Programming 1 — Homework assignment 6

Deadline: Sunday, December 16, 2018, at 23:55

Map

Task description

In the middle of the sea, there is a rectangular geographical area composed of $m \times n$ 'cells'. The map of the area is represented as an integer matrix in which a number 0 represents a cell on the sea, and a number $i > 0$ represents a cell belonging to the i-th country. The sea doesn't belong to any country.

In the rest of this document, we refer to the following example:

$$
\begin{array}{cccccccccc}
0 & 2 & 2 & 2 & 0 & 0 & 0 & 9 & 5 & 5 \\
0 & 0 & 2 & 2 & 0 & 0 & 0 & 0 & 0 & 5 \\
0 & 0 & 2 & 8 & 8 & 0 & 9 & 9 & 0 & 6 \\
4 & 3 & 8 & 3 & 3 & 3 & 0 & 9 & 9 & 6 \\
4 & 6 & 3 & 3 & 7 & 7 & 0 & 0 & 3 & 6 \\
4 & 6 & 6 & 6 & 1 & 1 & 0 & 0 & 6 & 6
\end{array}
$$

Write a program that, upon reading the numbers m and n, a map, and an instruction, executes the instruction in accordance with the rules given in the following text.

Input

All input numbers are integers. The numbers within the same line are separated by a single space.

The first line contains the numbers m and n.

The following m lines represent the individual 'rows' of the map. Each of these lines contains n numbers from the interval $[0, D]$ (D is the number of countries and is not known in advance). These numbers specify the membership of the individual cells to the individual countries (or to the sea). Each of the countries $1, 2, \ldots, D$ consists of at least one cell, but the number of cells on the sea may be equal to zero.

The input ends with a line containing the instruction ($u \in \{1, 2, 3, 4\}$). The instructions are as follows:

- **1**: Print the number of countries in the map. In the given example, there are 9 countries.

- **2**: Print the number of cells on the sea. In the given example, there are 20 such cells.

- **3**: Print D lines such that the i-th line (for $i = \{1, \ldots, D\}$) specifies the coast length of the i-th country. The coast length of a country is the number of that country's cells that belong to the coast. A cell belongs to the coast if it is adjacent to the sea on at least one of its four sides. Since the entire area is surrounded by the sea, all

non-sea cells on the border of the area are part of the coast. The following table shows the coast length of the individual countries in the running example:

country	1	2	3	4	5	6	7	8	9
coast length	2	6	3	3	3	8	1	1	5

- 4: We say that a country b is a *neighbor* of a country a if at least one cell of the country b is adjacent to some cell of the country a.

  To fulfill instruction 4, print the sequential number of the country having the greatest number of neighbors in the first line, and the number of neighbors of that country in the second line. If there are multiple countries with the greatest number of neighbors, choose the one with the lowest sequential number. The following table shows the number of neighbors of the individual countries in the running example:

country	1	2	3	4	5	6	7	8	9
number of neighbors	2	1	5	2	2	5	2	2	3

  The country we've been interested in is thus the one with sequential number 3. It has five neighbors.

Following are the properties of the individual test cases:

- J1–J3, S1–S12: $u = 1$.

- J4–J6, S13–S25: $u = 2$.

- J7–J9, S26–S37: $u = 3$.

- J10–J12, S38–S50: $u = 4$.

- J1–J8, J10–J11, S1–S33, S38–S45: $m, n \in [1, 50]$.

- J9, J12, S34–S37, S46–S50: $m, n \in [1, 1000]$.

Output

Print exactly what the instruction demands.

Test case J7

Input:

```
6 10
0 2 2 2 0 0 0 9 5 5
0 0 2 2 0 0 0 0 0 5
0 0 2 8 8 0 9 9 0 6
4 3 8 3 3 3 0 9 9 6
4 6 3 3 7 7 0 0 3 6
4 6 6 6 1 1 0 0 6 6
3
```

Output:

```
2
6
3
3
3
8
1
1
5
```

Submission

Submit your program as a single file named DN06_*vvvvvvvv*.java, where *vvvvvvvv* represents your student ID number.