Robot Racers

Spring Problem-Solving Tutorial

February 9, 2014

1 The Problem

This is a variation on a maze-solving problem. Suppose we represent a maze as a 2-D grid, $N \times N$, where each cell of the grid is either filled with a wall or open. There are m robots placed in the maze; each in a unique, different location. One cell in the maze is the goal, all the robots are trying to reach the goal. Your task is to determine which robot is closest to reaching the goal. You assume that each robot takes the shortest route between its starting location and the goal, that all robots move at the same speed, and that two robots may occupy the same cell at the same time. A movement of the robot moves it one cell to the right, to the left, up, or down: discrete movements. Not diagonal movements allowed.

Below is a picture showing a very simple 5×5 maze with three robots in it. Robot 1 is 8 steps from the goal, robot 2 is 14 steps from the goal, and robot 3 is 6 steps from the goal. Thus robot 3 will be the winner.

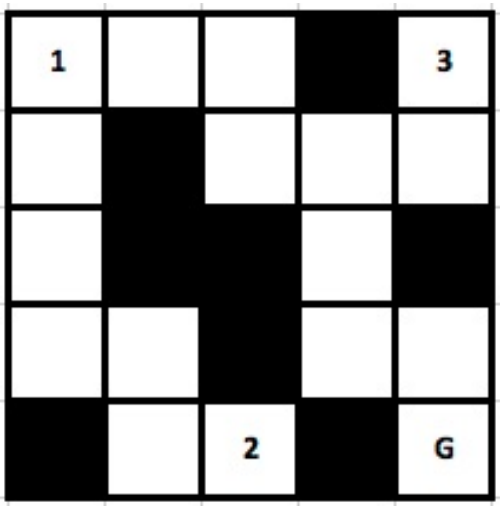

Figure out the path from each robot to the goal, and report which one(s) are shortest. Note that two or more robots could potentially be equally close to the goal. It is possible that some robots cannot reach the goal; some parts of the maze may be cut off from the goal.

2 Input

The input will contain one problem to solve. The first line of the input will have two integers on it, N and m, separated by one or more whitespace characters. The allowable ranges are: $2 \leq N < 100$ and $1 \leq m \leq 9$.

After the first line, there will be N more lines. Each line will contain one string, N characters long. These lines specify the initial configuration of the maze. Each line specifies the contents of one row of the maze: the character `'O'` (oh, not zero) represents an open square in the maze grid, the character `'X'` represents a blocked square in the

maze grid. There will be exactly one `'G'` in one of the strings, representing the goal location. And there will be m numbers, starting with 1, representing starting locations of the robots in the maze.

3 Output

Your output should simple list the robot(s) that are closest to the goal, on a single line, separated by spaces.

4 Sample Input

```
5 3
1OOX3
OXOOO
OXXOX
OOXOO
XO2XG
```

5 Sample Output

```
3
```