

2016 Canadian Computing Olympiad

Day 2, Problem 2

Zombie Apocalypse

Time Limit: 2 seconds

Problem Description

Your country has a problem with zombies. That is, it has zombies, which are a problem. Thankfully, you are gainfully employed at the Forsenic Institute for Zoology and Zombie Emerging Studies (FIZZES), and your job is simply to give a measure of how bad the problem is.

You have mapped out your country on an N -by- M array of cells marked with non-negative integers.

You have the exact locations of all the zombies, and know that no two zombies are in the same location. The cells containing a zombie are marked with 0. Next, all the unmarked cells touching a cell (where *touching a cell* means touching on any side or corner of a cell; so each cell touches up to 8 other cells) marked with 0 are marked with 1. Then, all the unmarked cells touching a cell marked with 1 are marked with 2. This process continues until all the cells are marked. These numbers indicate the level of concern your office has about the spread of zombies.

A small example is shown below.

```
2 2 1 1 1 2
2 1 1 0 1 2
2 1 0 1 1 2
2 1 1 1 2 2
2 2 2 2 2 3
```

Your boss has given you an integer Q , and you must determine the number of cells which are marked with the integer Q .

Input Specification

The first line of input will contain two space-separated integers N and M ($1 \leq N \leq 10^9; 1 \leq M \leq 10^9$) indicating the size of the grid. The next line contains the number K ($1 \leq K \leq 2000$), indicating the number of cells that contain zombies. The next K lines each contain two space-separated integers r_i c_i indicating the row and column of the i th zombie ($1 \leq r_i \leq N; 1 \leq c_i \leq M$). No two zombies are in the same cell: thus if $i \neq j$ then $(r_i, c_i) \neq (r_j, c_j)$. The last line will contain the integer Q ($0 \leq Q \leq N + M$).

For 5 of the 25 marks available, $N \leq 1000$ and $M \leq 1000$.

For an additional 5 of the 25 marks available, $K \leq 50$.

For an additional 5 of the 25 marks available, $N \leq 1000$.

Output Specification

Output the number of cells in the grid that are marked with the integer Q .

Sample Input

```
5 6
2
3 3
2 4
2
```

Output for Sample Input

```
15
```

Explanation for Output for Sample Input

The sample input is the example shown above, which has 15 2's.