Sairam INSTITUTIONS

Sri SAI RAM ENGINEERING COLLEGE
INSTITUTE OF TECHNOLOGY
West Tambaram, Chennai - 44

YEAR	SEM
2	3

CS8391

DATA STRUCTURES

UNIT No. 3

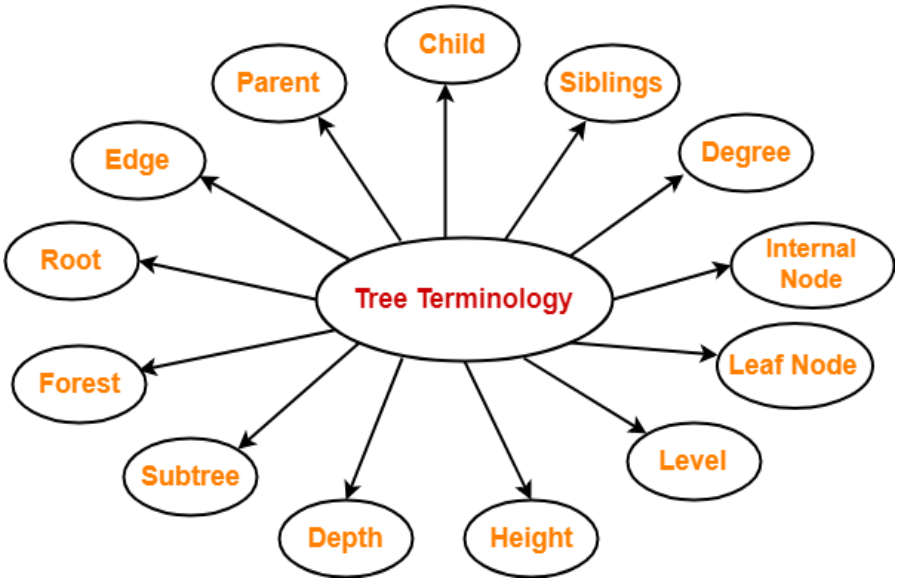
3.1.1 TREE ADT

Version: 1.XX

3.1.1 TREE INTRODUCTION

- In non-linear data structure, data elements are hierarchically connected and are present at various levels
- In non-linear data structure, data elements are present at multiple levels.
- Non-linear data structures are difficult to understand and implement as compared to linear data structures.
- Non-linear data structures are not easy to traverse and needs multiple runs to be traversed completely.
- Non-linear data structures uses memory very efficiently.
- Time complexity of non-linear data structure often remain with increase in size.
- Eg. Graph, Map, Tree.

TREE TERMINOLOGIES

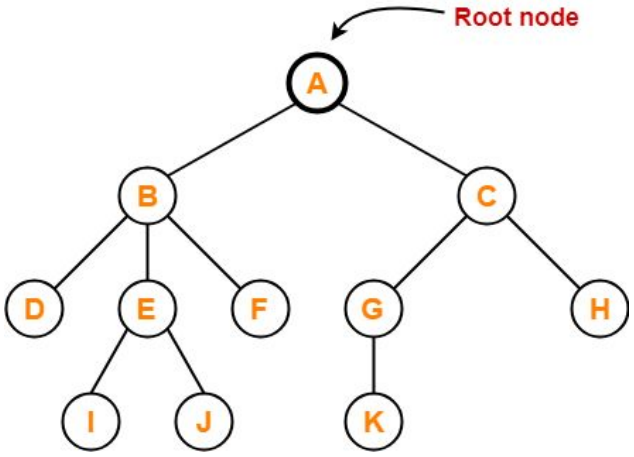


1. Root

The first node from where the tree originates is called as a root node.

In any tree, there must be only one root node.

