

Gradient

In graphics software for digital image editing, the term *gradient* or color gradient (sometimes called a *color ramp* or *color progression*) is used for a gradual blend of color which can be considered as an even gradation from low to high values, as used in the image to the right.



For a given image, represented as a matrix of integer numbers, we have to say if it is a gradient. We consider a matrix to be a gradient if, for each row of the matrix, the sum of the colors of the left half of the row is less than the sum of the colors of the right side of the row and both the left and right halves of the row are gradients.

Code a D&C function that, for a given image, returns whether the image is a gradient or not, taking into account the following requirements:

- The algorithm that solves the problem must receive a row of the matrix in an array of integers and return whether it is a gradient or not.
- Each row can be traversed only once.
- The maximum size of a row is 2^{20} .

In addition to coding the solution, you have to specify the algorithm and calculate its complexity.

Input

The input has several test cases. Each test case represents a matrix, where the first line contains the dimension of the matrix $n * m$ and the next n lines contain m numbers each with the values of the colors in that row of the matrix. The length of each line m is a power of 2.

Output

For each test case, the output must be YES if the image is a gradient and NO otherwise.

Sample input

```
3 4
1 3 2 6
2 5 4 11
2 3 3 10
3 8
2 6 7 12 1 8 15 22
2 5 2 6 2 3 3 4
1 2 3 4 5 6 7 8
2 8
2 5 2 16 2 8 16 50
1 3 4 5 2 8 14 15
1 4
1 3 2 3
```

Sample output

```
YES
NO
YES
YES
```

Notes

This exercise has been designed by Isabel Pita Andreu. It must be understood in the context of the *Data Structures and Algorithms* course, FDI-UCM 2016/2017 (prof. Gonzalo Méndez). Therefore, the only valid solutions are those that use the concepts studied in this course. Additional remarks may be provided in class.