Problem Solving Practice
HW Problem #2

CSE4152
Sogang University

Largest N numbers

Let M be an N × N integer matrix, where each element in M is distinct, ensuring that no two elements are equal. Propose an algorithm that efficiently identifies the N largest elements among the elements of M. Furthermore, provide a proof of the correctness of this algorithm. Note that the algorithm does not need to preserve M's initial state.

Example

Input

3

5 12 9

1 8 13

7 2 10

Answer:

13

12

10

Position of k

Consider an N × N matrix of integers where both its rows and columns are arranged in non-decreasing order. Propose an algorithm that, given such a matrix and an integer k, efficiently determines the position of k within the matrix. In cases where there are multiple occurrences of k in the matrix, the algorithm will identify one of them.

Position of k

In this problem, you will only be working within the main.cpp file. The following three functions are provided for you to interact with the problem:

- `query_cell(int r, int c):`
  - Query the value of the cell(r, c). R and c should be in the range [1, n].
  - Returns the value of the cell.
- `answer_with_cell(int r, int c):`
  - Verifies if the value of the cell (r, c) is K. r and c should be in the range [1, n].
- `answer_without_cell():`
  - Verifies if there is no cell with value K in the matrix.

Position of k

Your task

Implement the function `main()`, which should :

- Locate the cell with value K
- Return the position of the cell using the `answer_with_cell()` function
- If there is no cell with value K, return using the `answer_without_cell()` function

Position of k

Interaction

Your Output:

- You will print interactions using the provided query_cell(r, c) function to query the value of the cell (r, c)
- Example
  - ? 1 2 : query the value of the cell [1, 2]

Judge's Response:

- The judge will respond value of the cell (r, c)

Final Answer:

- After determining (r, c) as the location of K, call answer_with_cell(r, c). If there isn't K, call answer_without_cell()
- Example: ! 1 2 means you believe location of K is (1, 2). The judge will then confirm if this is correct.

Position of k

Steps to test your algorithm.

You should test your program by interacting with it by yourself.

Step 1. Create your own N x N matrix

- Before diving into the code, start by setting your N x N matrix.

Step 2. Run the program and answer function `query_cell(r, c)` by your hand.

- based on your matrix, manually type the output of query_cell(r, c).
- For example, if value of your matrix[1, 2] is 3 then type 3 as input of query_cell(1, 2)

Step 3. Type the response for `answer_with_cell(r,c)`

- When `answer_with_cell(r, c)` is called, based on your matrix, if the location of K is indeed at (r, c), input 1; otherwise, output 0.

Position of k

Example

Step 1. Create your own N x N matrix

- Before diving into the code, start by visualizing the relationships as a graph.

4 11
7 16

Your N x N matrix
(e.g. N = 2, K = 16)

Position of k

Example

Step 2. Run the program and answer function `query_cell(r, c)` by your hand.

```
4 11
7 16
```

Your N x N matrix
(e.g. N = 2)

Your Output	Judge	Explanation
	`2 16`	N = 2, K = 16.
`? 1 1`		What is the value of (1, 1)?
	`4`	Value of (1, 1) = 4.
`? 1 2`		What is the value of (1, 2)?
	`11`	Value of (1, 2) = 11.

Interaction

Type answer of query_cell(1, 1) : 4

When you call query_cell(1, 1)

Position of k

Example

Step 3. Type the response for `answer_with_cell(r,c)`

4 11
7 16

Your N x N matrix
(e.g. N = 2)

! 2 2		Does (2, 2) contain K?
	1	(2, 2) contains K.

Interaction

When the answer_with_cell(1, 2) is calld

Type 0 if the answer is incorrect

When the answer_with_cell(2, 2) is called

Type 1 if the answer is correct

answer_with_cell(r, c)

Submission

- Please submit your solution to this coding problem on the Elice platform by Monday, September 30th.
- Late submissions will not be accepted, so make sure to submit on time
- Feel free to post any questions in the Q&A section on the Cyber Campus