```
int mul(int x)
{
    if (x<5)
        return (3*x);
    else
        return (2*mul(x-5)+7);
}
```

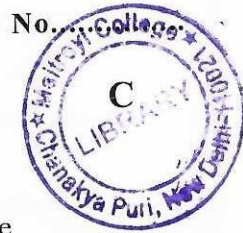What value will be returned by function when mul is called. Explain each step of recursion.   (10)

(b) Write the recursive function to calculate the GCD of the number.   (4)

[This question paper contains 8 printed pages.]

Your Roll No. ....

Sr. No. of Question Paper : 1499

Unique Paper Code   : 42347501

Name of the Paper   : Data Structure

Name of the Course   : **B.Sc. (P) LOCF (DSE)**

Semester   : V

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

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

2. The paper has **two** sections. **All** questions in 'Section A' are compulsory.

3. Attempt any **five** questions from 'Section B'. Parts of a question must be answered together.

SECTION A

1. (a) Mergesort needs additional storage for merging arrays which is a serious drawback for large amounts of data. Give one solution for this problem.   (2)

P.T.O.

(b) Consider the linear array a (5 : 50). Suppose base (a) = 300 and w = 4 words per memory cell for a. Find the address of a [15], a [35].   (2)

(c) Explain briefly the two main operations on a stack.   (2)

(d) Differentiate between an array and a linked list.   (2)

(e) Draw a diagram for a complete binary tree having five nodes.   (2)

(f) Which one is more efficient, binary search or linear search? Justify your answer.   (2)

(g) What operation does the following code perform on a singly linked list. Explain   (2)

```
void func( int x)
{
    head = new node (x, head);
    if ( tail = = 0)
        tail = head;
}
```
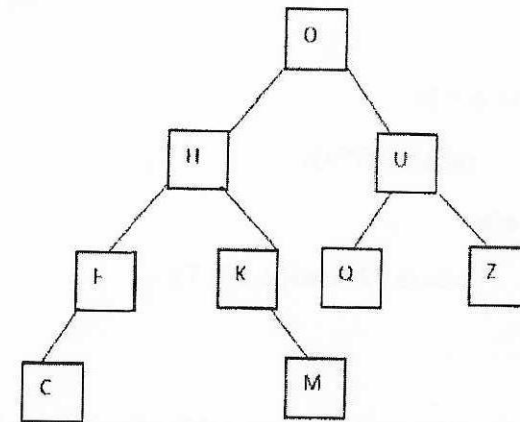
Determine the inorder, preorder, postorder traversal of the given tree. Also give the height of the above tree. Is the above tree a complete binary tree? Justify your answer.

(b) Define the following terms with the help of an example :

   (i) Binary Search tree

   (ii) Priority Queues   (4)

8. (a) Consider the following code: (6)

6. (a) Consider the following sequence of operations performed on an initially empty doubly linked list :

      (i) addtohead (25),

      (ii) addtohead (28),

      (iii) addtotail (23),

      (iv) addtotail (20),

      (v) deletefromhead ( ),

      (vi) deletenode (23)

Show the HEAD, TAIL, content of the list, and links between the nodes after each operation.

(6)

(b) Write a code to insert a node at the end of a singly linked list. (4)

7. (a) Consider the following binary tree: (6)

(h) Suppose a circular queue of capacity n elements is implemented with an array of n elements. Assume that the insertion and deletion operation are carried out using FIRST and LAST as array index variables, respectively. Initially, FIRST = LAST = −1. Write the conditions to detect if the queue is full, and the queue is empty. (3)

(i) Show all the steps of a stack while adding 679 and 2530. (4)

(j) Write a pseudocode for a recursive function to find the factorial of a number. (4)

SECTION B

2. (a) An array <77, 66, 55, 44, 33, 22, 11> is to be sorted in ascending order using quick sort. Show the status after each pass. (6)

(b) Consider a circular queue "CQueue" of size 5. Show the status of the circular queue and the value of the variable FRONT and REAR after each of the following operations :

    (i) Insert A, B, C, D, E to the "CQueue"

    (ii) Delete A, B from the "CQueue"

    (iii) Insert F

    (iv) Delete C, D, E, F   (4)

3.   (a) Consider the following arithmetic expression P, written in postfix notation where

    A=12, B=7, C=3, D=2, E=1, F=5:

    P: A B C − / D E F + * +

    (i) Translate P into its equivalent infix expression

    (ii) Evaluate the infix expression (show the steps using stack)   (6)

  (b) Write a pseudocode to add two large numbers using stack.   (4)

4.   (a) Consider the following code fragment :   (6)

    Stack stack1 = new Stack();

```
while (!queue.isEmpty())
    stack1.push(queue.dequeue());
while (!stack1.isEmpty())
    queue.enqueue(stack1.pop());
```

What function does it perform on the queue? What will happen if we swap the queue and stack in the above-mentioned code fragment?

(**Note:** enqueue will now become push and vice versa. Also, pop now becomes dequeue and vice versa.)

  (b) What kind of error can occur in an array implementation of queue? Give examples to illustrate it. How can this error be avoided?

                                 (4)

5.   (a) Differentiate between linked list and circular linked list with the help of an example. Also write a function to add a node at the end of a circular linked list.   (6)

  (b) Explain the depth first and breadth first traversal of a tree with the help of an example.   (4)