

# Assignment I — Structs and Arrays

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Deadline: **October 5, 11:59pm**, 2023

## Problem 1. Finding the largest area (40%)

### Description

The first line of the input data contains an integer which indicates the  $n$  of input records ( $1 \leq n \leq 1000$ ), and the second line shows the  $n$  numbers separated by a space. Each number is the height of the rectangle, and the width is always equal to 1. These  $n$  rectangles form an irregular area. You need to find the largest rectangle area from this irregular area. A set of sample input and output are provided below.

### Test case examples

- Sample Input

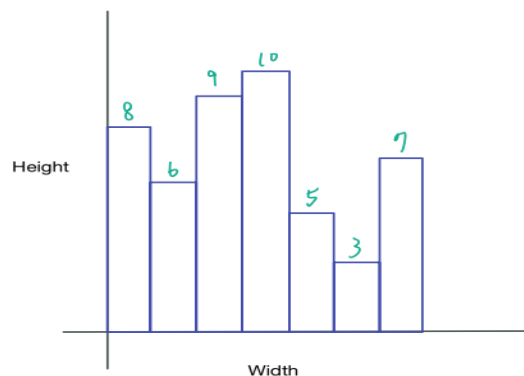
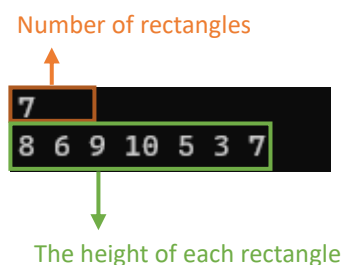


Figure 1: Example of an irregular area combining the several rectangles

- Sample Output

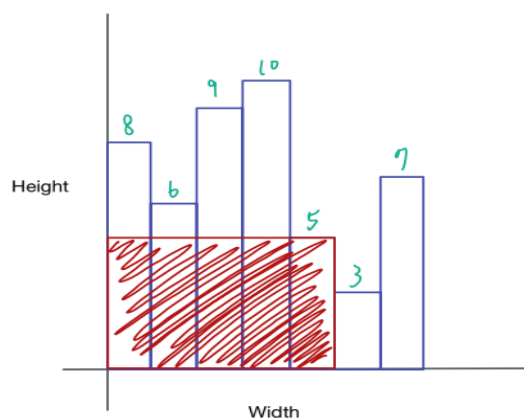


Figure 2: The maximum rectangle area

## Problem 2. Minesweeper (55%)

### Description

The first line of the input data contains an integer which indicates the size of a 2D array, and the rest of the input data shows  $n \times n$  characters. Three types of characters, '0', '\*', and '@', are given. '0' is the place where you need to show the number of how many mines around it in the output. '\*' defines a mine. '@' indicates a center of a  $3 \times 3$  matrix and you need to transpose that  $3 \times 3$  matrix. The details are described as follows.

#### ©Step 1:

Determine how many mines are around each character '0', and change the number 0 to the correct number. Character '0' is the center of  $3 \times 3$  matrix. There are eight characters around it.



Figure 3: Mine distribution map

#### ©Step 2:

Traverse the matrix by visiting each row one by one, starting from the top-left corner of the matrix. When meeting a character '@', you need to transpose the  $3 \times 3$  matrix. The transpose of a matrix is obtained by moving the rows data to the columns and columns data to the rows. The number of @ might not only be 1. \_

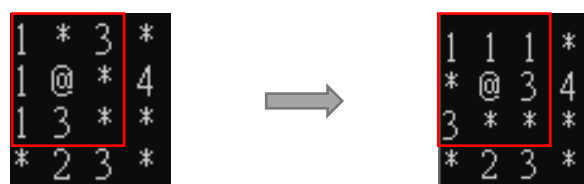
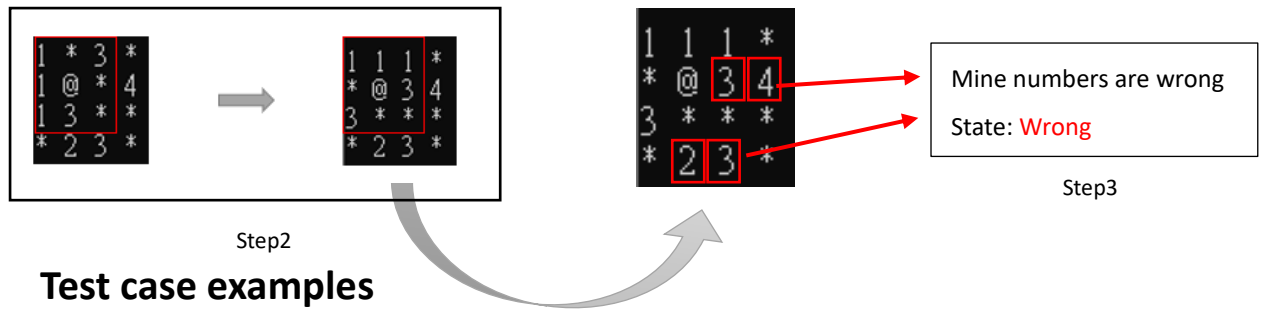


Figure 4: Transpose of the matrix

#### ©Step 3:

You need to determine if the data after transpose still maintains the correct state of the mine number around. If yes, print 'Correct'. If no, print 'Wrong'.



The following input and output are examples for testing your program. The format of your input and output should be exactly the same as shown in the following figures.

- Sample Input(1)

```
4
0 * 0 *
0 @ * 0
0 0 * *
* 0 0 *
```

Size of 2D array ex:4\*4

n\*n array

- Sample Output(1)

```
1 * 3 *
1 @ * 4
1 3 * *
* 2 3 *
```

The result of step 1 (calculate the number of mines around)

```
1 1 1 *
* @ 3 4
3 * * *
* 2 3 *
```

The result of step 2 (transpose of a 3\*3 matrix)

Wrong

The result of step 3 (the number of mines is not correct)

- Sample Input(2)

```
5
0 * 0 * 0
0 0 0 * 0
* 0 * 0 *
0 @ 0 0 0
* 0 0 0 *
```

- Sample Output(2)

```
1 * 3 * 2
2 3 4 * 3
* 2 * 3 *
2 @ 1 3 2
* 1 0 1 *

1 * 3 * 2
2 3 4 * 3
* 2 * 3 *
2 @ 1 3 2
* 1 0 1 *

Correct
```

## Readme, comments, and coding style

An indicator for good source code is readability. To keep source code maintainable and readable, you should add comments to your source code where reasonable. A consistent coding style also helps a lot when tracing the source code. For this assignment, please also compose a readme file in \*.txt format and name it as "README.txt". This file should contain a brief explanation of how to use your program. Please remember to have your source code comments and readme file in English.

## Submission

To submit your files electronically, login DomJudge website through the following url : <http://domjudge.csie.io:12345>

Press the submit button and choose the homework questions you want to submit. After submitting your code, DomJudge will give you a result to tell you whether your code is correct or not. **Please note that our code will be evaluated by different sets of test cases.** Please make sure your code can work correctly based on the description above. Additionally, you must compress your code and the README file into a **zip** file and upload it to Ecourse2. Otherwise, you will get zero point.

**ATTENTION: Do NOT copy others' work or you will get a zero.**

## Grading policies

The TA(s) will mark and give points according to the following rules:

40% - Problem 1

55% - Problem 2

5% - Readme, comments and coding style.