

CSE221 Assignment 03 Fall 2025

A. Count the Inversion

time limit per test: 1 second
memory limit per test: 256 megabytes

Forbidden Keywords for the Quiz: sort, open, file, creat(), fstream, thread, process, system(), exec()

Here is a Pseudocode of the Merge Sort Algorithm.

```
def merge(a, b):
    # write your code here
    # a and b are two sorted list
    # merge function will return a sorted list after merging a and b

def mergeSort(arr):
    if len(arr) <= 1:
        return arr
    else:
        mid = len(arr)//2
        a1 = mergeSort(.....) # write the parameter
        a2 = mergeSort(.....) # write the parameter
        return merge(a1, a2) # complete the merge function above
```

Now, you are given an array A of size N of N distinct integers. It is guaranteed that the array A contains a permutation of integers from 1 to N (i.e., every integer from 1 to N appears exactly once).

1. Count the number of inversions in the given array.

2. Sort the array in non-decreasing order.

An inversion is a pair (i, j) where $i < j$ and $A[i] > A[j]$.

Input

The first line contains an integer N ($1 \leq N \leq 10^5$) — denoting the length of the list.In the next line, there will be N integers $a_1, a_2, a_3 \dots a_n$ ($1 \leq a_i \leq N$) separated by spaces.

Output

In the first line, print the total number of inversions in the given array. In the next line, print the array in non-decreasing order.

Examples

input	<code>5</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5</code>	<input type="button" value="Copy"/>
input	<code>5</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5</code>	<input type="button" value="Copy"/>
input	<code>5</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5</code>	<input type="button" value="Copy"/>
input	<code>7</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5 6 7</code>	<input type="button" value="Copy"/>

Note

In the first example (1-based indexing), the inversions are the pairs of indices (3, 4), (3, 5) and (4, 5).

In the second example, there are no inversions.

In the third example, every pair of i, j where $i < j$, we have $A[i] > A[j]$. Hence, All 10 such pairs are inversions.

B. Count the Inversion Revisited

time limit per test: 1 second
memory limit per test: 256 megabytes

Forbidden Keywords for the Quiz: open, file, creat(), fstream, thread, process, system(), exec()

You are given an array A of N integers. Find the number of pairs of indexes (i, j) such that $i < j$ and $A[i] > A[j]^2$.

Input

The first line contains an integer N ($1 \leq N \leq 10^5$) — denoting the length of the list.In the next line, there will be N integers $a_1, a_2, a_3 \dots a_n$ ($-10^6 \leq a_i \leq 10^6$) separated by spaces.

Output

Output a single integer - number of such pairs.

Examples

input	<code>6</code>	<input type="button" value="Copy"/>
output	<code>10 2 5 1 -2 25</code>	<input type="button" value="Copy"/>
input	<code>5</code>	<input type="button" value="Copy"/>
output	<code>5 4 3 -2 -1</code>	<input type="button" value="Copy"/>
input	<code>4</code>	<input type="button" value="Copy"/>
output	<code>10</code>	<input type="button" value="Copy"/>
input	<code>14</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5 6 7</code>	<input type="button" value="Copy"/>

C. Fast Power Drift

time limit per test: 1 second
memory limit per test: 256 megabytes

Forbidden Keywords for the Quiz: pow, open, file, creat(), fstream, thread, process, system(), exec()

You are given two integers a and b . Calculate $a^b \bmod 107$.

Input

The input file contains two integers a ($1 \leq a \leq 10^4$) and b ($1 \leq b \leq 10^{12}$).

Output

Print one integer — the result of $a^b \bmod 107$.

Examples

input	<code>100 3</code>	<input type="button" value="Copy"/>
output	<code>85</code>	<input type="button" value="Copy"/>
input	<code>100 5</code>	<input type="button" value="Copy"/>
output	<code>99</code>	<input type="button" value="Copy"/>
input	<code>10000 100000000000</code>	<input type="button" value="Copy"/>
output	<code>27</code>	<input type="button" value="Copy"/>

D. Fast Matrix Drift

time limit per test: 1 second
memory limit per test: 256 megabytes

Forbidden Keywords for the Quiz: open, file, creat(), fstream, thread, process, system(), exec()

You are given a 2×2 integer matrix A and an integer exponent X ($1 \leq X \leq 10^9$).Your task is to compute the matrix A^X , where all intermediate operations (additions and multiplications during matrix multiplication) are performed modulo $10^9 + 7$.

