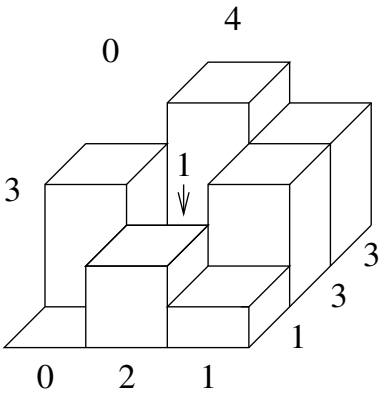
Problem C: Flood Modeling

Your task is to model how a piece of terrain would be flooded if it were covered with a large amount of water. The terrain is represented as a rectangular grid with square cells. Each cell has a certain height given as a non-negative integer. An example of such a model is the 3×3 rectangle specified in the first sample input and depicted in the figure.

Now imagine that a large amount of water is poured over the terrain. Any water that lands on a border cell spills off into the unbounded area outside the grid, but water that lands on an inner cell is either trapped there or spills onto one or more adjacent cells, where again it may be trapped or may spill further onto yet other adjacent cells, and so on, potentially reaching border cells and leaving the grid. For the purposes of this problem, "adjacent" means directly north, south, east, or west.



As your intuition probably tells you, water will be trapped above an inner cell if that cell lies in a "valley" formed by the surrounding terrain. More formally, water at some height $h > 0$ above an inner cell C is trapped if and only if it is impossible for that water to travel to the unbounded area outside the grid by moving from cell to adjacent cell *without going uphill at some point*.

In our particular example, water will be trapped above the middle cell (which itself has height 1) up to height 2, since any water higher than that will spill onto the adjacent cell to the south with height 2 (the bottom middle cell) and then leave the grid. Therefore the height of the water trapped above the middle cell is 1. Notice that water trapped above the middle cell cannot escape to either of the two corner cells with height 0, since cells that are positioned diagonally with respect to each other are not considered adjacent.

Your challenge is to write a program that computes the height of water trapped above each cell after the flooding. The expected output for the terrain in the figure is given in the first sample output.

Input

The first line of input contains two space-separated integers, N and M, where N is the number of rows and M is the number of columns in the rectangular grid. It is guaranteed that $1 \leq N, M \leq 2\,000$ and $1 \leq N \cdot M \leq 100\,000$. This is followed by N lines, each containing M space-separated integers h_j ($0 \leq h_j \leq 10^9$), representing the height of the terrain in each cell in that row.

(continued on the next page)

Output

Output N lines, each containing M space-separated integers h_j, denoting the height of the water above the terrain in each cell after the flood has finished. That is, the j-th integer on the i-th line of output is the height of the water above the terrain in the i-th row and j-th column.

Sample Input	*Sample Output*	*Sample Output, with visualized whitespace*
3 3 0 4 3 3 1 3 0 2 1	0 0 0 0 1 0 0 0 0	0␣0␣0\n 0␣1␣0\n 0␣0␣0\n

Sample Input	*Sample Output*	*Sample Output, with visualized whitespace*
4 4 5 4 3 4 4 1 5 3 4 1 2 3 5 4 6 7	0 0 0 0 0 2 0 0 0 2 1 0 0 0 0 0	0␣0␣0␣0\n 0␣2␣0␣0\n 0␣2␣1␣0\n 0␣0␣0␣0\n

Note: ␣ is a space, and \n is a newline character.