

Task 5: Virus

Time Limit: 3 seconds

Memory Limit: 1024 MB

Problem Statement

To get prepared for the annual national day celebrations, $R \cdot C$ soldiers from the National Legged Forced was selected to march in a R by C rectangular grid. The columns are parallel to the north-south direction, and the rows are parallel to the east-west direction. The soldier in the i -th row from north and the j -th column from west is called soldier (i, j) . The soldier in the north-west corner is soldier $(1, 1)$, and soldier in the south-east corner is soldier (R, C) . Every minute, the sergeant will ask these soldiers to face in one of the 4 cardinal directions, namely one of east, west, south or north.

However, it turns out that the sergeant and the soldiers have came up with a secret plan to let them skip their training. It turns out that N of the soldiers are initially infected with DIVOC-91. The sergeant wants to spread DIVOC-91 to all the soldiers.

Every minute after the sergeant has issued a command, any soldier who has DIVOC-91 will infect the soldier he is facing with DIVOC-91, if such a soldier exists. Consider if soldier $(1, 1)$ has DIVOC-91. If the soldiers are facing either north or west, he will not infect anyone. If the soldiers are facing east, he will infect soldier $(1, 2)$. If the soldiers are facing south, he will infect soldier $(2, 1)$. Note that once a soldier is infected with DIVOC-91, he will not be cured.

Help the sergeant find the minimum number of minutes until all soldiers have DIVOC-91 if he chooses the directions optimally.

Input Format

The first line contains 2 integers R, C which is the number of rows and columns respectively.

The second line of input contains an integer N , the number of soldiers initially infected with DIVOC-91.

The following N lines contain 2 integers S_i, E_i , describing the positions of those soldiers initially infected with DIVOC-91.

Output Format

Output the minimum number of minutes until all soldiers are infected with DIVOC-91.

Constraints

- $1 \leq N \leq 300$
- $1 \leq R, C \leq 10^9$
- $1 \leq S_i \leq R$ ($1 \leq i \leq N$)
- $1 \leq E_i \leq C$ ($1 \leq i \leq N$)
- There is at least 1 soldier who is not initially infected with DIVOC-91.
- $(S_i, E_i) \neq (S_j, E_j)$ ($1 \leq i < j \leq N$)

Subtasks

0. (0 points) Sample testcases
1. (2 points) $R, C \leq 4$
2. (3 points) $R, C \leq 40$
3. (15 points) $R \leq 40$
4. (40 points) $N \leq 25$
5. (20 points) $N \leq 100$
6. (20 points) No additional constraints

Sample Input And Output

Sample Input 1

```
3 4
3
1 2
1 4
2 3
```

Sample Output 1

```
3
```

Sample Input 2

```
4 4
4
1 1
1 4
4 1
4 4
```

Sample Output 2

```
4
```

Explanation of Sample Test Cases

In sample input 1 the following soldiers are initially infected with DIVOC-19.

| | | | |
|--|---|---|---|
| | 0 | | 0 |
| | | 0 | |
| | | | |

The grid of soldiers; cells with 0 represent soldiers initially infected with DIVOC-91.

In this sample input, we choose the first 3 directions as south, west, south. Then all the soldiers will be infected with DIVOC-91 after 3 minutes. It can be shown that this is the minimum number of minutes required.

| | | | |
|---|---|---|---|
| 2 | 0 | 2 | 0 |
| 2 | 1 | 0 | 1 |
| 3 | 2 | 1 | 3 |

The grid of soldiers; numbers in the cells represent the time where the soldier is first infected with DIVOC-91.