**PSG COLLEGE OF TECHNOLOGY, COIMBATORE -641 004**

**Department of Applied Mathematics and Computational Sciences**

**II Semester MSc Software Systems**

**18XW26 Data Structures Lab – Arrays**

**Problem Sheet – 3**

**Solve the following problems by writing efficient programs:**

1. A program P reads in 500 integers in the range [0..100] representing the scores of 500 students. It then prints the frequency of each score above 50.

(Note: use only an array of 50 numbers)

1. The minimum number of comparisons required to determine if an integer appears more than n/2 times in a sorted array of n integers is O(log n). Write a C program which finds whether the given integer number appears more than n/2 times in the given sorted array of n integers. Make sure, upper bound of your program is O(logn).
2. Consider an array consisting of –ve and +ve numbers. The worst case time complexity of an algorithm to segregate the numbers having same sign altogether i.e all +ve on one side and then all -ve on the other would be O(n). Write a C program to read n numbers which consisting of +ve and –ve values, segregate them with upper bound time complexity of O(n).
3. Let A[1...n] be an array of n distinct numbers. If i < j and A[i] > A[j], then the pair (i, j) is called an inversion of A. What is the expected number of inversions in any permutation on n elements?
4. Let s be a sorted array of n integers. Let t(n) denote the time taken for the most efficient algorithm to determined if there are two elements with sum less than 1000 in s. The efficient algorithm for the above said problem takes upper bound as T(n)=O(1). Write a C program to execute such algorithm with worst case time complexity O(1).
5. In a permutation a1.....an of n distinct integers, an inversion is a pair (ai, aj) such that i < j and ai > aj. What would be the worst case time complexity of the Insertion Sort algorithm, if the inputs are restricted to permutations of 1.....n with at most n inversions?

(Note: O(n) is the worst case )