

This question paper contains 7 printed pages.]

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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;
```

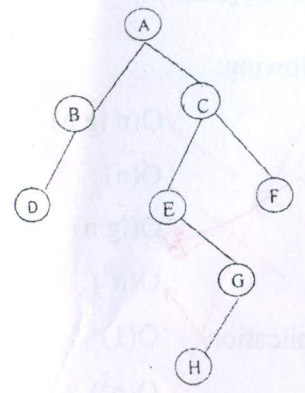
```
delete q;
```

```
}
```

*Handwritten corrections:*  
① q = new(node);  
② while (q != 0 && q->value != x)  
{ q = q->next; }  
p->next = q->next;

2 2  
 2  
 25  
 253  
 \*  
 \*  
 \* (+)

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



D B H G E F G A

(e) Perform ~~Insertion~~ Sort on the following list of integers, showing your steps: 4  
 44, 23, 51, 5, 61, 89, 2, 55

23, 44, 51

(f) Convert the following arithmetic expression to postfix, showing your steps: 4  
 $2 * (5+3) / (6-4)$

253+\*64-/\*

Attempt any five Questions from Question No.2 to 8

Correct answer = 2

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

1+1+1+1

[3] 2 5 9 2  
 3 5 1 10 20

(b) Evaluate the following post fix expression using a stack, showing the contents of stack at each step. 5

$3 \ 2 + \ 5 \ / \ 9 + \ 2 \ *$

20

4+1

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

1+3+1

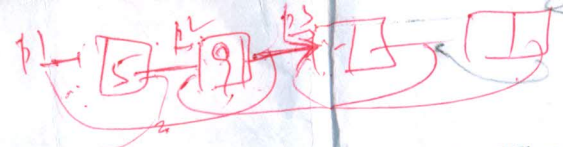
```

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

gcd(26, 16)  
 $\rightarrow \text{gcd}(16, 26 - 1 \cdot 16) = \text{gcd}(16, 10)$   
 $\rightarrow \text{gcd}(10, 16 - 1 \cdot 10) = \text{gcd}(10, 6)$   
 $\rightarrow \text{gcd}(6, 10 - 1 \cdot 6) = \text{gcd}(6, 4)$   
 $\rightarrow \text{gcd}(4, 6 - 1 \cdot 4) = \text{gcd}(4, 2)$   
 $\rightarrow \text{gcd}(2, 4 - 2 \cdot 2) = \text{gcd}(2, 0)$   
 return 2

(b) Define the following terms: 5

- (i) Deque  $1/2 + 1/2$
- (ii) Complete binary tree
- (iii) Sentinel value Extra key inserted at
- (iv) Abstract data type  $\rightarrow$  tool for specifying logical properties of a data type
- (v) Depth of recursion



Handwritten notes:  $O(n)$ ,  $O(n^2)$ ,  $O(\log n)$ ,  $1+1$ ,  $3$

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

- (i) An array  $7+3$
- (ii) A doubly linked list

5. Sort the following data using 10

- (i) insertion sort (29)
- (ii) bubble sort (30)

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

Handwritten note: push 2, pop 2.

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

Handwritten note: /algorithm

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

