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

Duration: 2 hours **Max. Marks: 50**
Date: 02/07/2021

Q1 a. State the difference between iterative and recursive calls with the help of an example. Consider an example with the help of following elements and sort these elements using Merge sort 38, 27, 43, 3, 9, 82, 10 with algorithm. In addition to above, calculate their time complexity analysis in all cases, and general characteristics of Merge Sort.

b. Consider the snippet of C programming code and predict the output with valid justification.

```
#include <stdio.h>
#include <stdlib.h>

int main(void)
{
    int j;
    int *ptr = (int *) malloc(5 * sizeof(int));

    for (j=0; j<5; j++)
        *(ptr + j) = j;

    printf("%d ", *ptr++);
    printf("%d ", (*ptr)++);
    printf("%d ", *ptr);
    printf("%d ", *++ptr);
    printf("%d ", ++*ptr);
}
```

Q2 a. Consider the following arithmetic expression P, written in Postfix notation. Translate P, into its equivalent Infix Expression; Evaluate the infix expression using algorithm.

P: 256, 7, 3, -, /, 12, 5, 5, +, *, +

b. Write an algorithm to find whether a particular element is present or not in circular queue. What is the advantage of circular queue over a simple queue?

Q3 a. Why do we add header node in the linked list? Write down the efficient code for sorting of elements in non-decreasing order of data values.

b. Define circular doubly linked list and write a function of how to add an element at the specified position.

Q4 a. Define binary tree and calculate the height of binary tree with the aid of a function. Note: This implementation follows the convention where height of a single node is 0.

b. Answer the following questions:
i. Define the properties and drawbacks of Binary search tree.
ii. Let a binary search tree (BST) contains the numbers 1, 2, 3, 4, 5, 6, 7, 8. When the tree is traversed in post-order and the values in each node printed out, the sequence of values obtained is 2, 1, 4, 3, 7, 8, 6, 5. If the tree is traversed in pre-order, then return the sequence obtained from the above information.

Q5 a. The elements 40, 17, 20, 30, 12, 25, 16, 8, 10, 31 are inserted one by one in the given order into a Max Heap. What will be the resultant Max Heap and the number of exchanges?

b. Let A and B are two sparse matrices, and the sample matrices are given below:

Matrix A: (4x4)

Row	Column	Value
1	2	10
1	4	12
3	3	5
4	1	15
4	2	12

Matrix B: (4x4)

Row	Column	Value
1	3	8
2	4	23
3	3	9
4	1	20
4	2	25

Now write down the logic for Transpose and Multiplication of a sparse matrix and return their results.

----------THE END----------