Lab 01
Arrays

CSE 4304

DATA STRUCTURES LAB

JANUARY 13, 2020

Answer To The Question No.

Mid Semester Exam of Imperial University of Texas (IUT) is going on. In the exam, each question has a difficulty level in the form of an integer. A student can only solve problems that have difficulty level less than X. However, there are some weird rules:

- Score of the student is equal to the maximum number of answers s/he has attempted without skipping a question
- Student is allowed to skip just "one" question that will not be counted in the continuity of the questions

Given the number of questions N, the maximum difficulty level of the problem a student can solve X, and the difficult level of each question A_i, can you find the maximum score that student can get?

Assume that the student knows the solution to the problem s/he attempts and always starts the paper from the first question.

Input

First line contains two integers N, the number of questions and X, the maximum difficulty level of problems that a students can solve.
Next line contains N space-separated integers denoting the difficulty level of each question.

Output

Print the maximum score the student can achieve.

Constraints

- $1 \leq N \leq 10^5$
- $1 \leq X \leq 10^9$
- $1 \leq A_i \leq 10^9$

Sample

Sample Input	Sample Output
7 6 4 3 7 6 7 2 2	3

Explanation

In this example, the maximum difficulty a student can solve is 6. S/he can solve the 1st and 2nd question, skip 3rd question, solves 4th question and stops at 5th question. Since 3 questions were solved, s/he'll get a maximum mark of 3.

Hint

Start from index 0 iterate over the array of difficulty levels. Count the number of elements until you encounter an element whose value is greater than X and store the result in P. Skip this number and start from the index next to index having X. Again start counting the number of elements until you encounter an element whose value is greater than X and store the result in Q. Make sure you stop at index $\geq N$. The result is $P + Q$.

Mark My Gifts

Students have become fan of CSE 4303 - Data Structures. After a superb Mid Semester Examination, its now time for the results. The teacher has released the marks of the students in the form of an array, where $arr[i]$ represents the mark of the i^{th} student. There are n students in the class. The marks are sorted in the order of their student IDs.

The teacher has decided to gift some chocolates to the students. But giving chocolate to the students who got highest marks is too predictable. So he wants to give chocolates to all those students whose marks are not smaller than those after them. Specifically, the teacher wants to find all the marks that are not smaller than those on its right side in the array.

Input

The first line of the input will contain a single integer n denoting the number of students.
The next line will contain n space-separated integers representing the marks of the students.

Output

Output all the marks of the students that will get the gift.

Constraints

- $1 \leq n \leq 1000000$
- $0 \leq arr[i] \leq 10000$

Sample

Sample Input	Sample Output
6 16 17 4 3 5 2	17 5 2

Hint

Traverse from the right and keep a track of the maximum element achieved till that point. When the max changes, enter it into an array and print in reverse, this array.

Operations

Students of CSE 4303 - Data Structures are very fond of matrices. Today, they created a matrix A of size $N \times M$. They defined four types of operations on the matrxi:

- Add v_1 to all elements of the row
- Update the value of all elements of a row to v_2
- Add v_3 to all elements of a column
- Update the value of all elements of a column to v_4.

They defined a function $F(x)$ as:

$$F(x) = \sum_{i=1}^{N} \sum_{j=1}^{M} abs(A[i][j]$$

where $A[i][j]$ refers to the j^{th} cell in the i^{th} row of the matrix A, and $abs(x)$ refers to the absolute value of any integer x.

They have also defined some restrictions:

- On any cell of the matrix, at most one operation can be performed. This operation can be of any type.
- Any type of operation can be used any number of times.

Your task is to maximize the value of $F(x)$ following these restrictions.

Input

The first line consists of two integers N and M denoting the number of rows and the number of columns in matrix A.
Each of the following N lines consist of M space-separated integers denoting the matrix.
The last line of input consists of four space-separated integers denoting the values of v_1, v_2, v_3, and v_4 respectively.

Constraints

- $1 \leq N \leq 1000$
- $1 \leq M \leq 1000$
- $-10^9 \leq A[i][j] \leq 10^9$
- $-10^9 \leq v_1, v_2, v_3, v_4 \leq 10^9$

Sample

Sample Input	Sample Output
2 2 -5 8 6 -9 -2 5 -1 6	29

Explanation

We use third type of operation on column 2 (or we can leave column 2 as it is) and fourth type of operation on column 1.
So, $F(x) = abs(6) + abs(8-1) + abs(6) + abs(-9-1) = 6+7+6+10 = 29$

Hint

The first observation to make in this problem is that we cannot perform an operation on a row as well as a column. Suppose we perform an operation on row i and column j. By doing so, we perform an operation on cell (i, j) twice. This violates the constraints, and thus can never be done.

So, the operations can be performed either on rows only, or columns only. The answer will be the maximum of the two.

For each row/column, there are 3 distinct possibilities, i.e.

1. Perform an operation of type 1
2. Perform an operation of type 2

3. Do not perform any operation

We need to check these 3 possibilities for each row/column, and then print the maximum of the two.