Data Structure and Algorithm (JAVA)

Semester V (Fall 2022)
Course Instructor: Mr. Muhammad Saleem

Deadline: 25th of October, 2024

LAB 01

OBJECTIVE(S):

1. Installation of Java JDK
2. Setting environment variable
3. Understanding of variables, constant and operators in java.
4. Understanding of Basics of Data Structures
5. Manipulate data using Array Data Structure
6. Create Dynamic List

Lab Task 1: Linear and Binary Search

Objective: Implement and compare the performance of linear search and binary search algorithms.

- Description:
  - Implement a linear search function and a binary search function.
  - The array should be sorted before binary search is applied.
  - Input: A sorted and an unsorted array of integers.
  - Search for a target value in both arrays.
  - Output: Return the index of the target value if found, else return -1.
- Additional:
  - Compare the time complexity of both algorithms on large datasets (n = 100,000).

Lab Task 2: Some Arithmetic's Processing

Objectives: Write a program in Java that initializes two arrays A and B. The program should create, calculate and display the contents of array C as following.

Note that every item in array A and B is of 2 digit number.

A	B	C
25	87	87.25
14	11	14.11
12	10	12.10
74	81	81.74
58	67	67.58
74	94	94.74
98	74	98.74
84	82	84.82
15	15	15.15
24	87	87.24

Lab Task 3: Dynamic Array

Objectives: According to the part of definition of an array it is static in nature, write a program in java where user should create its own Array Class and perform following operations.

Array ar = new Array (10);	
ar.insert(10);	// 10 is an element to store
ar.remove(0);	// 0 is an index to remove an element
ar. indexOf(10);	// 10 is elements to find in which index it is available
ar. Update(0)	0 is index where we need to update the value
Insert n number of elements int he array without worrying about actual size of the array	

Lab Task 4: ArrayList

Objective: Implement sorting and searching operations on an ArrayList.

Description:

- Create an ArrayList of integers.
- Perform the following:
  1. Insert 20 random integers.
  2. Implement a method to sort the ArrayList using any sorting algorithm (e.g., Collections.sort() or your own sorting algorithm like bubble sort).
  3. Implement binary search on the sorted list (use Collections.binarySearch()

Lab Task 5: Dynamic Insertion and Removing Data Element in the ArrayList

Objective: Insert and Remove elements into and form an ArrayList dynamically at specific positions.

Description:

- Create an ArrayList of integers including some duplicate values.
- Perform the following:
  1. Insert 20 random integers.
  2. Insert an element at the beginning of the `ArrayList`.
  3. Insert an element at the middle index.
  4. Insert an element at the last index.
  5. Print the `ArrayList` after each insertion.
  6. Remove middle value
  7. Remove last value
  8. Implement a method to remove all duplicate values.