Jumping to Conclusions

Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.25 seconds
Memory limit:	4 megabytes

You are given a matrix with n rows and m columns. The cell at the intersection of the i-th row and j-th column contains an integer, denoted by a_{ij}.

You are initially located at cell $(1, 1)$, and your goal is to reach cell (n, m). For that purpose, you can perform the following movement **any** number of times:

- Move from cell (i, j) to any cell within a distance equal to a_{ij}, either in the same row or in the same column.

Determine the minimum number of moves required to reach the goal, or whether it is impossible to do so.

Input

The first line of the input contains a single integer, t ($1 \le t \le 10^4$) — the number of test cases.

The first line of each test case contains two integers, n and m ($1 \le n \cdot m \le 2 \cdot 10^5$) — the number of rows and columns in the matrix.

The next n lines of each test case describe the matrix. The i-th line contains m integers, $a_{i1}, a_{i2}, \ldots, a_{im}$ ($1 \le a_{ij} \le \max(n, m)$) — the elements of the i-th row of the matrix.

It is guaranteed that the sum of $n \cdot m$ across all test cases does not exceed $2 \cdot 10^5$.

Output

For each test case, output a single integer — the minimum number of moves required to reach the goal, or -1 if it is impossible.

Example

standard input	standard output
3 1 1 1 2 2 1 0 0 1 3 8 1 1 1 1 3 1 1 2 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 -1 5

Note

In the first test case, no moves are needed.

In the second test case, the goal cannot be reached.

In the third test case, the following path can be taken:

$$(1, 1) \to (2, 1) \to (2, 5) \to (1, 5) \to (1, 8) \to (3, 8)$$