This question paper contains 7 printed pages.]

5192D *Your Roll No. .....*

B.Sc. (Physical / Mathematical Sciences) / Sem. II B

Computer Science – Paper-CSPT-202

(Data Structures)

(Admissions of 2010 and onwards)

Time : 3 Hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question no. 1 is compulsory. Attempt any five of Questions nos. 2 to 8. Parts of a Question must be answered together.

1. (a) Fill in the blank with the correct word from the words provided at the end of each statement: 5

   (i) _____ is the data structure that operates by LIFO method. [Stack / Queue /Tree]

   (ii) Implementation of _____ involves successively dividing the list into two halves. [Insertion Sort / Bubble Sort / Merge Sort]

[P.T.O.

(iii) The arithmetic expression that requires parentheses to define order of evaluation is in _____ notation. [prefix/ infix/ postfix]

(iv) The nodes in a tree that have no children are called _____ [Root / Leaves / Internal nodes]

(v) A priority queue would _____ its elements after each addition. [delete / reorder / insert]

(b) The following code is supposed to add a value 'x' to a circular queue of integers implemented using an array 'a' with size MaxLen Q. Correct the code so that it would work correctly. (Variable rear has its usual meaning. Assume other such variables as appropriate.) 4

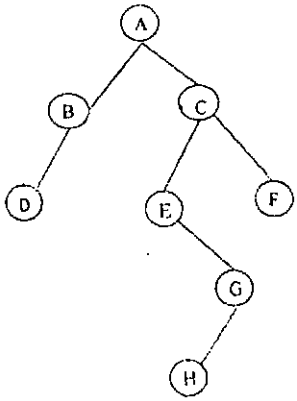
```
AddCirQueue(int x)
{
    if (rear!=MaxLenQ)
    {
        a[rear] = x;
        rear = (rear+1)% MaxLenQ;
}
else
```

```
        cout<<"Queue is Full, cannot add" <<endl;
    }
```

(c) The following code is supposed to delete a node having value x from a singly linked list pointed by head. Correct the code so that it accomplishes its intended operation. 4

```
typedef struct node
{
    int value;
    node* next;
}
... ... ... ...
Delete Node (node * head, int x)
{
    node *q;
    q = new(node);
    head = q;
    while (q->value ! = x)
        q = q->next;
    delete q;
```

(d) Perform the postorder traversal of the following binary tree: 4



(e) Perform Insertion Sort on the following list of integers, showing your steps:

44,23,51,5,61,89,2,55 4

(f) Convert the following arithmetic expression to postfix, showing your steps:

2 * (5+3) / (6 – 4) 4

*Attempt any **five** Questions from Question No.2 to 8*

2. (a) Define a class for stack of integers. Include the documented functions that may be required for operations to be performed by the stack. 5

(b) Evaluate the following post fix expression using a stack, showing the contents of stack at each step.

3 2 + 5 / 9 + 2 * 5

3. (a) The following function is called with values n = 16, m = 26. What will be returned by the function? Explain showing the sequence of actions that will happen. 5

```
int gcd (int m, int n)
{
    if (m = = 0)
        return n;
    if (n = = 0)
        return m;
    return (gcd (n, m % n));
}
```

(b) Define the following terms: 5

(i) Deque

(ii) Complete binary tree

(iii) Sentinel value

(iv) Abstract data type

(v) Depth of recursion

4. Write a function for Selection sort on a list of integers implemented as 3+7

   (i) An array

   (ii) A doubly linked list

5. Sort the following data using 10

   (i) insertion sort

   (ii) bubble sort

   showing your steps and count the number of comparisons you performed in each case.

   42,37,18,29,45,87,3,11,4

6. (a) Write a function in C++ that takes the pointer to a singly linked list as parameter and returns the reversed linked list. 5

   (b) Write an algorithm to reverse a string using a stack. 5

7. (a) Write a well-documented function to count the number of left-children in a binary tree. 5

   (b) Construct a Binary Search Tree by successive insertion of the following keys, showing the tree after each insertion

   27,13,89,56,34,8,67,16,4,91 5

8. (a) What is meant by 'best-case' and 'worst-case' analysis of an algorithm? Explain the best and worst cases in the context of Binary Search of a key on a list of integers. 5

(b) Match the following: 5

Selection sort	$O(n \lg n)$
Binary search	$O(n)$
Merge sort	$O(\lg n)$
Linear search	$O(n^3)$
Matrix multiplication	$O(1)$
	$O(n^2)$