Problem Statement

Your friends have been shipwrecked and lost on an Island. Fortunately for them, you can help them find their way to safety by guiding them to an exit. Considering there is heavy fog on the Island, they will be relying on you to give them instructions to move (you can do this!). Giving them a wrong instruction will result in them falling into pits!
You will be given the map of the Island. The map is a grid which lists different types of blocks.

Green Indicates a safe zone. Upon reaching this zone your friend will be saved!

Purple Indicates the current location of your friend

Black Indicates a pit, if your friend moves on this block they can never be saved!

You will need to provide a solution to the above problem in the form of the path your friend must take. You only have the following instructions: **up, down, left, right**.
To simplify the solution use u for up, d for down, l for left and r for right. A solution looks like: `rdrrul` this means the path is: right-down-right-right-up-left.

Note that you cannot move further from the map you are given, if your friend is on the left-most side, moving left will result in losing.

Instructions

Download and extract the file `lab1.zip` from moodle. You can ask the lab instructor to assist you if you are not familiar with extracting zip files. Create a text-file called `solution.txt` in it write the answers to the questions you will be asked.
The puzzle-solver will display one or more maps, then allow you to type in commands to attempt to solve the problem step-by-step. If the command-window turns green, it means the solution is valid. You will then be able to see the amount of moves you needed to solve it. If the command-window turns red, it means you did not solve it. At any point you can double-click the command-window to restart.
You can draw a map in your solution as a set of X to mark pits, S to mark start and E to mark End, and blank space to mark empty cells as follows:

```
XXXXX
XS  X
X X E
XXXXX
```

The solution to that is: `rrdr`

Problem 0

Take a good 15 minutes to read the instructions first (without asking your lab instructor for help). Understanding of the problem is crucial before attempting to solve it! Open `Problem1` in the folder you downloaded to get a visualization of one instance of the problem.

- Come up with a set of at least 3 example maps and solutions to them and write them in `solutions.txt`. Make sure that your maps illustrate different scenarios of the problem.

Problem 1

Run `Problem1` in the folder you are given. This should display one map. Answer the following questions:

1. What is the domain of the problem?

2. What are the parameters of the problem?

3. List some of the assumptions that are taken into account

4. Find one solution to the problem and note it down.

5. Find two different paths that solve the problem with the same amount of moves.

6. Does your solution work for all possible scenarios and maps one could give you? Think of at least 3 extra commands and describe their functionality. For each command describe and argue as to why it would be useful in a small paragraph.

Problem 2

Run `Problem2` in the folder you are given. You will notice multiple maps. The original problem has been changed to the following: You can now help multiple friends at the same time, however they can hear only you giving the commands and must all move in the same way! The only way to solve it is to reach a safe zone on all three simultaneously. That is the first person cannot reach a green block without the rest doing so at the same time.

1. What are the new problem parameters?

2. Write at least 2 examples with their solutions

3. Find a valid solution to the problem you have been given.

4. Elaborate in a paragraph a possible approach to solve the problem for all possible maps.

Problem 3

The fog on the Island seems to have intensified and you cannot be given an accurate map but have to explore it. After making a move your friends will now tell you what the 4 blocks adjacent to them are (up,down,left,right).

1. Is the problem now different from the ones before? Are the parameters different?

2. Run `Problem3` and find all possible safe zones. List them along with the number of moves it took to find them. What is the shortest path?

3. Can you think of a way to solve this problem for all kinds of maps? Explain your answer in a paragraph.

Problem 4

Suppose now you are the evil mastermind that actually plan for people to get shipwrecked on islands. To design your ultimate plan, you need to choose specific Islands where you can increase the chance of people falling into pits. As such you will be given the path and you must design a map under the following restrictions:

- The path given to you must be a valid path

- The map must contain multiple paths (we need to confuse the people so they fall into pits!)

- The map must contain at least 8 pits (remember, we are really trying to make them fall!)

- The map size will be provided to you as well along with the path.

The map format is given in `Instructions`. To test your map, save it in a file called `custom.txt` in the folder `mymap` and run `Problem4`.

1. What are the problem parameters?

2. Find a valid solution for a map size 8×8 and the path `dddrrrul` save it as `4-1.txt`

3. Can we find a solution for the path `rrrrrrdrr` and a map size 6×6. Explain your answer.

4. Can we find a solution for any problem where the map is 3×3? Explain your answer in a paragraph.

5. Design a map that has no solution regardless of map size or path provided. Save it as `4-2.txt`

6. Design a map that contain multiple paths, and challenge your lab instructor to solve it in the least amount of steps. Explain the reasonning behind your choices to the instructor. Save it as `4-3.txt`

Submission

Submit your solution as one zipfile containing solution.txt, 4-1.txt, 4-2.txt and 4-3.txt.
Name your file 205_sec_username.zip
Where sec is your section number and username your aub username.