Sl. No.

C0-R4.B3 : DATA STRUCTURE THROUGH JAVA

NOTE :
1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same questions should be answered together and in the same sequence.**

**Total Time : 3 Hours**   **Total Marks : 100**

1. (a) Develop an algorithm for inserting a new node with new Key into a binary search tree.

    (b) Give a suitable declaration of Node, and, if required, tree.
         Write the preorder and postorder traversal of the tree given below :

                     38
                    / \
                  21   64
                 / \   \
               12   32   71
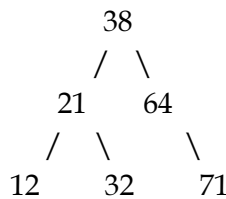
    (c) What is the maximum height of any AVL-tree with 7 nodes ? Assume that the height of a tree with a single node is 0.

    (d) How many topological sorts of the following DAG are there ?
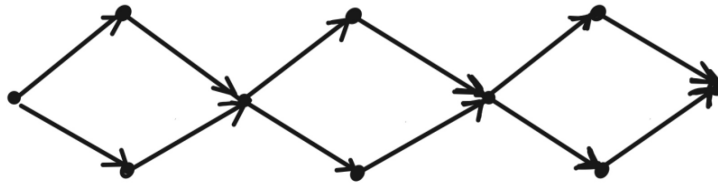

    (e) Write a function to print the non-zero elements of a non-square upper right triangular m*n matrix row by row and column by column.

    (f) What is meant by ADT ? Describe with examples.

    (g) Briefly explain some of the applications of string matching.   **7x4=28**

2. (a) Write a program for given array *arr* of size N to find largest number in the array.

    (b) A set of n unique elements and an unlabelled binary tree with n nodes are given. How many distinct binary search trees are possible ?

    (c) Write infix to postfix conversion algorithm using stack and show its working with the help of A*B-(C+D)+E.   **7+6+5**

3. (a) Write a recursive program in java to reverse the linked list in pairs. If the linked list is 1->2->3->4->X, then the result should be 2->1->4->3->X

    (b) Explain with suitable diagram how a linked list can be used to represent a polynomial $5x^3 + 4x^2 + 3x+2=0$? Write an algorithm to perform addition of two polynomials using linked list.

    (c) Given a binary tree, write a program to print all leaf nodes of the given binary tree from left to right using recursion.   **6+6+6**

4. (a) A Priority-Queue containing 5 elements is implemented as a Max-Heap. The level-order traversal of the heap is given below :
80 50 15 30 20
Two new elements '10' and '70' are inserted into the heap in that order. Briefly explain the level-order traversal of the heap after insertion of the elements.

(b) Consider the following AVL tree. Show the state of the AVL tree after :
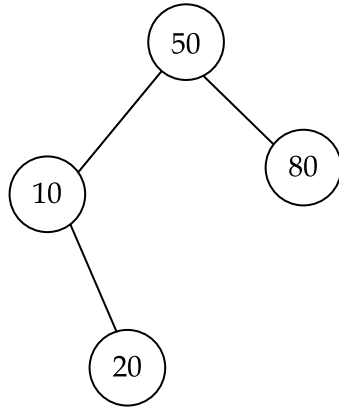
   (i) After inserting new node with value 15
   (ii) After inserting new node with value 12

(c) Construct the binary tree from given inorder and preorder traversal :
Inorder traversal : E D F A B C G
Preorder traversal : A D E F C B G   **7+6+5**

5. (a) What are the basic principles of Xtreme Programming ? What good practices are adopted in Xtreme programming ?

(b) What is the covariant method overriding in Java ? Can we prevent overriding a method without using the final modifier ?

(c) Sort the following array in ascending order using insertion sort.
30 10 90 20 50 40 5   **6+6+6**

6. (a) Compare the complexities (Best, Average and Worst) of insertion sort, quick sort and merge sort.

(b) How an undirected graph is represented using
   (i) Adjacency Matrix
   (ii) linked list ?

(c) A single array A [1…MAXSIZE] is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables top1 and top2 point to the location of topmost elements in each of the stacks. Implement functions push1 and push2 that pushes one element at a time in each of the stacks respectively. Also write algorithms for POP1 and POP2 that pops the topmost element of stack1 and stack2 respectively.   **4+7+7**

7. (a) Implement Rabin karp algorithm to perform pattern matching on the given Text T = "baecddabcdef" and Pattern P= "ecd".

(b) Write an algorithm to find maximum spanning tree ?

(c) Write an algorithm to check whether a given graph G has simple path from source S to destination D. Assume the graph G is represented using adjacency matrix.   **7+6+5**

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