UCS301 Data Structures
Lab Assignment 2
(Week 2 and Week 3)

1) Implement the binary search algorithm regarded as a fast search algorithm with run-time complexity of O(log n) in comparison to the Linear Search.

2) Bubble Sort is the simplest sorting algorithm that works by repeatedly swapping the adjacent elements if they are in the wrong order. Code the Bubble sort with the following elements:

64	34	25	12	22	11	90

3) Design the Logic to Find a Missing Number in a Sorted Array. Given an array of n-1 distinct integers in the range of 1 to n, find the missing number in it in a Sorted Array

(a) Linear time

(b) Using binary search.

4) String Related Programs

(a) Write a program to concatenate one string to another string.
(b) Write a program to reverse a string.
(c) Write a program to delete all the vowels from the string.
(d) Write a program to sort the strings in alphabetical order.
(e) Write a program to convert a character from uppercase to lowercase.

5) Space required to store any two-dimensional array is *number of rows* × *number of columns*. Assuming an array is used to store elements of the following matrices, implement an efficient way that reduces the space requirement.

(a) Diagonal Matrix.

(b) Tri-diagonal Matrix.

(c) Lower triangular Matrix.

(d) Upper triangular Matrix.

(e) Symmetric Matrix

6) Write a program to implement the following operations on a Sparse Matrix, assuming the matrix is represented using a triplet.

(a) Transpose of a matrix.

(b) Addition of two matrices.

(c) Multiplication of two matrices.

7) Let A[1 …. n] be an array of n real numbers. A pair (A[i], A[j]) is said to be an ***inversion*** if these numbers are out of order, i.e., i < j but A[i]>A[j]. Write a program to count the number of inversions in an array.

8) Write a program to count the total number of distinct elements in an array of length *n*.

Additional Questions

1) Find two numbers in an array whose difference equals K. Given an array arr[] and a positive integer k, the task is to count all pairs (i, j) such that i < j and absolute value of (arr[i] - arr[j]) is equal to k.
   https://www.geeksforgeeks.org/dsa/count-pairs-difference-equal-k/
2) String Split Challenge
   You are given a string consisting of lowercase English alphabets. Your task is to determine if it's possible to split this string into three non-empty parts (substrings) where one of these parts is a substring of both remaining parts
   https://www.codechef.com/practice/course/nutanix-interview-questions/NUTANIXCON01/problems/NUTANIX11?tab=statement
3) String Anagrams
   Given two strings str1 and str2, determine if they form an anagram pair.
   Note: Two strings are considered anagrams if one string can be rearranged to form the other string.
   https://www.codechef.com/practice/course/nutanix-interview-questions/NUTANIXCON01/problems/NUTANIX01
4) Sort an array of 0s, 1s and 2s - Dutch National Flag Problem
   Given an array arr[] consisting of only 0s, 1s, and 2s. The objective is to sort the array, i.e., put all 0s first, then all 1s and all 2s in last.
   https://www.geeksforgeeks.org/dsa/sort-an-array-of-0s-1s-and-2s/
5) Given a fixed-length integer array arr, duplicate each occurrence of two (2), shifting the remaining elements to the right.
   Note that elements beyond the length of the original array are not written. Do the above modifications to the input array in place and do not return anything.
   https://leetcode.com/problems/duplicate-zeros/description/