Unique Paper Code: 23412 02
Sr. No. of QP:- 2286

E-4

B.Tech. (Computer Science)

Semester II

Data Structures

Paper No. DCI 202

Time: 3 hrs **Max. Marks: 75**

Question 1 is compulsory.

Attempt any four questions out of the remaining Q2-Q7. Parts of a question must be answered together.

1)

a) Given that the base address of an array a[10][10] is 5010 with element size of 4 bytes, find the address of a[4][2] as per row-major and column-major mapping. Give the general formulae also. 5

b) Write a recursive function for linear search. The function should return the index of the element if it is found else it should return -1. 5

c) An ordered linked list is to be implemented using a node having *info* part of generic data type. Give the necessary class definitions for the same. Write a function to insert an element into this list. 5

d) Construct the binary tree for the following sequence of traversals of nodes:

Inorder E A C K F H D B G
Preorder F A E K C D H G B 5

e) Convert the following infix expression to postfix form using stack:

$$\frac{A + B * C}{D - E} + F$$

5

f) Apply bubble sort on the following data:

19 74 16 24 30 92 60

Show the intermediate steps. 5

g) Construct a binary search tree for the following keys (inserted in same order as they appear in the list):

24 59 43 37 9 97 86 33

Also show the preorder, inorder and postorder traversals for the constructed tree. 5

2)

a) Define a class to implement lower triangular matrix as a 1-D array. Write the member functions to store and retrieve its elements. 5

b) Consider a table of size 7.

i) Insert in this table the following elements using division method of hashing with linear probing for collision resolution:
77 45 52 28 39 66

ii) Show the status of the table when 52 is removed from it. What problem(s) may arise? What is the solution? 3 + 2

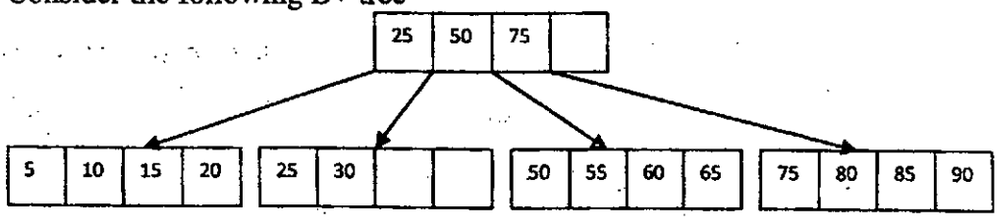
3)

a) Apply binary search algorithm to search for 24 and 91, in the following list of numbers:
18 24 36 41 57 62 75 89 93
Show the status of *first*, *last* and *mid* after each iteration. 6

b) What is the difference between a binary tree and a binary search tree? Is it possible to have a binary tree which is not a binary search tree and vice-versa? Give example(s). 4

4)

a) Consider the following B+ tree



i) What is the order of the tree? 1
ii) Show the insertion of 70 and then of 95 in the tree shown above. 2 + 2
iii) Delete 65 from the tree obtained in part (ii) above. 2

b) Write a function to insert an element *e* at the end of a doubly linked list. 3

5)

a) What are self-organizing lists? List the four methods generally used to self-organize the list. Out of those four methods, which method does not require traversing all the nodes of the list if the element is not present in the list and why? 4

b) Write the necessary class definition for a queue implemented as a circular linked list with a rear pointer only. 6

6)

a) Consider the following array implementation of a tree. Draw the binary tree corresponding to it: 5

Array Index	Info	Right	Left
0	13	4	2
1	31	6	-1
2	25	7	1
3	12	-1	-1
4	10	5	3
5	2	-1	-1
6	29	-1	-1
7	20	8	-1

8	15	-1	9
9	18	-1	-1

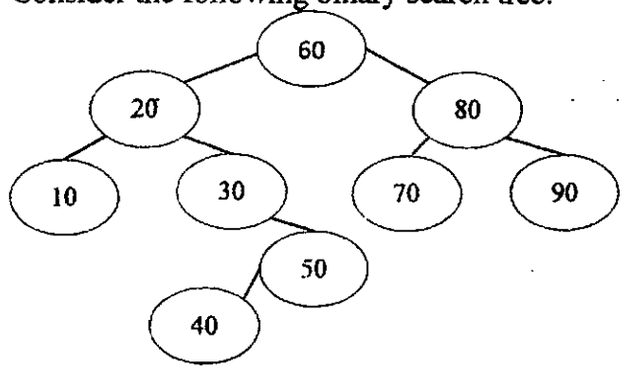
b) Give the iterative equivalent of the following recursive function:

```
int fn(int a, int b){
    if (b == 0)
        return 0;
    if (b == 1)
        return a;
    return a + fn(a, b-1);
}
```

What is the function given above calculating? 5

7)

a) Consider the following binary search tree:



Show the deletion of the following (start from the original tree every time)

i) 40
ii) 60 by merging
iii) 60 by copying 1+2+2

b) Write the function to add two large numbers using stacks. 5