NATIONAL INSTITUTE OF TECHNOLOGY KURUKSHETRA
B.TECH FIRST YEAR COMPUTER ENGINEERING
Data Structures (CSPC-12)
Mid Term-I (Online)

Duration: 50 Minutes M.M 15 Contact Number: 8307894949 Date: 27/04/2021
Note: All questions are compulsory and there is no step marking

Q:1 a. Suppose we choose the median of five items as the pivot in quicksort. If we have an N element array, then we find the median of the elements located at the following positions: left (= 0), right (= N – 1), center (the average of left and right, rounded down), leftOfCenter (the average of left and center, rounded down), and rightOfCenter (the average of right and center, rounded down). The median of these elements is the pivot. What is the worst case running time of this version of quicksort? Explain your answer with valid justification. (3)

b. Let P be a QuickSort Program to sort numbers in ascending order using the first element as pivot. Let t1 and t2 be the number of comparisons made by P for the inputs {1, 2, 3, 4, 5} and {4, 1, 5, 3, 2} respectively. Establish the relationship between t1 and t2. (2)

c. Is there any way to sort 1 GB of data with only 100 MB of available main memory. Which sorting technique will be most appropriate? (2)

Q:2 What do you understand by pointers and what are the various types of pointers in C programming. Explain their types with the help of an example and also identify the outcome of the program given below:
Consider a compiler where int takes 4 bytes, char takes 1 byte and pointer takes 4 bytes. (4)

```
#include <stdio.h>

int main()
{
    int arr_i_1[] = {1, 2 ,3};
    int *ptr_Arr_i = arr_i_1;

    char arr_c_2[] = {1, 2 ,3};
    char *ptrc = arr_c_2;

    printf("sizeof arr_i_1[] = %d ", sizeof(arr_i_1));
    printf("sizeof ptr_Arr_i = %d ", sizeof(ptr_Arr_i));

    printf("sizeof arr_c_2[] = %d ", sizeof(arr_c_2));
    printf("sizeof ptr_Arr_c = %d ", sizeof(ptr_Arr_c));

    return 0;
}
```

Q:3 Answer the following questions of Insertion Sort:
a. Write down the algorithm of Insertion sort.
b. What is the recurrence relation of it.
c. What are the general characteristics of Insertion Sort. (4)