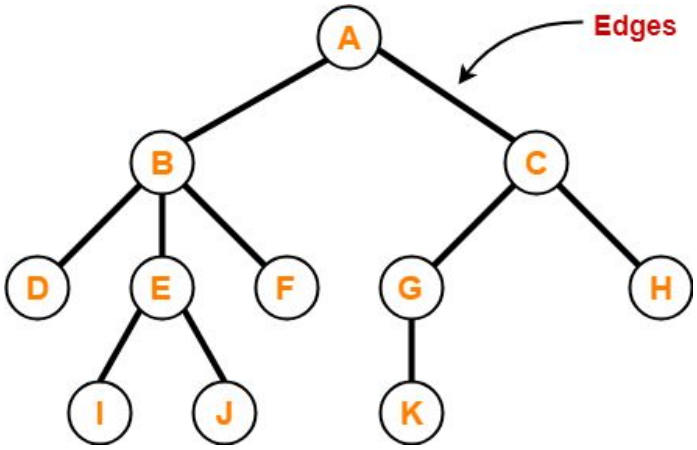
We can never have multiple root nodes in a tree data structure.



Here, node A is the only root node.

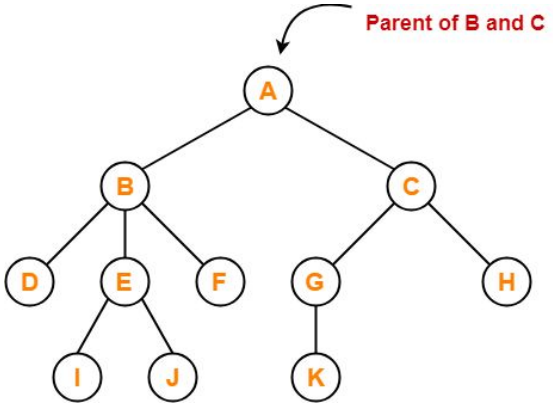
2. Edge

- **The connecting link between any two nodes is called as an edge.**
- **In a tree with n number of nodes, there are exactly (n-1) number of edges.**



3. Parent

- **The node which has a branch from it to any other node is called as a parent node.**
- **In other words, the node which has one or more children is called as a parent node.**
- **In a tree, a parent node can have any number of child nodes.**

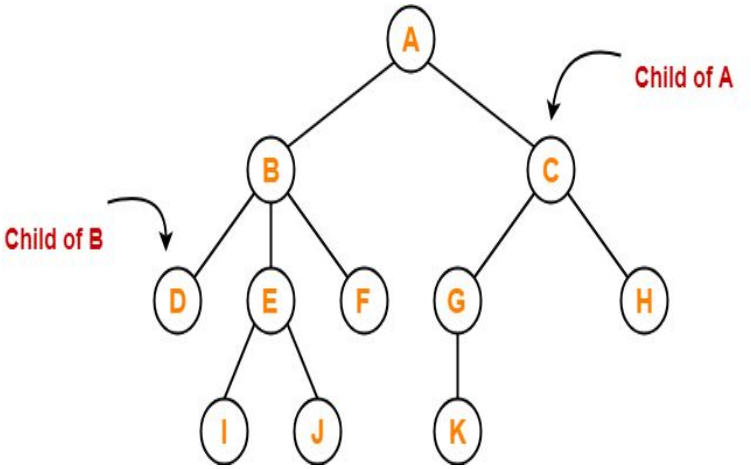


Here,

- **Node A is the parent of nodes B and C**
- **Node B is the parent of nodes D, E and F**
- **Node C is the parent of nodes G and H**
- **Node E is the parent of nodes I and J**
- **Node G is the parent of node K**

4. Child

- **The node which is a descendant of some node is called as a child node.**
- **All the nodes except root node are child nodes.**

