



## Problem G Smoker's Walk

Ms Millerose is an old hand in the local newspaper business. Throughout her whole career, she has worked in a big hall where each reporter occupies one of the desks neatly organized into a grid. The typewriters are now gone and have been replaced by computers, but that does not bother her. The other change, a non-smoking work environment, has forced her to satisfy her need to smoke, outside of the building regularly. However the stench of smoke that follows her on the walk back to her desk has been a source of inconvenience to her co-workers. Ms Millerose would like to learn how to plan her walk from the hall's entrance, which is located at the north-west corner of the hall, to her desk, so as to minimize the inconvenience to the reporters working at their desks at the time. Your task is to help Ms Millerose, and others in similar situations, by writing a program to plan a smoker's walk in a generic setting that may be described as follows:

Given a grid of  $N$  rows and  $M$  columns with a subset  $Q$  of the grid points occupied,  $Q < N * M$ . Write a program to find a path from the grid point  $(1,1)$ , which is located in the upper-left point in the grid, to another grid point  $(r,c)$  such that:

1. the path consists of a sequence of grid points with the constraint that consecutive points share a row or share a column,
2. the path does not contain a grid point in the subset  $Q$ ,
3. the sum of distances between the points in  $Q$  and the path is maximized.



All office descriptions have been designed such that at least one path exists between  $(1,1)$  and  $(r,c)$ .

The destination grid point is identified by its row number  $r$  and its column number  $c$ . The distance between a grid point  $\mathbf{X}$  and a path  $\mathbf{P}$  in the grid is the minimum number of grid edges required to travel between  $\mathbf{X}$  and  $\mathbf{P}$ .

#### INPUT Format:

The first line of the input contains a positive integer that represents the number of generic office descriptions that follow. The first line in each office description consists of two positive integers  $N$  and  $M$  that represent the number of rows and columns in the grid. The integers are separated by a single space. The second line contains a positive integer  $Q$  that represents the number of currently occupied grid points. Each of the following  $Q$  lines contains two integers that represent the row number  $r$  and column number  $c$  of an occupied point. The last line contains two integers that represent the row number  $r$  and column number  $c$  of the smoker's destination point. The integers are separated by single spaces.  $1 < N \leq 100$ ,  $1 < M \leq 100$ , and  $1 \leq Q \leq 500$ .

#### OUTPUT Format:

For each generic office description the output consists of a single line that contains the number starting with the value of one (1), followed by a “: ”, as shown in the “Example output G” below, and then followed by an integer  $N$  that is the measure of inconvenience a smoker's walk will cause to her office mates.



Input-Output Examples:

Example input G:	Example output G:
4	Office 1: 14
10 10	Office 2: 10
4	Office 3: 10
5 5	Office 4: 19
3 5	
4 6	
2 2	
8 8	
10 10	
4	
5 5	
4 4	
3 3	
2 2	
8 8	
10 10	
4	
1 5	
1 4	
1 3	
1 2	
8 8	
10 10	
4	
5 5	
4 9	
3 3	
2 10	
8 8	