Obstacles for a Llama

A llama wants to travel through the Andean Plateau. It has a map of the plateau in the form of a grid of $N \times M$ square cells. The rows of the map are numbered from 0 to $N-1$ from top to bottom, and the columns are numbered from 0 to $M-1$ from left to right. The cell of the map in row i and column j ($0 \leq i < N, 0 \leq j < M$) is denoted by (i, j).

The llama has studied the climate of the plateau and discovered that all cells in each row of the map have the same **temperature** and all cells in each column of the map have the same **humidity**. The llama has given you two integer arrays T and H of length N and M respectively. Here $T[i]$ ($0 \leq i < N$) indicates the temperature of the cells in row i, and $H[j]$ ($0 \leq j < M$) indicates the humidity of the cells in column j.

The llama has also studied the flora of the plateau and noticed that a cell (i, j) is **free of vegetation** if and only if its temperature is greater than its humidity, formally $T[i] > H[j]$.

The llama can travel across the plateau only by following **valid paths**. A valid path is a sequence of distinct cells that satisfy the following conditions:

- Each pair of consecutive cells in the path shares a common side.
- All cells in the path are free of vegetation.

Your task is to answer Q questions. For each question, you are given four integers: L, R, S, and D. You must determine whether there exists a valid path such that:

- The path starts at cell $(0, S)$ and ends at cell $(0, D)$.
- All cells in the path lie within columns L to R, inclusive.

It is guaranteed that both $(0, S)$ and $(0, D)$ are free of vegetation.

Implementation Details

The first procedure you should implement is:

```
void initialize(std::vector<int> T, std::vector<int> H)
```

- T: an array of length N specifying the temperature in each row.
- H: an array of length M specifying the humidity in each column.
- This procedure is called exactly once for each test case, before any calls to `can_reach`.

The second procedure you should implement is:

```
bool can_reach(int L, int R, int S, int D)
```

- L, R, S, D: integers describing a question.
- This procedure is called Q times for each test case.

This procedure should return `true` if and only if there exists a valid path from cell $(0, S)$ to cell $(0, D)$, such that all cells in the path lie within columns L to R, inclusive.

Constraints

- $1 \le N, M, Q \le 200\,000$
- $0 \le T[i] \le 10^9$ for each i such that $0 \le i < N$.
- $0 \le H[j] \le 10^9$ for each j such that $0 \le j < M$.
- $0 \le L \le R < M$
- $L \le S \le R$
- $L \le D \le R$
- Both cells $(0, S)$ and $(0, D)$ are free of vegetation.

Subtasks

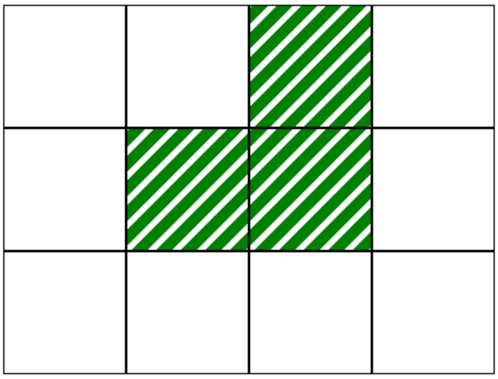
Subtask	Score	Additional Constraints
1	10	$L = 0$, $R = M - 1$ for each question. $N = 1$.
2	14	$L = 0$, $R = M - 1$ for each question. $T[i-1] \le T[i]$ for each i such that $1 \le i < N$.
3	13	$L = 0$, $R = M - 1$ for each question. $N = 3$ and $T = [2, 1, 3]$.
4	21	$L = 0$, $R = M - 1$ for each question. $Q \le 10$.
5	25	$L = 0$, $R = M - 1$ for each question.
6	17	No additional constraints.

Example

Consider the following call:

```
initialize([2, 1, 3], [0, 1, 2, 0])
```

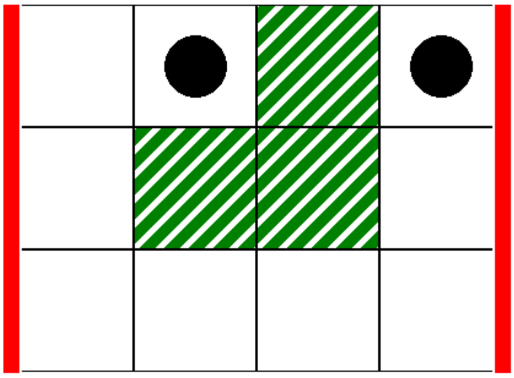
This corresponds to the map in the following image, where white cells are free of vegetation:



As the first question, consider the following call:

```
can_reach(0, 3, 1, 3)
```

This corresponds to the scenario in the following image, where the thick vertical lines indicate the range of columns from $L = 0$ to $R = 3$, and the black disks indicate the starting and ending cells:



In this case, the llama can reach from cell $(0, 1)$ to cell $(0, 3)$ through the following valid path:

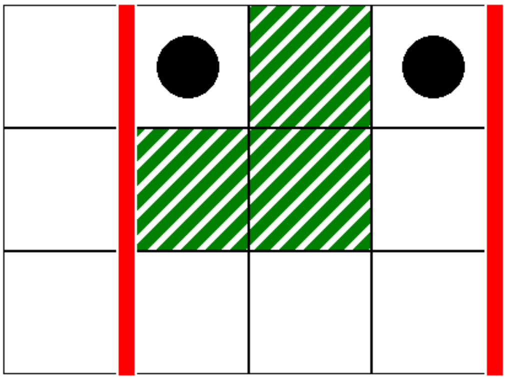
$$(0, 1), (0, 0), (1, 0), (2, 0), (2, 1), (2, 2), (2, 3), (1, 3), (0, 3)$$

Therefore, this call should return `true`.

As the second question, consider the following call:

```
can_reach(1, 3, 1, 3)
```

This corresponds to the scenario in the following image:



In this case, there is no valid path from cell $(0, 1)$ to cell $(0, 3)$, such that all cells in the path lie within columns 1 to 3, inclusive. Therefore, this call should return `false`.

Sample Grader

Input format:

```
N M
T[0] T[1] ... T[N-1]
H[0] H[1] ... H[M-1]
Q
L[0] R[0] S[0] D[0]
L[1] R[1] S[1] D[1]
...
L[Q-1] R[Q-1] S[Q-1] D[Q-1]
```

Here, $L[k], R[k], S[k]$ and $D[k]$ ($0 \leq k < Q$) specify the parameters for each call to `can_reach`.

Output format:

```
A[0]
A[1]
...
A[Q-1]
```

Here, $A[k]$ ($0 \leq k < Q$) is 1 if the call `can_reach(L[k], R[k], S[k], D[k])` returned `true`, and 0 otherwise.