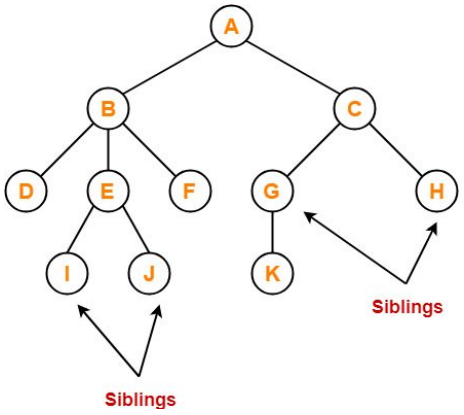


Here,

- **Nodes B and C are the children of node A**
- **Nodes D, E and F are the children of node B**
- **Nodes G and H are the children of node C**
- **Nodes I and J are the children of node E**
- **Node K is the child of node G**

5. Siblings

- **Nodes which belong to the same parent are called as siblings.**
- **In other words, nodes with the same parent are sibling nodes.**

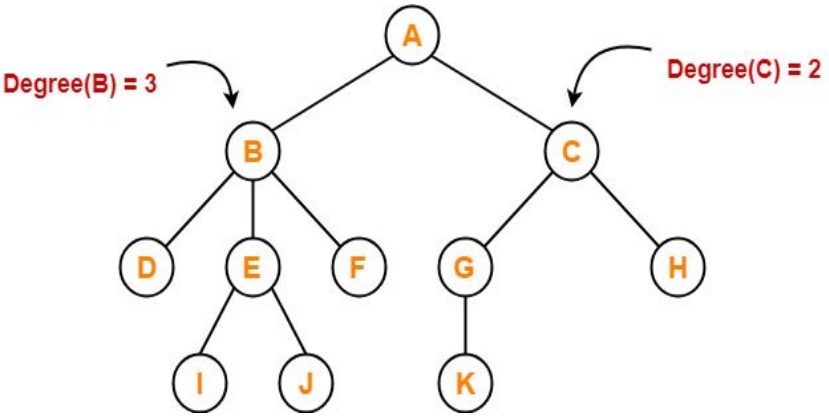


Here,

- **Nodes B and C are siblings**
- **Nodes D, E and F are siblings**
- **Nodes G and H are siblings**
- **Nodes I and J are siblings**

6. Degree

- **Degree of a node is the total number of children of that node.**
- **Degree of a tree is the highest degree of a node among all the nodes in the tree.**

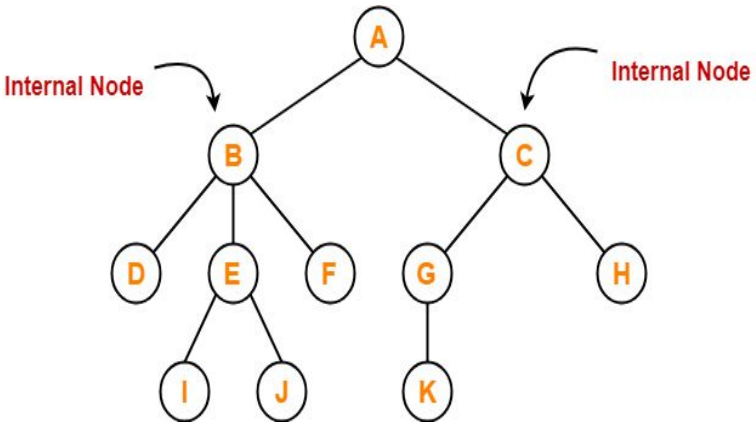


- **Degree of node A = 2**
- **Degree of node B = 3**
- **Degree of node C = 2**
- **Degree of node D = 0**
- **Degree of node E = 2**
- **Degree of node F = 0**
- **Degree of node G = 1**
- **Degree of node H = 0**
- **Degree of node I = 0**
- **Degree of node J = 0**
- **Degree of node K = 0**

7. Internal Node

- **The node which has at least one child is called as an internal node.**
- **Internal nodes are also called as non-terminal nodes.**

