Introduction to Algorithms

Module 04: Assignment 01 (Theory)

Deadline 100 marks: 11:59pm, 5 August 2023
Deadline 90 marks: 11:59pm, 7 August 2023
Deadline 80 marks: Anytime after that.
What you need to submit : Just your answer DOC

Question No 1

Question: Write a C++ program that takes N integer numbers and sorts them in non-increasing order using **Merge Sort.**

You can't use any built-in function for sorting.

Marks: 20

Sample Input	Sample Output
7 1 2 9 4 0 2 5	9 5 4 2 2 1 0
6 5 3 -1 3 3 8	8 5 3 3 3 -1

Question No 2

Question: Write a C++ program that takes N integer numbers that are sorted and distinct. The next line will contain an integer k. You need to tell whether K exists in that array or not. If it exists, print its index otherwise print "Not Found".

You must solve this in O(logn) complexity.

Marks: 20

Sample Input	Sample Output
8 -4 0 2 6 9 10 29 54 29	6
10 0 1 2 3 4 5 6 7 8 9 -3	Not Found

Question: You are given an array of N positive integers. The next line will contain an integer K. You need to tell whether there exists more than one occurrence of K in that array or not. If there exists more than one occurrence of K print YES, Otherwise print NO.

See the sample input-output for more clarification.

The given array will be sorted in increasing order. And it is guaranteed that at least one occurrence of K will exist. **You must solve this in O(logn) complexity.**

Marks: 20

Sample Input	Sample Output
7 1 3 4 6 6 9 17 6	YES
10 0 1 2 3 4 5 6 7 8 9 3	NO

Question No 4

Calculate the time complexity of the following code snippets.

Marks: 20

(a)

```
int count = 0;
for (int i = n; i > 0; i /= 2)
{
    for (int j = 0; j < n; j+=5)
    {
        count += 1;
    }
}
```

(b)

```
for(int i =1; i*i<n; i++)
{
    cout << "hello";
}
```

(c)

```
for(int i =1; i<n; i=i*2)
{
    for(int j=1; j*j<n; j+=2)
    {
        cout << "hello";
    }
}
```

(d)

```
int m = 1;
for(int i=0; m<=n; i++)
{
    m+=i;
}
```

Question No 5

Question: You are given two sorted arrays arr1 and arr2 in descending order. Your task is to merge these two arrays into a new array result using the merge sort technique, but Instead of merging the arrays in ascending order, you need to merge them in descending order to create the result array.

You cannot use stl sort function here

Marks: 20

Sample Input	Sample Output
4 8 6 4 2 4 7 5 3 1	8 7 6 5 4 3 2 1