Problem 1 - Quantum teleportation

A new team of engineers in Reply is working on a particular kind of quantum computer and wants you to help them!

This quantum computer is composed by a bidimensional grid of size **X** $\times$ **Y** (all the coordinates start at 0) and a single qubit of which we know the initial position ($\mathbf{X}_0$, $\mathbf{Y}_0$). The engineers want to use quantum teleportation to execute programs, so they have placed different teleportation portals on the grid; each of them is located in a precise position ($\mathbf{X}_{in}$, $\mathbf{Y}_{in}$) and has a precise destination ($\mathbf{X}_{out}$, $\mathbf{Y}_{out}$).

In particular the qubit can only travel on the grid moving one cell either horizontally or vertically (that is, without diagonal movements and without leaving the grid) and is attracted by the nearest teleportation portal (the one reachable in the minimum amount of moves). If there are several portals at the same distance, the qubit prefers the one with the smallest $\mathbf{X}_{in}$ coordinate, and in case of same $\mathbf{X}_{in}$ it prefers the one with the smallest $\mathbf{Y}_{in}$ coordinate. Once the qubit reaches a teleportation portal it is immediately teleported to the corresponding destination and the original teleportation portal is removed from the grid (i.e. it is no longer usable). The qubit will continue to move on the grid until no teleportation portals are left.

As the movement of the qubit is very fast (almost as fast as the speed of light) we want your help to write an algorithm to keep track of the total distance (i.e. number of moves) traveled by the qubit during the "attraction" phase (i.e. not counting any distance for the teleportations). Since this number could be very large, you are requested to only print the remainder[1] of this number when divided by 100 003.

Input data

The first line of the input file contains an integer **T**, the number of test cases to solve, followed by **T** testcases, numbered from **1** to **T**.

In each test case the first line contains the two integers **X** and **Y**, the size of the grid.

The second line contain the initial position ($\mathbf{X}_0$, $\mathbf{Y}_0$) of the qubit.

The third line contains the integer **N**, the number of teleportation portals.

The following **N** lines contain 4 integers: $\mathbf{X}_{in}$[i], $\mathbf{Y}_{in}$[i], $\mathbf{X}_{out}$[i], $\mathbf{Y}_{out}$[i], the initial coordinates of the i-th portal and its destination coordinates.

Output data

The output file must contain **T** lines. For each test case in the input file, the output file must contain a line with the words:

Case #t: d

where *t* is the test case number (from **1** to **T**) and *d* is the total distance traveled by the qubit (modulo 100 003).

[1] We remind you that the remainder of the division between one number and another is generally called modulo, and in many programming languages it is performed with the operator % (e.g. 13 % 5 = 3). Also remember that to avoid overflows is recommended to do ((A % R) + (B % R)) % R rather than (A + B) % R.

Constraints

- $1 \leq$ **T** ≤ 20.
- $1 \leq$ **X**, **Y** $\leq 100\,000$.
- $0 \leq$ $\mathbf{X}_0 < \mathbf{X}$ and $0 \leq$ $\mathbf{Y}_0 < \mathbf{Y}$.
- $2 \leq$ **N** ≤ 2000.
- $0 \leq$ $\mathbf{X}_{in}$[i], $\mathbf{X}_{out}$[i] < **X** for each i $= 0 \ldots$ **N-1**.
- $0 \leq$ $\mathbf{Y}_{in}$[i], $\mathbf{Y}_{out}$[i] < **Y** for each i $= 0 \ldots$ **N-1**.
- The initial position of the qubit is not located over a teleportation portal.
- There aren't two or more overlapping coordinates (all the initial and final coordinates are distinct).

Scoring

- **input 1** : **T** $= 1$, **N** ≤ 5, **X** ≤ 10 and **Y** = 1.
- **input 2** : **T** $= 5$, **N** ≤ 10, **X** ≤ 100 and **Y** = 1.
- **input 3** : **T** $= 10$, **N** ≤ 100, **X** ≤ 1000 and **Y** = 1.
- **input 4** : **T** $= 15$, **N** ≤ 1000, **X** $\leq 10\,000$ and **Y** $\leq 10\,000$.
- **input 5** : **T** $= 20$, **N** ≤ 2000, **X** $\leq 100\,000$ and **Y** $\leq 100\,000$.

Examples

input	output
1 3 3 1 1 3 0 0 1 2 0 2 2 0 2 2 1 0	Case #1: 5

Explanation

The qubit is initially located in (1, 1) and all the teleportation portals are at distance **2** from it; the one with the smallest *x* and the smallest *y* is the first one located in (0, 0).

After the first teleportation, the qubit is in (1, 2) and this time both of the remaning portals are at distance **1**, so it moves to the one with the smallest *y* in (0, 2).

After the second teleportation the qubit is in (2, 0). It then moves to the last remaning portals in (2, 2) at distance **2** from it.

The qubit finishes its execution in (1, 0) and the total travelled distance is 2 + 1 + 2 = **5**.

	0	1	2
0	in_0		in_1
1	out_2	start	out_0
2	out_1		in_2

Input grid