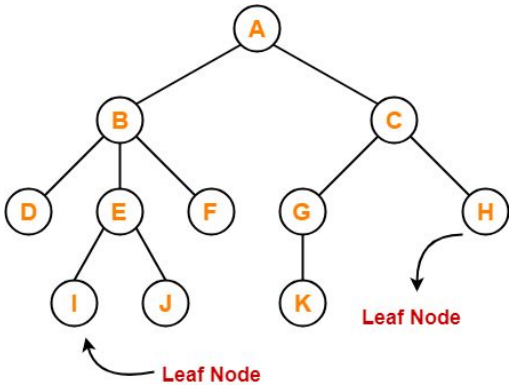
- **Every non-leaf node is an internal node.**



Here, nodes A, B, C, E and G are internal nodes.

8. Leaf Node

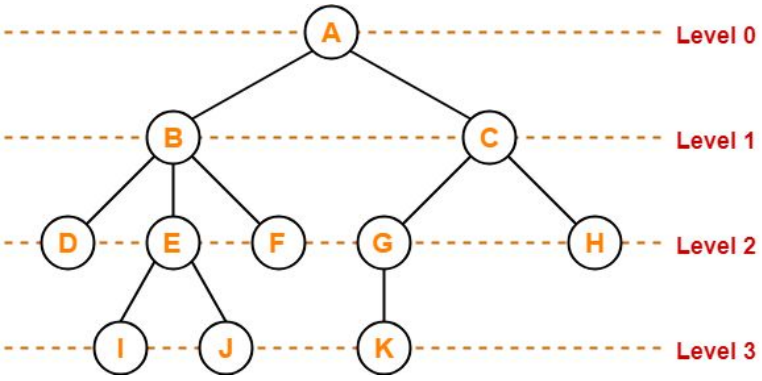
- **The node which does not have any child is called as a leaf node.**
- **Leaf nodes are also called as external nodes or terminal nodes.**



Here, nodes D, I, J, F, K and H are leaf nodes.

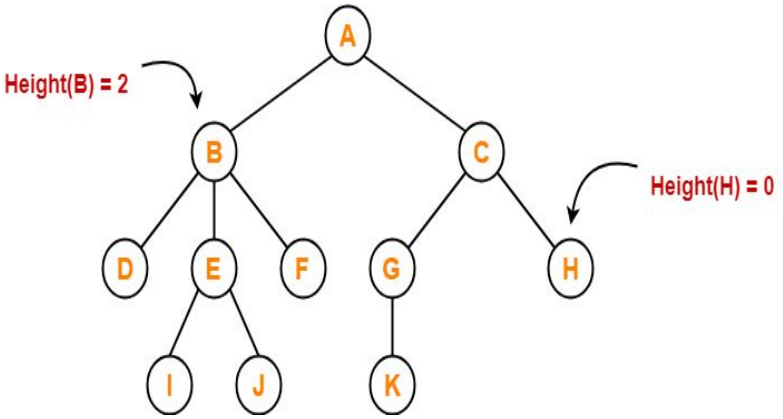
9. Level

- **In a tree, each step from top to bottom is called as level of a tree.**
- **The level count starts with 0 and increments by 1 at each level or step.**



10. Height

- **Total number of edges that lies on the longest path from any leaf node to a particular node is called as height of that node.**
- **Height of a tree is the height of root node.**
- **Height of all leaf nodes = 0**

