International Institute of Information Technology, Bangalore
CSE 102P Data Structures and Algorithms Lab- Sec A
End Term Exam: 12 May 2026.

You are given an $m \times n$ matrix A of integers. You need to find the **maximum length** of a path that is **strictly increasing**.

From any cell (i, j), you may move to any of its **eight adjacent neighbors** (horizontally, vertically, or diagonally) provided the move stays within the matrix bounds. Wrap-around moves are not allowed.

More formally, from cell (i, j), you can move to (i', j') if and only if:

- $0 \leq i' < m$ and $0 \leq j' < n$ (within bounds)
- $\max(|i - i'|, |j - j'|) = 1$ (adjacent in any of the 8 directions)
- $A[i'][j'] > A[i][j]$ (strictly increasing)

A path is a sequence of cells where each consecutive pair satisfies the above conditions. The **length** of a path is the number of cells visited. A single cell is a valid path of length 1.

Your task: Compute the length of the **longest strictly increasing path** in the matrix.

Input Format

```
m n
A[0][0] A[0][1] ... A[0][n-1]
A[1][0] A[1][1] ... A[1][n-1]
...
A[m-1][0] A[m-1][1] ... A[m-1][n-1]
```

First line: Two integers m and n

- $1 \leq m \times n \leq 10^5$

Next m lines: Each contains n integers representing the matrix A

- $-10^9 \leq A[i][j] \leq 10^9$

Output Format

Print a single integer: the length of the longest strictly increasing path in the matrix.

Sample 1

Input:

```
3 3
1 2 3
6 5 4
7 8 9
```

Output:

```
9
```

Explanation:
Matrix:

$$\begin{bmatrix} 1 & 2 & 3 \\ 6 & 5 & 4 \\ 7 & 8 & 9 \end{bmatrix}$$

The longest strictly increasing path visits all 9 cells:

$$1 \to 2 \to 3 \to 4 \to 5 \to 6 \to 7 \to 8 \to 9$$

Path traced: $(0,0) \to (0,1) \to (0,2) \to (1,2) \to (1,1) \to (1,0) \to (2,0) \to (2,1) \to (2,2)$
Length = 9 (all cells visited)

Sample 2

Input:

```
3 3
9 8 7
2 1 6
3 4 5
```

Output:

```
9
```

Explanation:
Matrix:

$$\begin{bmatrix} 9 & 8 & 7 \\ 2 & 1 & 6 \\ 3 & 4 & 5 \end{bmatrix}$$

The longest strictly increasing path visits all 9 cells:

$$1 \to 2 \to 3 \to 4 \to 5 \to 6 \to 7 \to 8 \to 9$$

Path traced: $(1,1) \to (1,0) \to (2,0) \to (2,1) \to (2,2) \to (1,2) \to (0,2) \to (0,1) \to (0,0)$
Length = 9

Sample 3

Input:

```
4 4
15 10 14 12
9 7 8 13
3 4 1 11
2 5 6 16
```

Output:

```
8
```

Explanation:
Matrix:

$$\begin{bmatrix} 15 & 10 & 14 & 12 \\ 9 & 7 & 8 & 13 \\ 3 & 4 & 1 & 11 \\ 2 & 5 & 6 & 16 \end{bmatrix}$$

One valid longest increasing path:

$$2 \to 3 \to 4 \to 5 \to 6 \to 11 \to 13 \to 14$$

Length = 8

Sample 4

Input:

```
3 5
5 4 3 2 1
6 10 11 12 13
7 8 9 14 15
```

Output:

```
15
```

Explanation:
Matrix:

$$\begin{bmatrix} 5 & 4 & 3 & 2 & 1 \\ 6 & 10 & 11 & 12 & 13 \\ 7 & 8 & 9 & 14 & 15 \end{bmatrix}$$

The longest strictly increasing path visits all 15 cells:

$$1 \to 2 \to 3 \to 4 \to 5 \to 6 \to 7 \to 8 \to 9 \to 10 \to 11 \to 12 \to 13 \to 14 \to 15$$

Path traced: $(0,4) \to (0,3) \to (0,2) \to (0,1) \to (0,0) \to (1,0) \to (2,0) \to (2,1) \to (2,2) \to (1,1) \to (1,2) \to (1,3) \to (1,4) \to (2,3) \to (2,4)$
Length = 15