Formally, for two matrices:

$$B = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}, \quad C = \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix}.$$

Their product $D = B \times C$ is defined as: $D_{ij} = (b_{11} \cdot c_{1j} + b_{12} \cdot c_{2j}) \bmod (10^9 + 7)$.

Input

The first line contains a single integer T ($1 \leq T \leq 10^5$) — the number of test cases.

Output

For each test case, print two lines, each containing two integers: the resulting 2×2 matrix A^X . Each element should be printed modulo $10^9 + 7$.

Examples

input	<code>2</code>	<input type="button" value="Copy"/>
output	<code>1 1 1 0</code>	<input type="button" value="Copy"/>
input	<code>5</code>	<input type="button" value="Copy"/>
output	<code>2 0 0 2</code>	<input type="button" value="Copy"/>
input	<code>3</code>	<input type="button" value="Copy"/>
output	<code>1 2 1 2</code>	<input type="button" value="Copy"/>
input	<code>10</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 12</code>	<input type="button" value="Copy"/>
input	<code>12</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5 6 7 8 9 10 12</code>	<input type="button" value="Copy"/>
input	<code>5</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5 6 7 8 9 10 12</code>	<input type="button" value="Copy"/>
input	<code>16</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5 6 7 8 9 10 12 16</code>	<input type="button" value="Copy"/>
input	<code>16</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5 6 7 8 9 10 12 16 16</code>	<input type="button" value="Copy"/>

E. Fast Series Drift

time limit per test: 2.5 seconds
memory limit per test: 256 megabytes

Forbidden Keywords for the Quiz: pow, open, file, creat(), fstream, thread, process, system(), exec()

You are given three integers a , n and m . Calculate $(a^1 + a^2 + \dots + a^n) \% m$.

Input

The first line contains an integer T ($1 \leq T \leq 10^5$) — total numbers of test cases.

Output

Print one integer — the result of $(a^1 + a^2 + \dots + a^n) \% m$.

Examples

input	<code>100 3 1000000000000000000</code>	<input type="button" value="Copy"/>
output	<code>85</code>	<input type="button" value="Copy"/>
input	<code>100 5 1000000000000000000</code>	<input type="button" value="Copy"/>
output	<code>99</code>	<input type="button" value="Copy"/>
input	<code>10000 1000000000000000000</code>	<input type="button" value="Copy"/>
output	<code>27</code>	<input type="button" value="Copy"/>
input	<code>1000000000000000000 1000000000000000000</code>	<input type="button" value="Copy"/>
output	<code>10</code>	<input type="button" value="Copy"/>
input	<code>1000000000000000000 1000000000000000000</code>	<input type="button" value="Copy"/>
output	<code>10</code>	<input type="button" value="Copy"/>

F. Ordering Binary Tree

time limit per test: 1 second
memory limit per test: 256 megabytes

Forbidden Keywords for the Quiz: open, file, creat(), fstream, thread, process, system(), exec()

you are given an array A of size N in increasing order. Find an order of these N integers such that, if these integers are inserted into a Binary Search Tree (BST) one by one, the height of the resulting BST is minimized.

A Binary Search Tree is a binary tree in which each node has at most two children, referred to as the left and right child. For any node, all elements in the left subtree are smaller than the node's value, and all elements in the right subtree are greater than the node's value.

The height of a Binary Search Tree is defined as the maximum depth among all the nodes in the tree.

Note

All the elements in the array A are guaranteed to be unique. In other words, $A_i \neq A_j$ if $i \neq j$.

Input

The first line contains an integer N ($1 \leq N \leq 10^5$) — denoting the length of the list.

Output

Output the order of the elements such that when inserted into a Binary Search Tree, the height of the tree is minimized. If there are multiple such orders then find any of them.

Examples

input	<code>5</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5</code>	<input type="button" value="Copy"/>
input	<code>4</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4</code>	<input type="button" value="Copy"/>
input	<code>10</code>	<input type="button" value="Copy"/>
output	<code>1 2 3 4 5 6 </code>	