

## IOI Training Camp 2010 – Final 1, 25 June, 2010

### Problem 0 Desktop Icons<sup>1</sup>

Happy Singh, lead developer of the Boing search engine at Evil Inc, has a problem for which he needs your help. All employees at Evil Inc are required to use the new generation desktop manager supplied as part of the Evil operating system. In this futuristic operating system, the icons on the desktop are arranged on a toroid and not merely on the plane. This means that from the top row of icons you can reach the corresponding position in the bottom row by scrolling up, and from the bottom row you can reach the corresponding position in the top row by scrolling down. A similar relationship holds when moving horizontally between the leftmost column and rightmost column.

Happy Singh is being harassed by his boss and is eager to take revenge. One day, he finds his boss's screen unlocked and decides to delete an icon from his boss's desktop. Happy's boss has tagged each icon with a *happiness number*, and deleting an icon will mean that his boss's happiness reduces by that amount. Happy's boss has poor eyesight and has magnified his screen resolution so that only an  $a \times b$  rectangular portion of the desktop is visible at any time. Happy decides he will pick one of these rectangles and delete the icon with the second highest happiness number within that rectangle (he does not want to delete the happiest icon to avoid arousing suspicion.)

Your task is to help Happy determine for every  $a \times b$  rectangle, the second highest happiness number within that rectangle. The second highest happiness number in a rectangle is the value in the second position when all the happiness numbers in the rectangle are listed in descending order. You should output the second highest happiness number for all  $a \times b$  rectangles in ascending order.

Remember that the desktop is a toroid and so a rectangle can wrap around from the top row to the bottom row (or vice versa) as well as from the leftmost column to the rightmost (or vice versa).

#### Input format

The first line of the input contains two integers  $M$  and  $N$  giving the number of rows and columns of the grid of icons on Happy Singh's desktop. This is

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<sup>1</sup>Problem formulated by Prateek

followed by  $M$  rows with  $N$  numbers each listing the happiness values of the  $N$  icons in the  $M$  rows. Finally, the last row contains two integers  $a$  and  $b$  indicating the dimensions of the rectangle within which an icon must be deleted.

### Output format

The output must contain  $M * N$  integers reporting the happiness values of the  $M * N$  rectangles of size  $a * b$  in ascending order, one per line.

### Test Data

You may assume that  $2 \leq M, N \leq 40$  and that  $2 \leq a \leq M$  and  $1 \leq b \leq N$ . Every icon has a positive happiness value and will fit in a 32-bit signed integer.

#### Sample input

```
3 3
4 8 3
9 1 3
7 6 2
2 2
```

#### Sample output

```
3
3
4
4
6
7
7
7
8
```

### Time and memory limits

The time limit for this task is 1 second. The memory limit is 44 MB (actual limit 32 MB, plus 12 MB buffer for 64-bit compilation).