Find the Path

HackerRank

You are given a table, a, with n rows and m columns. The top-left corner of the table has coordinates $(0,0)$, and the bottom-right corner has coordinates $(n-1,m-1)$. The i^{th} cell contains integer $a_{i,j}$.

A path in the table is a sequence of cells $(r_1,c_1),(r_2,c_2),\ldots,(r_k,c_k)$ such that for each $i \in \{1,\ldots,k-1\}$, cell (r_i,c_i) and cell (r_{i+1},c_{i+1}) share a side.

The weight of the path $(r_1,c_1),(r_2,c_2),\ldots,(r_k,c_k)$ is defined by $\sum_{i=1}^{k} a_{r_i,c_i}$ where a_{r_i,c_i} is the weight of the cell (r_i,c_i).

You must answer q queries. In each query, you are given the coordinates of two cells, (r_1,c_1) and (r_2,c_2). You must find and print the minimum possible weight of a path connecting them.

Note: A cell can share sides with at most 4 other cells. A cell with coordinates (r,c) shares sides with $(r-1,c)$, $(r+1,c)$, $(r,c-1)$ and $(r,c+1)$.

Input Format

The first line contains 2 space-separated integers, n (the number of rows in a) and m (the number of columns in a), respectively.
Each of n subsequent lines contains m space-separated integers. The j^{th} integer in the i^{th} line denotes the value of $a_{i,j}$.
The next line contains a single integer, q, denoting the number of queries.
Each of the q subsequent lines describes a query in the form of 4 space-separated integers: r_1, c_1, r_2, and c_2, respectively.

Constraints

- $1 \le n \le 7$
- $1 \le m \le 5 \times 10^3$
- $0 \le a_{i,j} \le 3 \times 10^3$
- $1 \le q \le 3 \times 10^4$

For each query:

- $0 \le r_1, r_2 < n$
- $0 \le c_1, c_2 < m$

Output Format

On a new line for each query, print a single integer denoting the minimum possible weight of a path between (r_1,c_1) and (r_2,c_2).

Sample Input

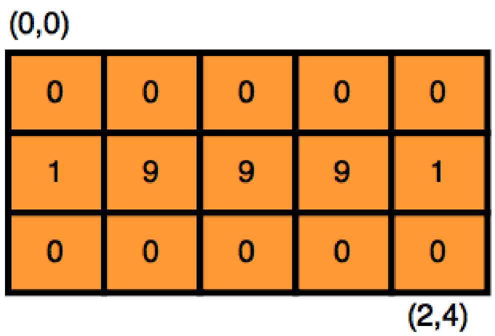
```
3 5
0 0 0 0 0
1 9 9 9 1
0 0 0 0 0
3
0 0 2 4
0 3 2 3
1 1 1 3
```

Sample Output

```
1
1
18
```

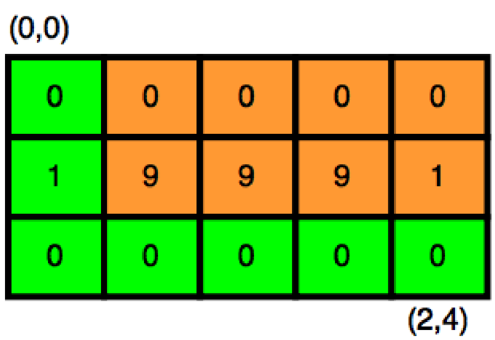
Explanation

The input table looks like this:



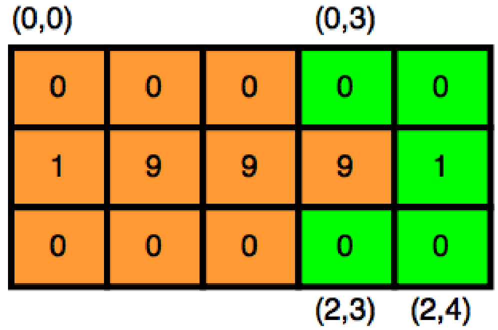
The first two queries are explained below:

1. In the first query, we have to find the minimum possible weight of a path connecting $(0, 0)$ and $(2, 4)$. Here is one possible path:



   The total weight of the path is $0 + 1 + 0 + 0 + 0 + 0 + 0 = 1$.

2. In the second query, we have to find the minimum possible weight of a path connecting $(0, 3)$ and $(2, 3)$. Here is one possible path:



The total weight of the path is $0 + 0 + 1 + 0 + 0 = 1$.