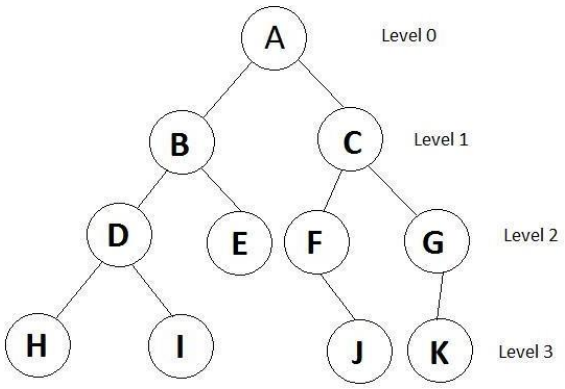
1. Define tree?

Tree is a non linear data structure. There is no linear relation between the data items. It can be defined as finite set of more than one node.

There is a special node designated as root node.

The remaining nodes are partitioned into sub tree of a tree.

The below diagram shows the tree

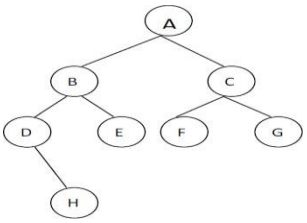


2. Define the terminologies used in Trees

- **Root** - the top most node in a tree.
- **Parent** - node that has achild.
- **Siblings** - nodes with the same parent.
- **Leaves** - nodes with nochildren.
- **Non Leaf**- nodes withchildren
- **Internal nodes** - nodes with at least one child.
- **Degree** - number of sub trees of a node.
- **Edge** - connection between one node to another.
- **Level** - The level of a node is defined by 1 + the number of connections between the node and the root
- **Height** - The height of a node is the length of the longest downward path between the node and a leaf
- **Forest** - A forest is a set of n ≥ 0 disjoint trees.

3. Define a path in a tree. Give example.

A path from a node n1 to nk is defined as the sequence of nodes n1, n2.....nk such that ni is the parent of ni+1 for 1<i<k.

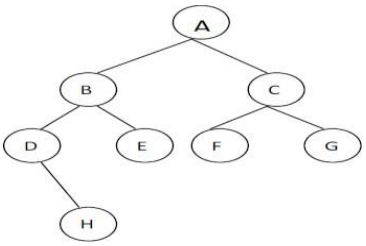


Eg:

The path from A-H is A-B-D-H

4. Define height of the node in a tree. Give example.

The height of node ni the length of the longest path from ni to a leaf Eg:



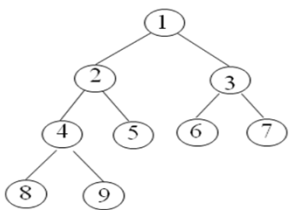
The height of node B is 2

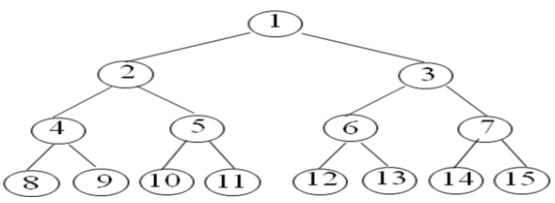
5. List the applications oftrees.

- Binary search trees
- Expression trees
- Threaded binary trees

6. Difference between Complete and Fully Binary Tree. (Nov 2012)

Complete Binary Tree	Full Binary Tree
It is a binary tree of depth d is an almost complete binary tree if ➢ Any node at level less than d-1 has 2 sons. ➢ For any node in the tree with a right descendent at level d, the node must have a left son and every left descendent of the node is either a leaf at level d or has 2 sons.	A full binary tree of depth d is the strictly binary tree all of whose leaves are at level d. For depth d , the maximum number of nodes present in the tree is equal to $2^{d+1}-1$.





Complete binary tree Full binary tree of depth 4

7. Define tree traversal. List out the types of Tree traversal?(apr/may 2017)

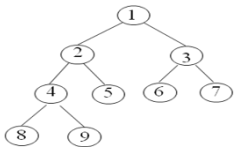
Traveling through all the nodes of the tree in such a way that each node is visited exactly once.

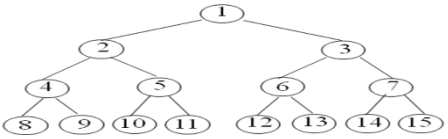
There are three types of tree traversal

- Preorder traversal
- Inorder traversal
- Postorder traversal

8. Define terminal nodes in a tree?

A node that has no children is called as a terminal node. It is also referred as a leaf node. These





nodes have degree has zero.

9. Define non-terminal nodes in a tree?

All intermediate nodes that traverse the given tree from its root node to the terminal nodes are referred as non-terminal nodes.

10. Define branch, siblings & ancestors?

Branch or edge of a tree is called as the link or connection between two nodes. The nodes having the same parent are called siblings. The ancestor of a node is referred as all nodes along the path of root node to the path node.

