

Lab #3: Algorithms

The main aim of the lab is to deal with some searching algorithms.

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Task 1: Basic problems

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Task 1.1: Implement the following methods related to **linear search** in the class **MyArray.java**:

```
public class MyArray {
    private int[] array;

    public MyArray(int[] array) {
        this.array = array;
    }

    // To find the index of the target in the array. If the target
    // is not found
    // in the array, then the method returns -1.
    // Input: int[] array = {12, 10, 9, 45, 2, 10, 10, 45}, 45
    // Output: 3

    public int iterativeLinearSearch(int target) {
        // TODO
        return 0;
    }

    // To find the index of the target in the array. If the target
    // is not found
    // in the array, then the method returns -1.
    // Input: int[] array = {12, 10, 9, 45, 2, 10, 10, 45}, 15
    // Output: -1
    public int recursiveLinearSearch(int target) {
        // TODO
        return 0;
    }
}
```

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Task 1.2: Implement the following methods related to **binary search** in the class **MyArray.java**:

```
// To find the index of the target in the sorted array. If the
target is not
```

```
// found in the array, then the method returns -1.
    public int iterativeBinarySearch(int target) {
        // TODO
        return 0;
    }

// To find the index of the target in the sorted array. If the
// target is not
// found in the array, then the method returns -1.
    public int recursiveBinarySearch(int target) {
        // TODO
        return 0;
    }
}
```

Task 1.3: How to **change the implemented methods** so that they can use for the case in which **the array is sorted by descending order**.

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Task 2: Application of searching algorithms

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For a given class, Student having the following attributes:

```
public class Student {
    private String id;
    private String name;
    private int yob;//birth year
    private double gpa;
}
```

Then, implement the followings methods in class **StudentManagement**.

```
public class StudentManagement {
    private Student[] students;

    //find the student based on the given id using binary search
    public Student findStudent(String id) {
        // TODO
        return null;
    }

    public Student[] findByYoB(int yob) {
        // TODO
        return null;
    }
}
```

```
public Student findSecondLargestGPASStudent() {  
    // TODO  
    return null;  
}  
}
```

Suggestions:

- Using **Arrays.sort(T[] array)** to sort the array of students. In the case of T is not a primary type (i.e., Student), T have to implement **Comparable** interface and override **compareTo** method.
- Otherwise, using **Arrays.sort(T[] array, Comparator c)** and we should define an implementation of **Comparator** interface.