Exp-02: Performing Operations on Arrays in C++

a) Objectives:

- Understand the concept of arrays in C++.
- Learn to perform insertion and deletion in an array.
- Implement linear and binary search algorithms on arrays.
- Practice basic sorting techniques: bubble sort, selection sort, and insertion sort.

c) Theory:

An array is a collection of items stored at contiguous memory locations. It allows storing multiple values of the same type using a single variable name. Operations like insertion, deletion, searching, and sorting can be applied to arrays.

d) Lab Tasks

Task 1: Insertion at a Specific Position

Description: Insert an element at a specific position in the array.

Sample Input:
Length of Array: 6
Array: 3 6 13 2 8 9
Insert value: 25
Position: 3
Sample Output:
New Length: 7
Array: 3 6 13 25 2 8 9

Task 2: Deletion from a Specific Position

Description: Delete an element from a specific position in the array.

Sample Input:
Length of Array: 5
Array: 10 20 25 30 40
Delete position: 3
Sample Output:
New Length: 4
Array: 10 20 25 40

Task 3: Linear Search

Description: Implement linear search to find an element in the array.

Sample Input 01:
Array: 5 17 12 15 3
Search: 12
Sample Output: Element found at position 2

Sample Input 02:
Array: 5 17 12 15 3
Search: 10
Sample Output: Element not found

Task 4: Binary Search

Description: Implement binary search to find an element in a sorted array.

Sample Input:
Array: 5 10 15 20 25 30 35 40 45 50
Search: 35
Sample Output: Element found at position 6

Task 5: Bubble Sort

Description: Implement bubble sort to sort the array in ascending order.

Sample Input:
Array: 25 17 10 5 12 8 4 12 2 1
Sample Output: 1 2 4 5 8 9 12 17 25

Task 6: Selection Sort

Description: Implement selection sort to sort the array in ascending order.

Sample Input:
Array: 64 25 12 22 11
Sample Output: 11 12 22 25 64

Task 7: Insertion Sort

Description: Implement insertion sort to sort the array in ascending order.

Sample Input:
Array: 12 11 13 5 6
Sample Output: 5 6 11 12 13

e) Discussion

- Insertion and deletion operations in arrays require shifting elements to maintain order.
- Linear search is simple but inefficient for large datasets, while binary search requires a sorted array.

- Sorting algorithms like bubble, selection, and insertion sort are fundamental and help build understanding of algorithmic thinking.

f) Homework Tasks

1. Count the frequency of a specific element in the array.
2. Find the largest and smallest element in the array.
3. Remove all duplicates from the array.
4. Find the K-th Smallest Element from an array.
5. Rotate the array to the left/right by a given number of positions.