Data Structure and Algorithm [Assignment 1]

Submission to be done on UCP PORTAL
Deadline: Saturday, April 27, 2024, 11:59pm

Task 1

Let us implement Rat in a MAZE as example problem that can be solved using a Stack. A Maze is given as N*N binary matrix of blocks where source block is the upper left most block i.e., maze[0][0] and destination block is lower rightmost block i.e., maze[N-1][N-1]. A rat starts from source and has to reach destination. The rat can move in four directions: back, forward, up and down.

In the maze matrix, 0 means the block is dead end and 1 means the block can be used in the path from source to destination. Visited path (visited index) should be marked as -1. Note that this is a simple version of the typical Maze problem. For example, a more complex version can be with limited number of moves.

All inputs and outputs will be done using filing. Input file name will be ***input.txt*** and output will be in ***output.txt***.

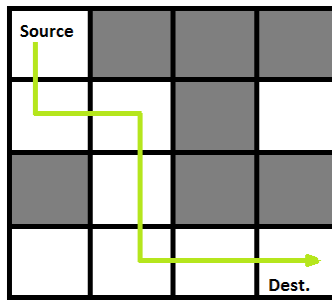Following is an example maze.

```
Gray blocks are dead ends (value = 0).
```


Following is binary matrix representation of the above maze (in file "***input.txt***"). Each row is in a new line; numbers in each row are separated by white spaces.

```
1    0    0    0

1    1    0    1

0    1    0    0

1    1    1    1
```

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Following is maze with highlighted solution path.

Following is the solution matrix (output of program) for the above input matrix. The output will be placed in "*output.txt*"

```
1       0       0       0

1       1       0       0

0       1       0       0

0       1       1       1
```

Note: In case of multiple path, the very first path found should be saved. If the solution does not exist, that is, you are not able to find a path, write: **PATH NOT FOUND** in the file "*output.txt*".

Task 2

The compiler scans the expression either from left to right or from right to left.

Consider the expression: **a + b * c + d**

The compiler first scans the expression to evaluate the expression "b * c", then again scan the expression to add "a" to it. The result is then added to "d" after another scan. The repeated scanning makes it very in-efficient. It is better to convert the expression to postfix (or prefix) form before evaluation. The corresponding expression in postfix form is: "a b c*+d+". The postfix expressions can be evaluated easily using a stack.

Implementation

You have to implement the following functionality using stack which takes input of fully parenthesized **infix expressions** and **convert it to postfix form.**

Sample Input:

(((12 + 13) * (20 - 30)) / (811 + 99))

Sample Output: (there is a single space in between each operator and operand)

12 13 + 20 30 - * 811 99 + /

Hint:

Take input in a character array. If there is a space in between 2 digits, consider them as separate numbers. For example: 12 will be considered as TWELVE, however, 1 2 will be ONE and TWO. Our algorithm cannot contain negative numbers, otherwise, you will have to pop multiple items till a starting bracket. We are popping 2 values only.