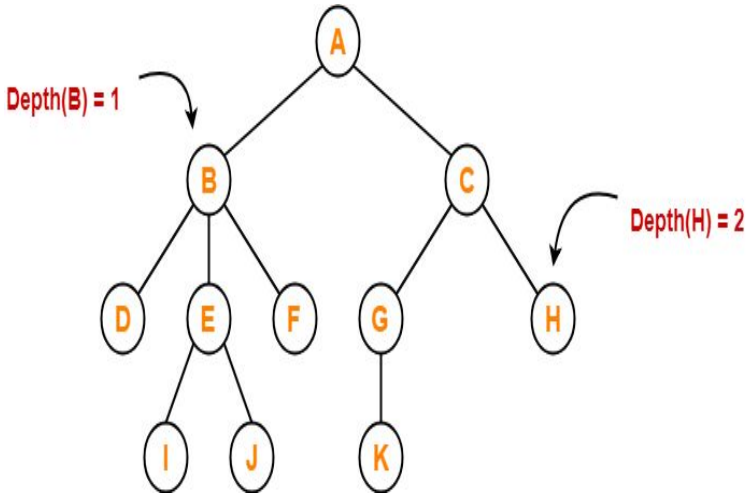


Here,

- **Height of node A = 3**
- **Height of node B = 2**
- **Height of node C = 2**
- **Height of node D = 0**
- **Height of node E = 1**
- **Height of node F = 0**
- **Height of node G = 1**
- **Height of node H = 0**
- **Height of node I = 0**
- **Height of node J = 0**
- **Height of node K = 0**

11. Depth

- **Total number of edges from root node to a particular node is called as depth of that node.**
- **Depth of a tree is the total number of edges from root node to a leaf node in the longest path.**
- **Depth of the root node = 0**
- **The terms "level" and "depth" are used interchangeably.**



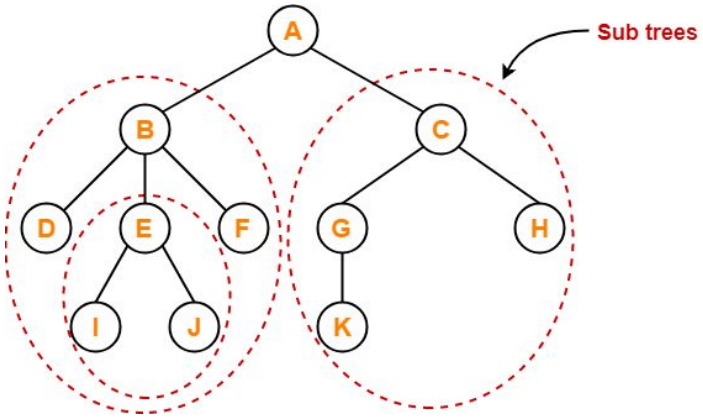
Here,

- **Depth of node A = 0**
- **Depth of node B = 1**
- **Depth of node C = 1**
- **Depth of node D = 2**
- **Depth of node E = 2**
- **Depth of node F = 2**
- **Depth of node G = 2**
- **Depth of node H = 2**
- **Depth of node I = 3**

- **Depth of node J = 3**
- **Depth of node K = 3**

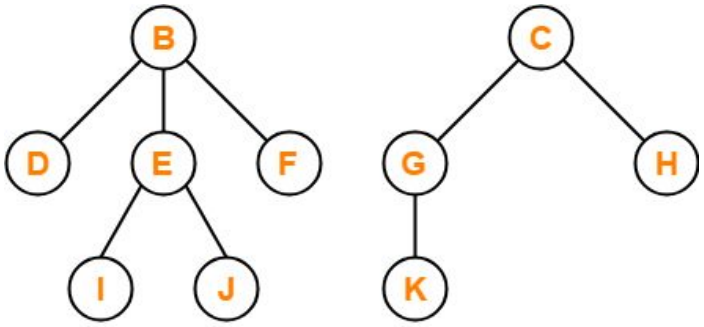
12. Subtree-

- **In a tree, each child from a node forms a subtree recursively.**
- **Every child node forms a subtree on its parent node.**



13. Forest

A forest is a set of disjoint trees.



Forest

APPLICATIONS OF TREE

- Directory structure of a file store
- Structure of an arithmetic expressions
- Used in almost every 3D video game to determine what objects need to be rendered.
- Used in almost every high-bandwidth router for storing router-tables.
- used in compression algorithms, such as those used by the .jpeg and .mp3 file- formats.