Lakeside Walk 2 (lake2)

☞ Note the unusual memory limit for this problem.

Inspired by Carlo's success, Alessandro has decided to start his own software company in the mountains. However, unlike Carlo, he settled in a city where the weather is highly unpredictable.

Initially, the entire city is dry, but over the course of Q days, rainfall and droughts will continuously change its conditions.

Figure 1: The city chosen by Alessandro.

The city is represented as an $N \times M$ grid, with cells indexed from $(1, 1)$ to (N, M).

On day i $(0 \leq i < Q)$, a rectangular region of the grid undergoes a weather change. Given integers x_1, x_2, y_1, y_2, all cells (x, y) satisfying:

$$x_1 \leq x \leq x_2 \qquad \text{and} \qquad y_1 \leq y \leq y_2$$

will switch their state – wet cells become dry, and dry cells become wet.

At the end of each day, Alessandro wonders: What is the total perimeter of the wet regions? Unfortunately, he struggles to find this value. Can you help him determine the perimeter after each day's changes?

☞ Among the attachments of this task you may find a template file `lake2.*` with a sample incomplete implementation.

Input

The input file consists of:

- a line containing integers N, M, Q: N and M represent the size of the city, Q represents the number of days.

- Q lines, with line i consisting of integers $\texttt{x}_{1i}$, $\texttt{x}_{2i}$, $\texttt{y}_{1i}$, $\texttt{y}_{2i}$, representing the rectangular area that will change on day i.

Output

The output file must contain a single line consisting of the Q integers $P_0, \ldots, P_{Q-1}$.

Constraints

- $1 \leq N, M \leq 1\,000\,000$.
- $N \cdot M \leq 10\,000\,000$.
- $1 \leq Q \leq 200\,000$.
- $1 \leq x_{1i} \leq x_{2i} \leq N$ and $1 \leq y_{1i} \leq y_{2i} \leq M$ for each $i = 0 \ldots Q-1$.

Scoring

Your program will be tested against several test cases grouped in subtasks. In order to obtain the score of a subtask, your program needs to correctly solve all of its test cases.

– **Subtask 1** (0 points) Examples.

– **Subtask 2** (9 points) $N, M \leq 100$, $Q \leq 100$.

– **Subtask 3** (33 points) $N, M \leq 1000$, $Q \leq 10\,000$.

– **Subtask 4** (25 points) $N \cdot M \leq 100\,000$.

– **Subtask 5** (33 points) No additional limitations.

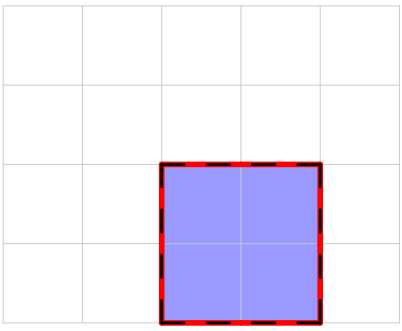
Examples

input	output
4 5 4 1 2 3 4 2 3 4 5 1 4 2 5 1 4 3 5	8 16 24 22

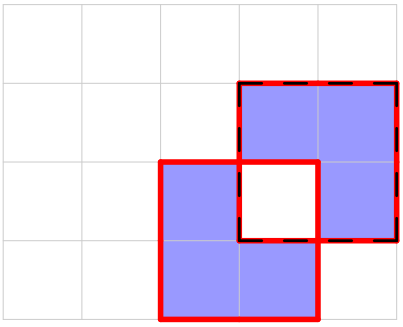
Explanation

In the **first sample case** the city is represented as a 4×5 grid, with $(1, 1)$ being in the bottom left corner.

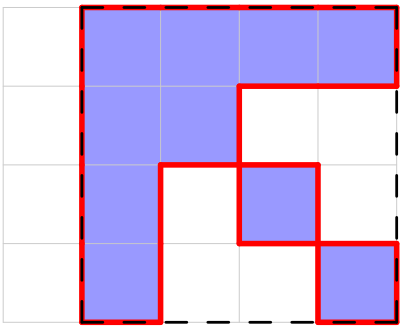
In the following figures, at the end of each day, the wet cells will be colored in blue, a red line will mark the perimeter of the wet regions, and a dashed black line will outline the region affected by a weather change.



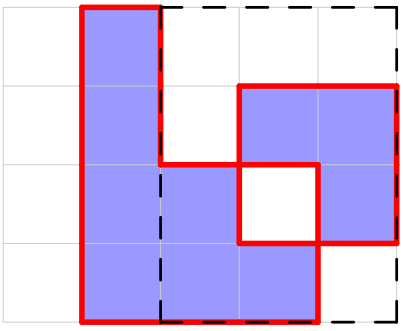
At the end of the first day, the total length of the perimeter is 8.



At the end of the second day, the total length of the perimeter is 16.



At the end of the third day, the total length of the perimeter is 24.



At the end of the fourth day, the total length of the perimeter is 22.