YILDIZ TECHNICAL UNIVERSITY

COMPUTER ENGINEERING DEPARTMENT

Maze Solver

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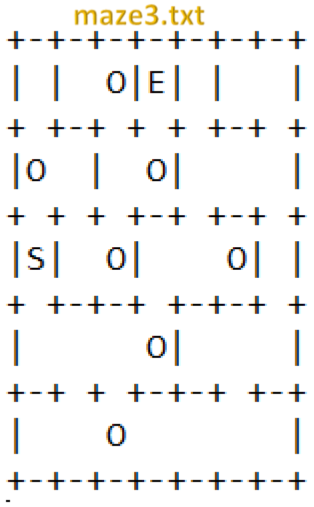
Problem:

We are trying to figure out how to get out of a maze that we have entered. You earn **10** points for collecting apples on the roads you travel through during your maze tour, and you lose **5** points for touching the wall on a dead-end road. At first, the apples were placed at random.

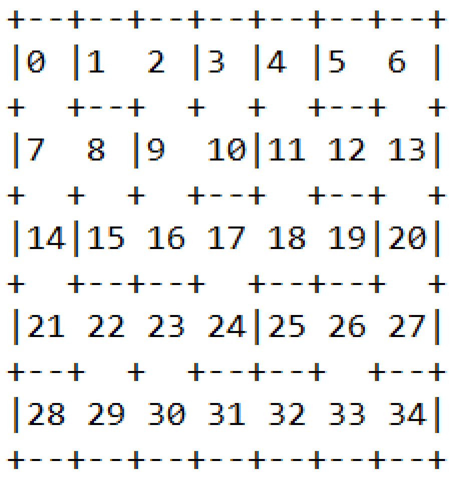
The **“maze.txt”** file provides the maze as an input. The letter **‘S’** indicates the starting point and the exit point is indicated by the letter **'E'**. Letter **'O'** stands for apples (Big O)

maze3.txt



```
+-+-+-+-+-+-+-+
| |  O|E| |   |
+ +-+ + + +-+ +
|O  |  O|     |
+ + + +-+ +-+ +
|S|  O|    O| |
+ +-+-+ +-+-+ +
|      O|     |
+-+ + +-+-+ +-+
|    O        |
+-+-+-+-+-+-+-+
```

test.txt



```
+--+--+--+--+--+--+--+
|0 |1  2 |3 |4 |5  6 |
+  +--+  +  +  +--+  +
|7  8 |9  10|11 12 13|
+  +  +  +--+  +--+  +
|14|15 16 17 18 19|20|
+  +--+--+  +--+--+  +
|21 22 23 24|25 26 27|
+--+  +  +--+--+  +--+
|28 29 30 31 32 33 34|
+--+--+--+--+--+--+--+
```

Solution:

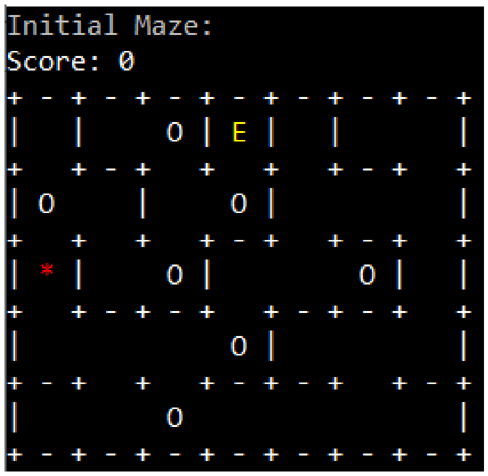
Three different data structures are used to store the maze:

1) It is first saved as a two-dimensional array of characters that displays the maze as it appears in the text file. Later on, this array (**mazeMatrixChar[][]**) is used to display the maze's current situation.
2) The readMazeBinary() function reads the maze and saves it to **mazeMatrixBinary[][]** as binary. The number one is assigned to the cells, and the number zero is assigned to the walls.
3) Finally, the binary matrix is used to create a graph (**mazeGraph**). To keep track of the graph's edges, I used an adjacency list.

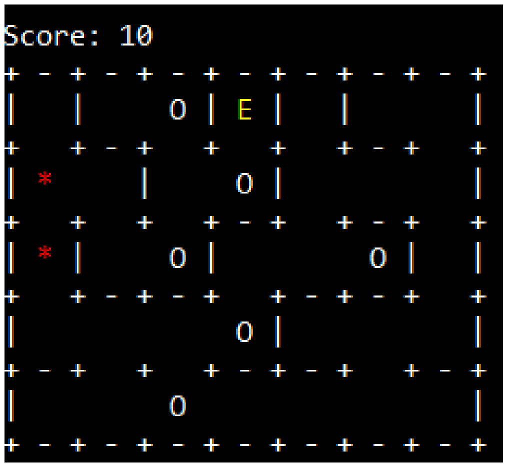
To solve the maze, I used the DFS algorithm, which is an algorithm for traversing or searching tree or graph data structures. Before backtracking, the algorithm starts at the root node and explores as far as possible along each branch.

