IOI Training Camp 2010 – Test 5, 22 June, 2010

Problem 2 Walk

Finding your destination in a big unknown city like Dommasandra can be challenging, especially if you are a computer scientist like Happy Singh, always trying to use the shortest possible path. Planning can help—given a map of the city, Happy wants to find the shortest path between his current position and his destination.

The map of the city can be represented in the plane as an infinite grid composed of unit squares. Happy is currently located at the square $(0, 0)$ and his destination is the square (X, Y).

There are N buildings in the city. Each building is a rectangle fully occupying a number of unit squares. No two buildings touch or overlap: that is, Happy can walk freely around every building. A building is defined by specifying the coordinates of two diagonally opposite squares occupied by the building.

In each step, Happy can walk to one of the four neighboring squares, but he is not allowed to step onto a square occupied by a building. His current position, $(0, 0)$, is to the west of the city and the x coordinate of every square occupied by a building is strictly greater than zero.

Write a program that, given the locations of the buildings, finds the length of any shortest path from Happy's current position to his destination. The length of a path is the number of squares contained in the path, excluding the initial square.

Input format

The first line of input contains two integers X and Y, where (X, Y) are the coordinates of the destination square. The second line of input contains a single integer N, the number of buildings in the city. Each of the following N lines contains four integers X_1, Y_1, X_2, Y_2, where (X_1, Y_1) and (X_2, Y_2) are the coordinates of two diagonally opposite squares occupied by the building.

Output format

A single line with an integer that is the length of the shortest path to the destination.

Test Data

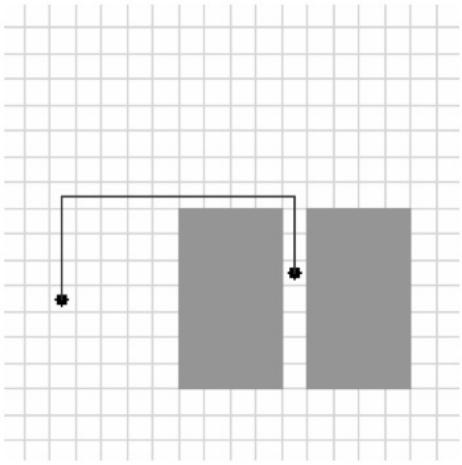
You may assume that for the destination coordinates X and Y, $1 \leq X \leq 10^6$ and $-10^6 \leq Y \leq 10^6$. Also, $0 \leq N \leq 10^5$. Further for each building described by coordinates X_1, Y_1, X_2, Y_2, it is the case that $1 \leq X_1, X_2 \leq 10^6$ and $-10^6 \leq Y_1, Y_2 \leq 10^6$.

Sample input 1

```
9 1
2
5 -3 8 3
10 -3 13 3
```

Sample output 1

```
16
```

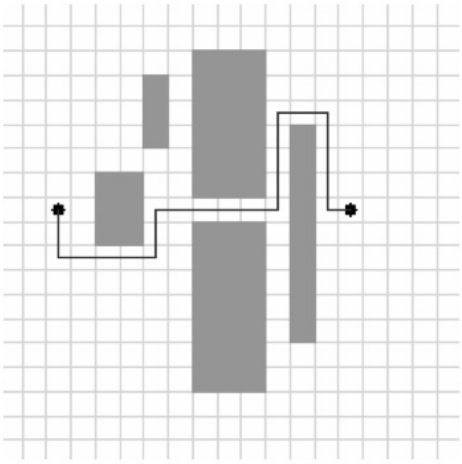


Sample input 2

```
12 0
5
2 -1 3 1
6 -7 8 -1
6 1 8 6
4 3 4 5
10 -5 10 3
```

Sample output 2

```
24
```



Time and memory limits

The time limit for this task is 2 seconds. The memory limit is 76 MB (actual limit 64 MB, plus 12 MB buffer for 64-bit compilation).