

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1901

C

Roll No. 1305827002

Unique Paper Code : 234201

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

Name of the Paper : Data Structure (CSHT-203)

Semester : II

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. Question 1 is compulsory.
3. Attempt any **four** questions out of the remaining Q2-Q7.
4. Parts of a question must be answered together.

1. (a) Define a class to represent node of a doubly circular linked list.
Write a member function to display the content of doubly circular linked list. (5)

(b) Consider the following postfix expression :

8 7 3 - / 6 2 5 4 + * + -

The above expression is evaluated using stack. Show the content of stack after each step. (5)

(c) Draw binary trees with 3 nodes which when traversed in post-order gives the sequence A, B, C. (5)

(d) Consider following list S of alphabetic characters :

B, F, H, M, Q, S, U, V

An application requires to perform search operations on the above list. Which of the search technique is appropriate and why? Apply the technique suggested by you to search an element U on the list S and count the number of comparisons performed in searching U. (5)

P.T.O.

(e) Consider following list of 9 numbers :

- 66, 33, 44, 22, 55, 88, 11, 77, 99

Suppose the list is to be sorted. Use the quicksort algorithm to find final position of first number 66 in the sorted list. (5)

(f) The Binomial Coefficient is defined recursively according to the following definition

$C(n,k) = 1$ if $k = 0$ or $k = n$

$C(n,k) = C(n-1, k-1) + C(n-1, k)$

otherwise Find the value of $C(3,2)$ and $D(4,4)$. (5)

(g) Write a function to delete an element x from an ordered linked list. (5)

2. (a) Consider the following class definition of singly linked list :

```

class SLList
{
    Node * start; //points to first node
public:
    SLList()
    { start = 0; }
    .....
    void change();
}

```

Member function change() removes the first element of the singly linked list and adds it to the end of the list without changing any value of info. Write the code of member function change(). Assume class Node is defined and have data members info for storing value of the node and next to store address of next node and constructor to initialize these members. (5)

(b) What are self-organizing lists? For a given sequence BCADADACB, show the list after each step using (i) Move to Front (ii) Transpose (5)

3. (a) Consider the following queue QUEUE of characters, where queue QUEUE is a circular queue of size 6. FRONT is at 2 and REAR is at 4. And queue Q is :

0	1	2	3	4	5
		S	A	U	

Show the status of QUEUE, FRONT and REAR as the following operations take place in the sequence given below :

- (i) Elements P, Y are added.
 - (ii) Elements C, N, B are added.
 - (iii) Two elements are deleted.
 - (iv) Three elements are deleted.
- (4)

(b) In the part 3(a), which operation(s) will cause overflow or underflow? What is condition for overflow and underflow to occur in a circular queue? Write the functions to test for overflow and underflow conditions and to print an appropriate message in a circular queue. (6)

4. (a) Consider the following recursive function :

```

unsigned int Fib (unsigned int n){
    if (n < 2)
        return n;
    else
        return (Fib(n-2) + Fib(n-1)); }

```

This function produces Fibonacci sequence 0,1,1,2,3,5,8,13 Function Fib(5) is called to compute sixth number of Fibonacci sequence. How many recursive calls and additions will be performed to compute Fib(5). Draw the tree showing all the calls generated by Fib(5). (5)

(b) What is hashing? Consider the following 4 digit numbers (keys): 6514, 4331, 1825 Find the 2-digit hash address of each key using Mid Square method. (5)

5. (a) Consider a upper triangular matrix of $n \times n$ size. What will be total number of non zero entries in this upper triangular matrix. Give the mapping formula for storing and retrieving elements of upper triangular matrix in a one dimensional array. (6)

(b) Consider the following Sparse Matrix :

0	0	0	0	0	5	0	2
8	0	0	0	3	0	0	0
0	9	0	0	0	0	4	0
0	6	1	0	0	0	0	0

Show how the elements will be stored in one dimensional array in row major order and column major order. (4)

6. (a) Write a function to implement iterative preorder traversal on a Binary search tree. (5)

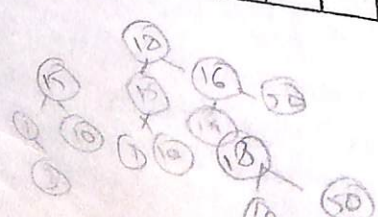
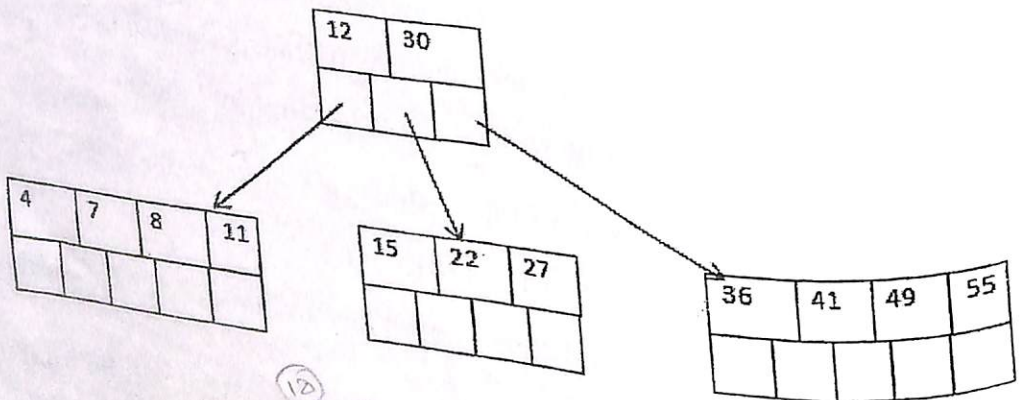
(b) Create a Binary Search Tree using following data :

15, 7, 1, 18, 50, 19, 3, 10, 16

Then, perform deletion of node 7 using (i) deletion by copying and (ii) deletion by merging method. Show the tree structure for each deletion separately. (5)

7. (a) Write a function to count total number of left children in a Binary Search tree. (5)

(b) Consider the following B-tree of order 5. Insert 13, 45, and 37 in the following B - tree. Show the status of B-tree after each insertion (5)



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