Visualization of the Algorithm:

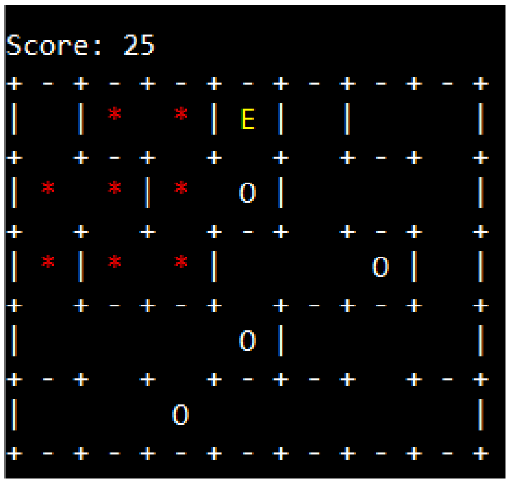
The current and previously visited cells (nodes) are marked with a star (*) to show the steps in reaching the goal (‘c’).



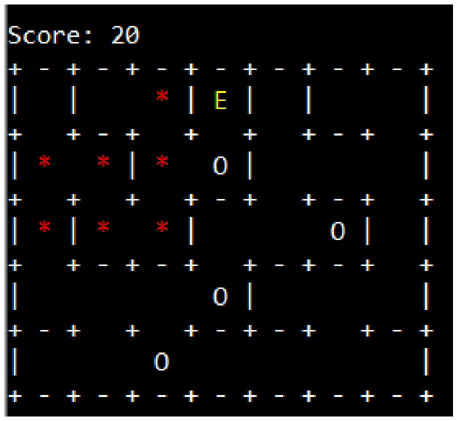
```
Initial Maze:
Score: 0
+ - + - + - + - + - + - + - +
|   |     O | E |   |       |
+   + - +   +   +   + - +   +
| O     |     O |           |
+   +   +   + - +   + - +   +
| * |     O |         O |   |
+   + - + - +   + - + - +   +
|             O |           |
+ - +   +   + - + - +   + - +
|         O                 |
+ - + - + - + - + - + - + - +
```



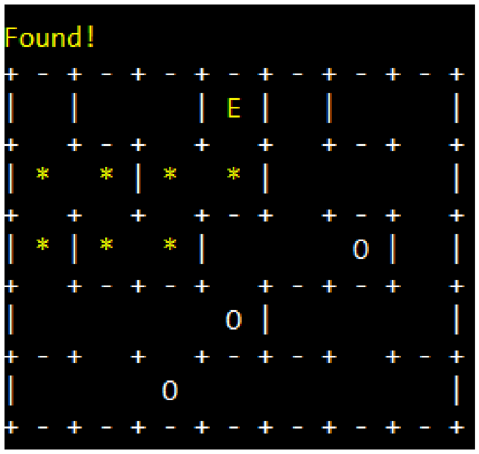
```
Score: 10
+ - + - + - + - + - + - + - +
|   |     O | E |   |       |
+   + - +   +   +   + - +   +
| *     |     O |           |
+   +   +   + - +   + - +   +
| * |     O |         O |   |
+   + - + - +   + - + - +   +
|             O |           |
+ - +   +   + - + - +   + - +
|         O                 |
+ - + - + - + - + - + - + - +
```



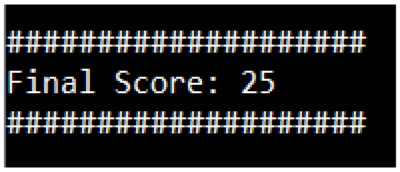
```
Score: 25
+ - + - + - + - + - + - + - +
|   | *   * | E |   |       |
+   + - +   +   +   + - +   +
| *   * | *   O |           |
+   +   +   + - +   + - +   +
| * | *   * |         O |   |
+   + - + - +   + - + - +   +
|             O |           |
+ - +   +   + - + - +   + - +
|         O                 |
+ - + - + - + - + - + - + - +
```



```
Score: 20
+ - + - + - + - + - + - + - +
|   |     * | E |   |       |
+   + - +   +   +   + - +   +
| *   * | *   O |           |
+   +   +   + - +   + - +   +
| * | *   * |         O |   |
+   + - + - +   + - + - +   +
|             O |           |
+ - +   +   + - + - +   + - +
|         O                 |
+ - + - + - + - + - + - + - +
```



```
Found!
+ - + - + - + - + - + - + - +
|   |       | E |   |       |
+   + - +   +   +   + - +   +
| *   * | *   * |           |
+   +   +   + - +   + - +   +
| * | *   * |         O |   |
+   + - + - +   + - + - +   +
|             O |           |
+ - +   +   + - + - +   + - +
|         O                 |
+ - + - + - + - + - + - + - +
```



```
####################
Final Score: 25
####################
```

Video Link:

https://youtu[redacted]