales, books, paving stones of contrasting colors or designs, and brick, or in fields of crops such as corn or, indeed, maize. Maize mazes can be very large; they are usually only kept for one growing season, so they can be different every year, and are promoted as seasonal tourist attractions. Indoors, mirror mazes are another form of maze, in which many of the apparent pathways are imaginary routes seen through multiple reflections in mirrors. Another type of maze consists of a set of rooms linked by doors (so a passageway is just another room in this definition). Players enter at one spot, and exit at another, or the idea may be to reach a certain spot in the maze. Mazes can also be printed or drawn on paper to be followed by a pencil or fingertip. Mazes can be built with snow.

Solving Maze

Maze solving is the act of finding a route through the maze from the start to finish. Some maze solving methods are designed to be used inside the maze by a traveler with no prior knowledge of the maze, whereas others are designed to be used by a person or computer program that can see the whole maze at once.

The mathematician Leonhard Euler was one of the first to analyze plane mazes mathematically, and in doing so made the first significant contributions to the branch of mathematics known as topology.

Mazes containing no loops are known as "standard", or "perfect" mazes, and are equivalent to a tree in graph theory. Thus, many maze solving algorithms are closely related to graph theory. Intuitively, if one pulled and stretched out the paths in the maze in the proper way, the result could be made to resemble a tree.

Maze in Data Structures

There are many ways to represent the maze in programming language and you need data structures for that. From many ways of representing maze few are representing a maze using a graph, where each Node represents the position of a cell in the maze and all other connected nodes explains the possible move available from that cell to other cells.

Another way to represent a maze is a 2-D array where each index is the cell and all connected cells are possible places to move from that cell. In order to restrict the move, we can use different values like **1** for empty cell (which can be visited), **0** for the blocked cell (wall) and X for the cell which has Bomb in it, which can kill. A sample maze of size 5x5 is attached here.

1	1	1	1	1
1	0	1	0	1
X	X	X	0	1
0	1	1	1	1
X	X	X	0	1

You can use the same data structure to represent a maze.

Path Finding

So, you must have an idea about the maze now, but the issue is that there is a Mouse which wanted to find a path from a starting position which is the top left place and wanted to pass the maze, and passing the maze will get him food, destination position the bottom right position.

A possible path from source to destination is highlighted in the given maze below

1	1	1	1	1
1	0	1	0	1
X	X	X	0	1
0	1	1	1	1
X	X	X	0	1

Task

Now your task is given below

1. Represent a Maze in any Data Structure, you can use Graph, LinkedList, ArrayList.
2. You can search for any algorithm which finds the shortest path in the maze.
3. Understand and Implement that algorithm to find the shortest path in the maze from source to destination.
4. Your algorithm must avoid the bombs and remember Mouse cannot pass through the blocked cell.
5. Your algorithm must print the Shortest path from source to destination or can print **-1** if there isn't any path available from source to destination.
6. Source and destination can be changed for evaluation of better working of your algorithm.

Hint

There are many search algorithms which can be used to solve this problem. Some of them are listed below

1. (Breadth-First Search) BFS
2. (Depth First Search) DFS
3. Dijkstra's Algorithm
4. Bellman-Ford Algorithm

Anything taken from internet or any other source, will cost you 0 marks in this assessment.

End of Question Paper.