

## Problem 7: Nobody Jumps for the Rank 3 4+6 Points

Problem ID: `reservoir`

Rank: 2+3

### Introduction

To sabotage Evbo from reaching Parkour Master level, Seawatt pulls out the unforeseen lava parkour, where Evbo will need to jump on islands over the Lava to secure the freedom of Parkour noobs everywhere. However, Evbo... the chosen one... learns from the parkour god that he can set the lava level in the temple to whatever height he wants to. In order to 360 jump his way to the top of [Parkour Civilization](#), and to never let another parkour noob be forced to choose between the chicken or the beef ever again, he must conquer this parkour climb!



### Problem Statement

There is a plot of land represented by a grid of cells with  $N$  rows and  $M$  columns, where the cell at row  $i$  and column  $j$  has a height of  $G_{i,j}$ . Evbo can fill the land with lava up to some height  $h$ , which will *submerge* all cells with  $G_{i,j} < h$ . This will leave some number of *islands* (possibly zero); formally, an *island* is a set  $S$  of cells such that:

- All cells in  $S$  are orthogonally (up, down, left, right) contiguous to each other.
- None of the cells in  $S$  are *submerged*.
- All cells not in  $S$  but orthogonally adjacent to any cell in  $S$  are *submerged*.

Evbo wants to choose  $h$  to **maximize** the number of islands—what is this maximum?

## Input Format

The first line of the input contains a single integer  $T$  denoting the number of test cases that follow. For each test case:

- The first line contains two space-separated integers  $N$   $M$  denoting the number of rows and columns in the plot of land, respectively.
- The next  $N$  lines contain  $M$  space-separated integers each, where the  $i^{\text{th}}$  line ( $1 \leq i \leq N$ ) contains  $G_{i,1} \dots G_{i,M}$  describing the heights of each cell.

## Output Format

For each test case, output a single line containing an integer denoting the maximum number of islands Evbo can leave by choosing  $h$ .

## Constraints

Time limit: **1 second**

Memory limit: **256 MB**

### Main (Chicken) Test Set

$$1 \leq T \leq 100$$

$$1 \leq N \leq 30$$

$$1 \leq M \leq 30$$

$$0 \leq G_{i,j} \leq 100$$

It is guaranteed that the sum of  $NM$  over all test cases does not exceed 900.

### Bonus (Beef) Test Set

$$1 \leq T \leq 100$$

$$1 \leq N \leq 500$$

$$1 \leq M \leq 500$$

$$0 \leq G_{i,j} \leq 10^9$$

It is guaranteed that the sum of  $NM$  over all test cases does not exceed 250000.

# Sample Test Cases

## Sample Input

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```
3
6 5
18 2 19 2 10
2 19 13 8 1
11 6 8 11 10
8 14 6 12 9
5 6 15 9 4
2 9 6 15 1
5 7
1 1 1 2 5 1 1
7 5 9 2 2 2 1
1 2 2 1 1 2 5
1 2 5 1 5 2 1
1 1 2 5 2 1 1
10 14
2 2 1 2 2 1 1 1 2 2 9 1 5
2 1 1 3 1 1 3 1 1 1 2 5 9 6
5 2 1 1 1 1 1 5 1 4 1 2 5 8
8 2 3 1 6 6 1 6 5 1 2 2 8 2
6 9 1 1 6 5 1 6 6 5 1 1 2 2
8 5 1 2 2 5 5 1 1 1 1 3 1 2
1 1 1 1 1 2 1 2 2 8 5 1 2 1
1 4 2 8 1 1 1 2 9 5 9 1 8 6
1 2 9 5 1 3 1 2 8 1 1 8 5 8
1 1 6 9 9 1 1 2 1 2 3 1 8 2
```

## Sample Output

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```
8
6
17
```

## Sample Explanations

### Test Case #1:

At  $h = 10$ , the highlighted cells will be submerged, giving us 8 islands. It can be shown that this is the maximum number of islands:

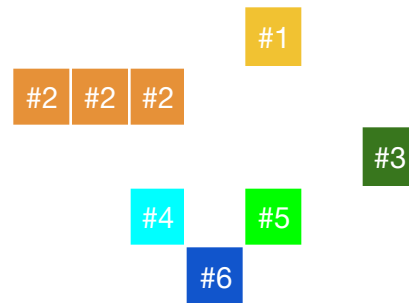
18	2	19	2	10
2	19	13	8	1
11	6	8	11	10
8	14	6	12	9
5	6	15	9	4
2	9	6	15	1



Test Case #2:

At  $h = 3$ , the highlighted cells will be submerged, giving us 6 islands. It can be shown that this is the maximum number of islands:

1	1	1	2	5	1	1
7	5	9	2	2	2	1
1	2	2	1	1	2	5
1	2	5	1	5	2	1
1	1	2	5	2	1	1



Test Case #3:

The maximum number of 17 islands can be achieved by filling the land with lava up to a height of  $h = 7$  or  $h = 8$ .

