Homework 10 (Deadline 15:00, June 3, submit your files to TronClass)

Please submit the source code only. The file name should include your student ID number. For example, if your ID number is 406290123, then the file names for problems 1 and 2 should be **406290123_hw10_1.txt** and **406290123_hw10_2.txt**, respectively.

1. Temperature distribution on a metallic plate

Under steady-state conditions, the temperature at any point on the surface of a metallic plates are the average of the temperature of all points surrounding it. This fact can be used in an iterative procedure to calculate the temperature distribution at all points on the plate.

The following figure shows a square plate divided in 100 squares or nodes by a grid. The temperatures of the nodes form a two-dimensional array T. The temperature in all nodes at the edges of the plate is constrained to be 15 degree by a cooling system, and the temperature of the node (3,8) is fixed at 100 degree by exposure to boiling water.

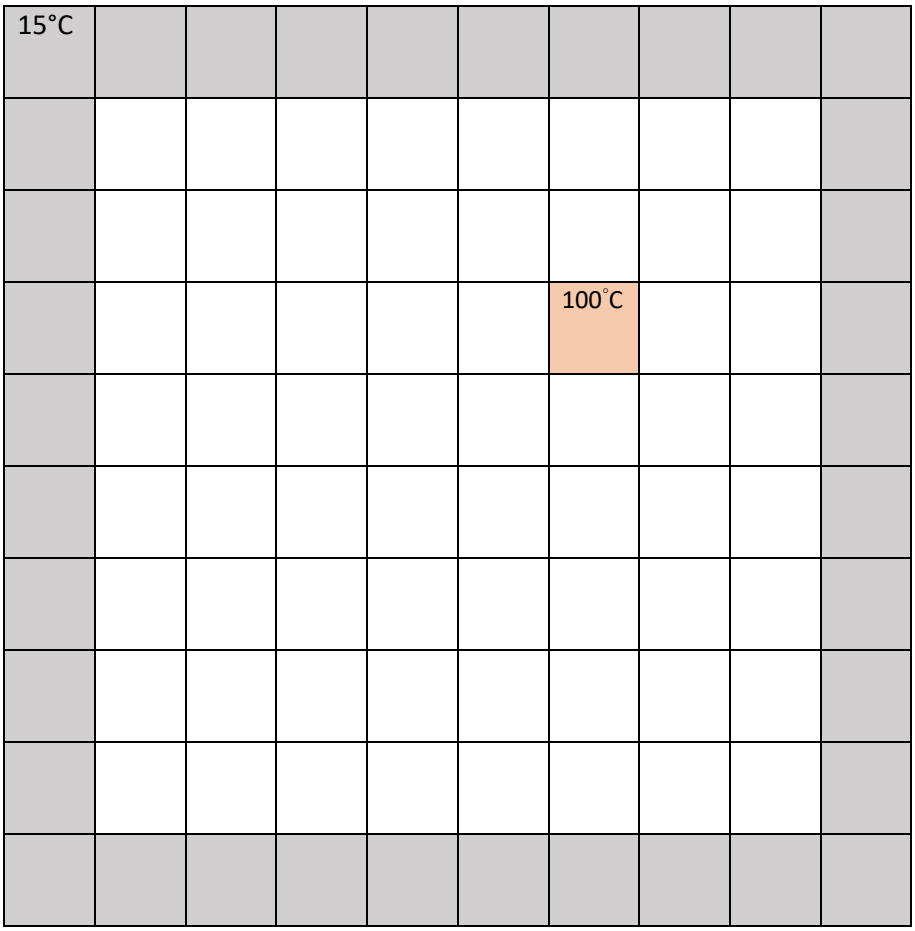
A new estimate of the temperature T_{ij} in any given node can be calculated from the average of the temperatures in all segments surrounding it:

$$T_{ij,new} = \frac{1}{4}\left(T_{i-1,j} + T_{i+1,j} + T_{i,j+1} + T_{i,j-1}\right).$$

To determine the temperature distribution on the surface of a plate, an initial assumption must be made about the temperature in each node. Then, the above equation is applied to each node whose temperature is not fixed to calculate a new estimate of the temperature in that node. These updated temperature estimates are used to calculate newer estimates and the process is repeated until the new temperature estimate in each node differ from the old ones by only a small amount. At that point, a steady-state solution has been found.

Write a program to calculate the steady-state temperature distribution throughout the plate, making an initial assumption that all interior segments are at a temperature of 50 degree. Remember that all outside segments are fixed at a temperature of 15 degree and the segment (3,8) is fixed at a temperature of 100 degree. The program should apply the above equation

iteratively until the maximum temperature change between iteration in any node is less than 0.01 degree. Output the temperature of all segments as an array.



2. Column Average

Task Description

Write a program to read the number of rows (r) and columns (c) of a two-dimensional integer array first, then read the array elements row by row. Finally print the average (in integer) of every column.

Limits

Both r and c are no more than 100.

Input Format

There are r+1 lines in the input. The first line has r and c. Each of the next r lines has c integers as a row in the matrix.

Output Format

There are c lines in the output. The i-th line has the average of the i-th column.

Sample Input

2 3

1 2 3

4 5 6

Sample Output

2

3

4

3. Larger than Neighbors

Task Description

Write a program to read the number of rows (r) and columns (c) of a two-dimensional integer array, then read the array elements row by row. Finally print the elements that are greater than all of its neighbors. Note that an element can have at most 4 neighbors. If there are multiple such elements, print them in the order of row by row, column by column.

讀入一個 r 行 c 列的二維整數陣列，找到那些格子上的數字皆大於它的鄰近格子上的數字，鄰近只有限制在它的上下左右四格。如果有多個答案，從上而下、由左而右依序印出。

Limits

Both r and c are no more than 100.

Input Format

There are r+1 lines in the input. The first line has r and c. Each of the next r lines has c integers as a row in the matrix.

Output Format

There are k lines in the output, where k is the number of elements that are larger than its neighbors.

Sample Input

2 3

7 8 3

4 5 6

Sample Output

8

6