[This question paper contains 7 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : **7403** **J**

Unique Paper Code : 32341301

Name of the Course : **B.Sc.(Hons.) Computer Science**

Name of the Paper : Data Structures

Semester : III

Time : 3 Hours ***Maximum Marks : 75***

Instructions for Candidates :

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

(b) Question No. **1** is compulsory.

(c) Attempt any **four** questions out of the remaining Question No. **2** to **7**.

(d) Parts of a question must be answered together.

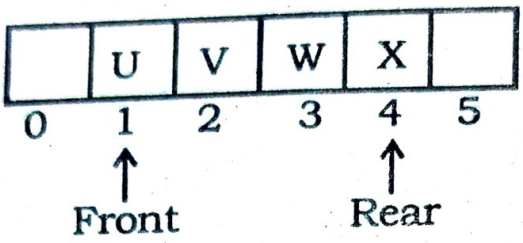
1. (a) Convert the following infix expression to postfix form using a stack : 5

(A – B / C) * (D * E – F)

Show the contents of the stack at every step.

P.T.O.

(b) Consider the following Queue of characters of size 6 : 5



This Queue is implemented as a circular array. Show the contents of the Queue with the positions of Front and Rear after each of the following operations :

(i) Y is added to the Queue

(ii) One element is deleted

(iii) Z, A and B are added

(iv) Three elements are deleted

(v) C is added

(c) Given a single linked list of characters, write a function to check whether this list is a palindrome or not. You may use any one additional data structure. 5

(d) Consider the intermediate configurations of an array being sorted. Which sorting algorithm is being used in each case ? Justify your answer. 2.5+2.5=5

(i) (4, 5, 8, 1) (1, 5, 8, 4) (1, 4, 8, 5) (1, 4, 5, 8)

(ii) (4, 5, 8, 1) (4, 5, 1, 8) (4, 1, 5, 8) (1, 4, 5, 8)

(e) Create a binary search tree using the following sequence of data : 2+2+1=5

25, 28, 40, 15, 10, 17, 20, 26

Delete 25 using (i) deletion by merging (ii) deletion by copying.

Which of the two methods of deletion is better and why ?

(f) What is a hashing ?

Insert the keys 35, 44, 61, 72, 56, 51 into a hash table of size m=7 using linear probing with hash function as the Division Method. 2+3=5

(g) Give the recursive version of the following function : 4+1=5

```
void cubes (int n)
{ for (int i =1; i<= n; i++)
        cout << i*i*I << ' ';
}
```

How will this recursive function be initially invoked for n = 5 ?

2. (a) Give template class definition for an ordered singly linked list of integers. Write a member function to insert a node in this linked list such that the list remains in order. 2+4=6

(b) Calculate the address of the element X[3][4] of the 2D array defined as int X[7][10], if the elements are stored in : 2+2=4

(i) row major order

(ii) column major order

The beginning address of the array is 100. Every element requires 4 bytes of storage.

3. (a) Write an algorithm that determines whether a given binary tree is complete. 5

(b) A binary tree has 10 nodes. The preorder and inorder traversals of the tree are shown below. Construct the tree. 5

I. Preorder : JCBADEFIGH

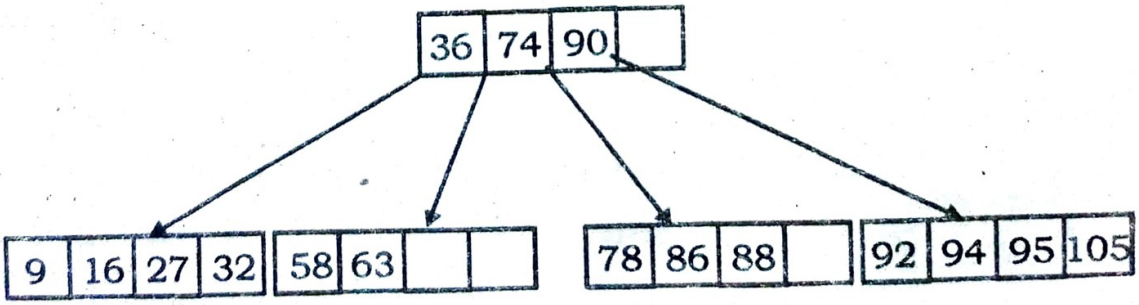
II. Inorder : ABCEDFJGIH

Also give the Postorder Traversal of the constructed tree.

4. (a) Insert the given keys one by one in the following B tree of order 5 : 5

55, 80, 40, 42, 99

Show the status of the tree after each insertion.



(b) Consider the following array of integers : 1+4=5

12, 14, 9, 18, 120, 30, 40, 35, 60

Which sorting algorithm will be best suited to sort this array ? Use this algorithm to sort it and show the contents of the array after every step.

5. (a) Given a queue of integers, write an algorithm that deletes all negative integers without changing the order of the remaining elements of the queue. 6

(b) Give an algorithm to display the minimum value in a Binary Search Tree. 4

6. (a) Apply binary search algorithm to search for 25 and 91 in the following array of integers : 3+3=6

16 25 33 43 59 64 78 87 99

Show the status of *first*, *last* and *mid* after each iteration. Also show the number of comparisons made in both the cases.

(b) A Tridiagonal matrix T of dimension n × n that has all non-zero entries on the three central diagonals is mapped to a one-dimensional array D by diagonals, starting with the lowest diagonal. Obtain the formula for the location of an element T(i, j) in D. 4

7. (a) Given a doubly linked list, write an algorithm to swap the kth node from the beginning of this list with the kth node from the end of the same list. The nodes have to be swapped and not their contents. 6

(b) Write a recursive function to find the sum of the elements of an array. 4