CS204(2025)
Sorting-1
Instructions for Implementation

- Write the program in C or C++ using standard input/output.
- Follow the input/output format strictly.
- Ensure your code:
  - Handles **edge cases** correctly.
  - Meets the **time and space complexity constraints**.
- **Do not use STL containers like** `vector`**,** `set`**, or** `map` **in C++.** Use raw arrays unless explicitly allowed.
- You are encouraged to write clean, modular, and well-documented code.

Q1. Sort Strings By Length

Problem:

Given a list of strings(without spaces), sort them by increasing length. If two strings are of the same length, sort them lexicographically.

Input Format:

- First line: Integer size (size of array)
- Subsequent lines: inputs strings one line after the other

Output Format:

- Print the sorted strings one by one in the same line.

Constraints:

- $1 \leq size \leq 10^4$
- $0 \leq arr[i].length \leq 100$
- **Expected Time Complexity:** O(nlogn)
- **Expected Space Complexity:** O(1)

Sample Input 1:

6

apple

bat

cat

apricot

ant

batman

Sample Output 1:

ant bat cat apple batman apricot

Sample Input 2:

5

zoo

elephant

ant

dog

tiger

Sample Output 2:

ant dog zoo tiger elephant

Q2. Group and Sort Students by Department and Name

Problem:

Each student has a name and a department. Group students by department, and within each department, sort them alphabetically by name. Print the sorted list department-wise.

Input Format:

- First line: Integer n (number of students).
- Next n lines: Each line has two space-separated strings, first name and department

Output Format:

- Print the grouped and sorted student details, each student on a new line

Constraints:

- $1 \leq n \leq 10^5$
- . All names and departments are string of maximum size 20
- **Time Complexity:** O(nlogn)
- **Space Complexity:** O(1)

Sample Input 1:

5

Alice CS

Bob EE

Charlie CS

Dave EE

Eve ME

Sample Output 1:

Alice CS

Charlie CS

Bob EE

Dave EE

Eve ME

Sample Input 2:

6

Aditi IT

Rahul CSE

Amit CSE

Manoj ECE

Anjali ECE

Vikram IT

Sample Output 2:

Amit CSE

Rahul CSE

Anjali ECE

Manoj ECE

Aditi IT

Vikram IT

Q3. Sort Colors (Dutch National Flag Problem)

Problem:

You are given an array consisting only of 0s, 1s, and 2s which represent colors. Sort the array in-place in a single traversal.

Input Format:

- First line: input size n
- Next line: n space-separated integers(0, 1 and 2) only.

Output Format:

- Print sorted array

Constraints:

- $1 \leq n \leq 10^6$
- Input only contains values 0, 1 and 2.
- **Time Complexity:** O(n)
- **Space Complexity:** O(1)

Sample Input 1:

20

2 0 2 1 1 0 0 1 2 1 0 2 0 1 2 0 2 1 0 1

Sample Output 1:

0 0 0 0 0 0 1 1 1 1 1 2 2 2 2 2 2 2 2 2

Sample Input 2:

20

2 2 2 2 2 2 1 1 1 1 1 0 0 0 0 0 0 0 0 0

Sample Output 2:

0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 2 2 2 2 2

Q4. Sort Squares

Problem:

Given an integer array nums sorted in non-decreasing order, return an array of the squares of each number sorted in non-decreasing order.

Input Format:

- First line: input size n
- Next line: n space-separated integers

Output Format:

- Print sorted array of squares of the values given

Constraints:

- $1 \leq n \leq 10^4$
- -10^4 <= each value <= 10^4
- Given values are in non-decreasing order

Sample Input 1:

5

-4 -1 0 3 10

Sample Output 1:

0 1 9 16 100

Sample Input 2:

5

-7 -3 2 3 11

Sample Output 2:

4 9 9 49 121

Q5. Merge Arrays

Problem:

You are given two integer arrays nums1 and nums2, sorted in non-decreasing order, and two integers m and n, representing the number of elements in nums1 and nums2 respectively.

Merge nums1 and nums2 into a single array sorted in non-decreasing order.

The final sorted array should not be returned by the function, but instead be stored inside the array nums1. To accommodate this, nums1 has a length of m + n, where the first m elements denote the elements that should be merged, and the last n elements are set to 0 and should be ignored. nums2 has a length of n.

Input Format:

- First line: input size m and n
- Next line: m+n space-separated integers, including 0s to accomodate the merged array
- Next line: n space-separated integers, denoting the second array

Output Format:

- Print sorted array(first array only)

Constraints:

- $1 \leq n \leq 10^4$
- each value <= 10^5
- Given values are in non-decreasing order in both arrays except for space left to accomodate the increase in size

Sample Input 1:

3 3

1 2 3 0 0 0

2 5 6

Sample Output 1:

1 2 2 3 5 6

Explanation:

The arrays we are merging are [1,2,3] and [2,5,6].

The result of the merge is [1,2,2,3,5,6] with the underlined elements coming from nums1.

Sample Input 2:

1 0

1

Sample Output 2:

1

Explanation: The arrays we are merging are [1] and [].

The result of the merge is [1].

Q6. Median of Sorted Arrays

Problem:

There are two sorted arrays nums1 and nums2 of size m and n respectively. Find the median of the two sorted arrays. The overall run time complexity should be O(log (m+n)).

Input Format:

- First line: input size m and n
- Next line: m space-separated integers, denoting the first array
- Next line: n space-separated integers, denoting the second array

Output Format:

- Print the median only

Constraints:

- $1 \leq n \leq 10^4$
- each value <= 10^5

Sample Input 1:

2 1

1 3

2

Sample Output 1:

2.0

Sample Input 2:

2 2

1 2

3 4

Sample Output 2:

2.5

Q7. Remove Duplicates from Sorted Array

Problem:

Given an integer array nums sorted in non-decreasing order, remove the duplicates in-place such that each unique element appears only once. The relative order of the elements should be kept the same. Then return the number of unique elements in nums.Consider the number of unique elements of nums to be k, to get accepted, you need to do the following things:

Change the array nums such that the first k elements of nums contain the unique elements in the order they were present in nums initially. The remaining elements of nums are not important as well as the size of nums.

Input Format:

- First line: input size m
- Next line: m space-separated integers, denoting the array

Output Format:

- Print the number of unique elements, k

Constraints:

- $1 \leq n \leq 10^4$
- each value <= 10^5
- Given values are in non-decreasing order

Sample Input 1:

3

1 1 2

Sample Output 1:

2

Sample Input 2:

10

0 0 1 1 1 2 2 3 3 4

Sample Output 2:

5

Q8. Sort Dates

Problem:

Given `n` dates in the format `DD-MM-YYYY`, sort them in chronological order.

Input Format:

- First line: input size n
- Next n lines: a string denoting each date in dd-mm-yyyy format in each line

Output Format:

- Print the sorted dates line by line

Constraints:

- $1 \leq n \leq 10^4$
- All dates are in DD-MM-YYYY format

Sample Input 1:

4

05-04-2020

03-03-2022

25-12-2019

05-04-2020

Sample Output 1:

25-12-2019

05-04-2020

05-04-2020

03-03-2022

Sample Input 2:

5

25-12-2025

05-04-2021

05-04-2020

03-03-2024

02-03-2024

Sample Output 2:

05-04-2020

05-04-2021

02-03-2024

03-03-2024

25-12-2025