

# Indian Institute of Technology Ropar

## Data Structures and Algorithms

CS506 and CS205

### **Lab Assignment 1**

**DEADLINE:** 14th August 2024; 11:59PM

#### (A) Sorting Algorithms:

The purpose of this assignment is to implement and analyze various sorting algorithms. The following sorting algorithms need to be implemented:

1. Bubble Sort
2. Selection Sort
3. Merge Sort
4. Insertion Sort
5. Quick Sort

#### **Programming Language:**

C/C++ Programming (Any kind of inbuilt libraries/functions can't be used. You can't use any container even. **Otherwise penalty will be imposed**)

#### **Expected Documents:**

1. Program file
2. Analytical Report

#### **Instruction for Programming:**

There will be one single file. All the sorting algorithms will be written as a function. Users need to call the suitable sorting function.

In the very first line of input, the user needs to select a sorting algorithm. Choices will be as follows:

1. Bubble Sort
2. Selection Sort
3. Merge Sort
4. Insertion Sort

### 5. Quick Sort

In the second line, the user needs to give the number of test cases (T) as input.

Now for each test case, there will be two lines for input:

The first line should be the size of the array (N)

The second line should be the N elements in the array.

#### **Example:**

```
1
2
5
1 5 9 6 7
3
20 30 15
```

#### **Expected Output:**

```
1 5 6 7 9
15 20 30
```

#### **Explanation:**

```
1 -> Selecting Bubble Sort
2 -> 2 Test Cases
5 -> Length of the array in Test Case 1
1 5 9 6 7 -> Array of Test Case 1
3 -> Length of the array in Test Case 2
20 30 15 -> Array of Test Case 2
```

#### **Constraints:**

```
1 <= N <= 103
1 <= arr[i] <= 103
```

#### **Instruction for Report:**

- On the very front page, need to mention the details of the student (Name, Entry No., Department, Courseid) and the system specification (RAM, CPU, OS, etc.)
- For comparative analysis, various kinds of graphs are highly appreciated.
- Explain if you find any observations in the results.
- Be precise but analytical.
- Submit the report in pdf format.

## (B) Ternary Search Algorithm:

This assignment aims to take your binary search understanding to the next level.

### ***Hint:***

This is just an extension of Binary Search where you need to divide the array into three subarrays. **Note that the array will be sorted.**

### **Programming Language:**

C/C++ Programming (Any kind of inbuilt libraries/functions can't be used. You can't use any container even. ***Otherwise penalty will be imposed***)

### **Expected Documents:**

Program File

### **Instruction for Programming:**

The searching function should be separately written as a function.

In the first line, the user needs to give the number of test cases (T) as input.

Now for each test case, there will be three lines for input:

The first line should be the size of the array (N)

The second line should be the N elements in the array.

The third line should be the key element that we want to find.

### ***Example:***

```
2
5
1 3 5 7 9
5
3
15 20 30
25
```

### ***Expected Output:***

Found in index 2

Not present in the given array

### ***Explanation:***

2 -> 2 Test Cases

5 -> Length of the array in Test Case 1

1 3 5 7 9 -> Array of Test Case 1  
5-> Key for the Test Case 1  
3 -> Length of the array in Test Case 2  
15 20 30 -> Array of Test Case 2  
25 -> Key for the Test Case 2

**Constraints:**

$1 \leq N \leq 10^3$   
 $1 \leq \text{arr}[i] \leq 10^3$

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**General Instructions:**

1. Don't put unnecessary pieces of information or codes.
2. Good documentation is highly appreciable in the codes. (You may use comments)
3. Please remember to make modular codes.

**Naming conventions of Files:**

FirstName\_EntryNo\_CS506\_Lab01\_ProgA.c (For Sorting program files)  
FirstName\_EntryNo\_CS506\_Lab01\_ProgB.c (For Searching program file)  
FirstName\_EntryNo\_CS506\_Lab01\_ReportA.pdf (For the report of Sorting)

Example:-

Rejoy\_2023CSM1011\_CS506\_Lab01\_ProgA.c  
Rejoy\_2023CSM1011\_CS506\_Lab01\_ProgB.c  
Rejoy\_2023CSM1011\_CS506\_Lab01\_ReportA.pdf

**Regarding Plagiarism Check:**

Do not copy from each other or any source on the internet. Plagiarism will be checked. If any plagiarism is found (above a reasonable threshold), heavy penalties will be given to the student (which may even lead to an F grade in the course).

**For any clarification, you may contact the TAs in the lab sessions:**

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