# SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

**COIMBATORE – 35**

**DEPARTMENT OF COMPUTER SIENCE AND ENGINEERING (UG & PG)**

**Subject Code & Name: 23ITT101 Programming in C & Data Structure**

## UNIT – V

1. Define a tree

A tree is a collection of nodes. The collection can be empty; otherwise, a tree consists of adistinguished node r, called the root, and zero or more nonempty (sub) trees T1, T2,…,Tk, each of whose roots are connected by a directed edge from r.

2. Define root

This is the unique node in the tree to which further sub-trees are attached.Here, A is the root.

3. Define degree of the node

The total number of sub-trees attached to that node is called the degree of the node. For node A, the degree is 2 and for B and C, the degree is 0.

4. Define leaves

These are the terminal nodes of the tree. The nodes with degree 0 are always the leaves. Here, B and C are leaf nodes.

5. Define internal nodes

The nodes other than the root and the leaves are called internal nodes. Here, C is the internal node.

6. Define parent node

The node which is having further sub-branches is called the parent node of those sub-branches.

Here, node C is the parent node of D and E

7. Define depth and height of a node

For any node ni, the depth of ni is the length of the unique path from the root to ni. The height of ni is the length of the longest path from ni to a leaf.

8. Define depth and height of a tree

The depth of the tree is the depth of the deepest leaf. The height of the tree is equal to the height of the root. Always depth of the tree is equal to height of the tree.

9. What do you mean by level of the tree?

The root node is always considered at level zero, then its adjacent children are supposed to be at level 1 and so on.

Here, node A is at level 0, nodes B and C are at level 1 and nodes D and E are at level 2.

10. Define forest

A tree may be defined as a forest in which only a single node (root) has no predecessors. Any forest consists of a collection of trees.

11. Define a binary tree
A binary tree is a finite set of nodes which is either empty or consists of a root and two disjoint binary trees called the left sub-tree and right sub-tree.

12. Define a path in a tree

A path in a tree is a sequence of distinct nodes in which successive nodes are connected by edges in the tree.

13. Define a full binary tree

A full binary tree is a tree in which all the leaves are on the same level and every non-leaf node has exactly two children.

14. Define a complete binary tree

A complete binary tree is a tree in which every non-leaf node has exactly two children not necessarily to be on the same level.

15. State the properties of a binary tree

• The maximum number of nodes on level n of a binary tree is 2n-1, where n≥1.

• The maximum number of nodes in a binary tree of height n is 2n-1, where n≥1.

• For any non-empty tree, nl=nd+1 where nl is the number of leaf nodes and nd is the number of nodes of degree 2.

16. What is meant by binary tree traversal?
Traversing a binary tree means moving through all the nodes in the binary tree, visiting each node in the tree only once.

17. What are the different binary tree traversal techniques?
• Preorder traversal

• Inorder traversal

• Postorder traversal

• Levelorder traversal

18. What are the tasks performed during inorder traversal?

• Traverse the left sub-tree

• Process the root node

• Traverse the right sub-tree

19. What are the tasks performed during postorder traversal?

- Traverse the left sub-tree

- Traverse the right sub-tree

- Process the root node

20. State the merits of linear representation of binary trees.

- Storage method is easy and can be easily implemented in arrays

- When the location of a parent/child node is known, other one can be determined easily

- It requires static memory allocation so it is easily implemented in all programming language

21. State the demerit of linear representation of binary trees.
Insertions and deletions in a node take an excessive amount of processing time due to data movement up and down the array.

22. State the merit of linked representation of binary trees.

Insertions and deletions in a node involve no data movement except the rearrangement of pointers, hence less processing time.

23. State the demerits of linked representation of binary trees.

- Given a node structure, it is difficult to determine its parent node

- Memory spaces are wasted for storing null pointers for the nodes, which have one or no sub-trees

- It requires dynamic memory allocation, which is not possible in some programming language

24. Define a binary search tree
A binary search tree is a special binary tree, which is either empty or it should satisfy the following characteristics: Every node has a value and no two nodes should have the same value i.e) the values in the binary search tree are distinct

- The values in any left sub-tree is less than the value of its parent node

- The values in any right sub-tree is greater than the value of its parent node

- The left and right sub-trees of each node are again binary search trees

25. What is the use of threaded binary tree?
In threaded binary tree, the NULL pointers are replaced by some addresses. The left pointer of the node points to its predecessor and the right pointer of the node points to its successor.

26. Traverse the given tree using Inorder, Preorder and Postorder traversals.
Inorder : D H B E A F C I G J

Preorder: A B D H E C F G I J

Postorder: H D E B F I J G C A

27. In the given binary tree, using array you can store the node 4 at which location?
At location 6

1 2 3 - - 4 - - 5 where LCn means Left Child of node n and RCn means Right Child of node n

28. Define AVL Tree.

An empty tree is height balanced. If T is a non-empty binary tree with TL and TR as its left and right subtrees, then T is height balanced if

i) TL and TR are height balanced and

ii) $|hL - hR| \leq 1$

Where hL and hR are the heights of TL and TR respectively.

29. What do you mean by balanced trees?

Balanced trees have the structure of binary trees and obey binary search tree properties. Apart from these properties, they have some special constraints, which differ from one data structure to another. However, these constraints are aimed only at reducing the height of the tree, because this factor determines the time complexity.

Eg: AVL trees, Splay trees.

30.What are the categories of AVL rotations?
Let A be the nearest ancestor of the newly inserted nod which has the balancing factor ±2. Then the rotations can be classified into the following four categories:

Left-Left: The newly inserted node is in the left subtree of the left child of A.

Right-Right: The newly inserted node is in the right subtree of the right child of

A. Left-Right: The newly inserted node is in the right subtree of the left child of A.

Right-Left: The newly inserted node is in the left subtree of the right child of A.

31.What do you mean by balance factor of a node in AVL tree?
The height of left subtree minus height of right subtree is called balance factor of a node in AVL tree.The balance factor may be either 0 or +1 or -1.The height of an empty tree is -1.

32. Define splay tree.

A splay tree is a binary search tree in which restructuring is done using a scheme called splay. The splay is a heuristic method which moves a given vertex v to the root of the splay tree using a sequence of rotations.

33. What is the idea behind splaying?

Splaying reduces the total accessing time if the most frequently accessed node is moved towards the root. It does not require to maintain any information regarding the height or balance factor and hence saves space and simplifies the code to some extent.