11. State the properties of the tree?

Any node can be the root of the tree.

If the root is identified; then that tree is called as the rooted

node. If it is not identified; then that tree is called as the free

tree.

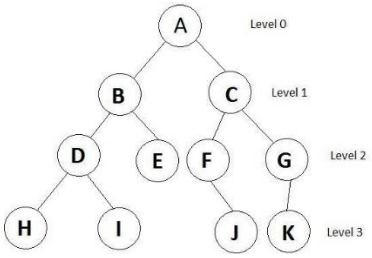
Every node, expect the root node has a unique parent.

12. Define degree?

The degree of a node is referred as the number of sub-trees of a particular node.

13. Define a binary tree?

A binary tree is tree, which has nodes either empty or not more than two child nodes each of which may be a leaf node.



14. 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.

15. When a binary tree of depth 'd' is almost complete binary tree? (Nov 2012)(Nov 2017)

A complete binary tree of depth d is the strictly binary tree all of whose leaves are at level d. For depth d, the number of nodes in the tree vary from 2^d to 2^{d+1} -1.

16. Give some Properties of Binary Tree(April 2012)

- The number of nodes *n* in a **binary tree of height** *h* is at least $n = h + 1$ and at most $n = 2^{h+1}-1$ where *h* is the depth of the tree.
- The number of nodes *n* in a **perfect binary tree** can also be found using this formula: $n = 2l-1$ where *l* is the number of leaf nodes in the tree.
- The number of null links (i.e., absent children of nodes) in a **complete binary tree** of *n* nodes is $(n+1)$.
- The number of internal nodes (i.e., non-leaf nodes or $n-l$) in a **complete binary tree** of *n* nodes is $\lfloor n/2 \rfloor$.
- For any non-empty binary tree with n_0 leaf nodes and n_2 nodes of degree 2, $n_0 = n_2 + 1$.

17. What are the different ways of representing binary tree?

- Linear representation using arrays
- Linked representation using pointers

18. 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.

19. What are the different types of binary tree traversal?

- Preorder
- Inorder
- Postorder

20. What are the tasks performed during preorder tree traversal?

Process the root node.

Traverse the left subtree

Traverse the right subtree

21. What are the tasks performed during inorder tree traversal?

Traverse the left subtree

Process the root node.

Traverse the right subtree

22. What are the tasks performed during postorder tree traversal?

Traverse the left subtree

Traverse the right subtree

Process the root node.

23. State the merits and demerits of linear representation of binary tree?

Merits:

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

Demerits:

Insertions and deletions in a node, taker an excessive amount of processing time due to data movement up and down the array.

24. State the merits and demerits of linked representation of binary tree?

Merits:

Insertions and deletions in a node, involves no data movement except the re arrangement of pointers, hence less processing time.

Demerits:

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 subtrees. It requires dynamic memory allocation, which is not possible in some programming languages.

25. What do you mean by general tree?

General tree is a tree with nodes having any number of children

26. What is the length of the path in a tree?

The path length of a tree is the sum of the levels of all the tree's nodes. The path length of a tree with N nodes is the sum of the path lengths of the subtrees of its root plus N-1.

27. Define B+ tree indexing?

A B+ tree can be viewed as a B-tree in which each node contains only keys (not key-value pairs), and to which an additional level is added at the bottom with linked leaves. The primary values of a B+ tree is in storing data for efficient retrieval in a block-oriented storage context — in particular, file systems.

28. What are the applications of binary trees?

1. Binary search tree
2. Binary tries
3. Hash trees
4. Heaps
5. T-tree
6. Syntax tree
7. Huffman coding tree
8.

29. What is the use of indexing technique?

Indexing is an auxiliary data structure which speeds up the record retrieval.

30. Compare B- tree and B+ tree?

a. A B+ tree is the form of a balanced tree in which every path from the root of the tree to a leaf of the tree is the same length. B+ trees are good for searches but cause some overhead issues in wasted space.

b. B-trees are similar to B+ trees but it allows search-key values to appear only once, eliminates redundant storage of search keys. It is possible sometimes to find search-key value before reaching the leaf node. Implementation is harder than B+ trees.

31. Differentiate binary tree and binary search tree?

a. Binary is a specialized form of tree with two child (left child and right child). It is simply representation of data in tree structure.

b. Binary search tree is a special type of binary tree that follows the following condition:

   i. Left child is smaller than its parent node

   ii. Right child is greater than its parent node

32. Give some of the applications of B tree?

B tree is optimized for systems that read and write large blocks of data. It is commonly used in databases and file systems.

B tree also optimizes costly disk accesses that are of concern when dealing with large data sets.

33. <u>Define AVL tree?</u>

AVL tree is a self-balancing Binary Search Tree (BST) where the difference between heights of left and right subtrees cannot be more than one for all nodes.

<u>An Example Tree that is an AVL Tree</u>