Bitaro's Travel 2

The JOI Mountain Range consists of many mountains. It is represented as a grid with H rows and W columns, where the north-south direction is vertical, and the east-west direction is horizontal. The cell at the i-th row from the north ($1 \leq i \leq H$) and the j-th column from the west ($1 \leq j \leq W$) is denoted as (i, j). There is exactly one mountain in each cell. The height of the mountain at cell (i, j) is $T_{i,j}$.

Bitaro, the beaver, can move between the summits of the mountains using the procedure called **high jump**, which is described below. Here, L is the parameter for his jumping skill.

1. Bitaro floats straight up from the summit of the current mountain. When the altitude of the summit is x, Bitaro will float up to the point of altitude $x + L + 0.5$.
2. Bitaro then repeats moving to the adjacent cell in one of the four directions without changing the altitude. The height of the mountains at the visiting cells must be lower than the altitude at which he is floating.
3. Bitaro finally lands at the summit of the current cell's mountain.

Bitaro is planning for Q trips. In the k-th trip ($1 \leq k \leq Q$), he plans to move from the summit of the cell (A_k, B_k)'s mountain to the summit of the cell (C_k, D_k)'s mountain by only using high jumps. He wants to know if these trips are possible, and if so, he also wants to know the minimum number of high jumps needed, because high jumps require much energy.

The information on the mountains, Bitaro's jumping skill, and his trip plans, are given. Write a program that, for each trip plan, determines whether it is possible, and calculates the minimum number of high jumps needed if the trip is possible.

Input

Read the following data from the standard input.

H W L
$T_{1,1}$ $T_{1,2}$ $\cdots$ $T_{1,W}$
$T_{2,1}$ $T_{2,2}$ $\cdots$ $T_{2,W}$
$\vdots$
$T_{H,1}$ $T_{H,2}$ $\cdots$ $T_{H,W}$
Q
A_1 B_1 C_1 D_1
A_2 B_2 C_2 D_2
$\vdots$
A_Q B_Q C_Q D_Q

Output

Write Q lines to the standard output. In the k-th line ($1 \leq k \leq Q$), output the minimum number of high jumps needed in the k-th trip if the trip is possible. If the trip is impossible, output `-1`.

Constraints

- $1 \leq H$.
- $1 \leq W$.
- $2 \leq H \times W \leq 300\,000$.
- $1 \leq L \leq 10^9$.
- $1 \leq T_{i,j} \leq 10^9$ $(1 \leq i \leq H, 1 \leq j \leq W)$.
- $1 \leq Q \leq 300\,000$.
- $1 \leq A_k \leq H$ $(1 \leq k \leq Q)$.
- $1 \leq B_k \leq W$ $(1 \leq k \leq Q)$.
- $1 \leq C_k \leq H$ $(1 \leq k \leq Q)$.
- $1 \leq D_k \leq W$ $(1 \leq k \leq Q)$.
- $(A_k, B_k) \neq (C_k, D_k)$ $(1 \leq k \leq Q)$.
- Given values are all integers.

Subtasks

1. (10 points) $H \times W \leq 300$, $Q \leq 150\,000$.
2. (20 points) $H \times W \leq 3\,000$, $Q \leq 150\,000$.
3. (20 points) $H \times W \leq 150\,000$, $Q \leq 150\,000$, $(A_k, B_k) = (1, 1)$ $(1 \leq k \leq Q)$.
4. (30 points) $H \times W \leq 150\,000$, $Q \leq 150\,000$.
5. (20 points) No additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
2 4 5 1 3 22 1 8 13 6 16 6 1 1 2 2 1 1 1 3 1 1 2 3 1 1 2 4 1 1 1 4 1 1 1 2	3 -1 3 4 4 1

For the first trip, Bitaro can move from the summit of the mountain at cell $(1, 1)$ to the summit of the mountain at cell $(2, 2)$ by using 3 high jumps, in the following way:

- First high jump
  - Float up from the summit of the cell $(1, 1)$'s mountain. Then, his altitude becomes 6.5.
  - Move to cell $(1, 2)$. It is possible because the height of the mountain at cell $(1, 2)$, which is 3, is lower than 6.5.
  - Land at the summit of the cell $(1, 2)$'s mountain.
- Second high jump
  - Float up from the summit of the cell $(1, 2)$'s mountain. Then, his altitude becomes 8.5.
  - Move to cell $(1, 1)$.
  - Move to cell $(2, 1)$.
  - Land at the summit of the cell $(2, 1)$'s mountain.
- Third high jump
  - Float up from the summit of the cell $(2, 1)$'s mountain. Then, his altitude becomes 13.5.
  - Move to cell $(2, 2)$.
  - Land at the summit of the cell $(2, 2)$'s mountain.

It is impossible to end the first trip with less than 3 high jumps. Therefore, output 3 in the first line.
For the second trip, it is impossible to realize the trip. Therefore, output `-1` in the second line.
This sample input satisfies the constraints of all subtasks.

Sample Input 2	Sample Output 2
6 5 11 175 100 110 117 158 144 133 123 150 191 167 252 219 181 346 231 241 280 201 209 261 332 325 225 338 269 298 315 291 308 12 1 1 4 2 1 1 1 5 1 1 5 1 1 1 5 4 1 1 3 4 1 1 6 4 1 1 2 5 1 1 3 1 1 1 4 4 1 1 5 5 1 1 6 2 1 1 6 1	8 1 10 6 1 13 2 1 3 19 14 11

This sample input satisfies the constraints of all subtasks.

Sample Input 3	Sample Output 3
4 4 5 53 55 51 49 56 60 89 45 54 57 92 43 96 99 95 92 9 1 4 2 3 4 1 3 2 2 4 2 3 2 1 4 1 1 2 1 1 2 4 1 1 4 1 2 3 3 4 1 1 1 3 1 4	-1 1 -1 -1 1 3 1 4 1

This sample input satisfies the constraints of Subtasks 1, 2, 4, and 5.