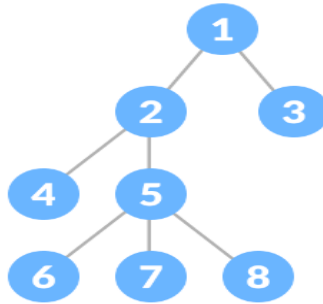


Tree

A tree is a *nonlinear* data structure, compared to arrays, linked lists, stacks and queues which are linear data structures.

Tree stores the information in hierarchical form that is represented by nodes connected by edges.

Example:



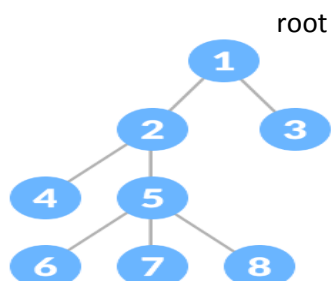
Applications:

- To implement file system for operating systems
- Evaluation of arithmetic expressions
- Efficient searching of elements, etc

A tree has following general properties:

- One node is distinguished as the root
- Every node (excluding the root) is connected by a directed edge from exactly one other node. A direction is from parent -> children

Example:



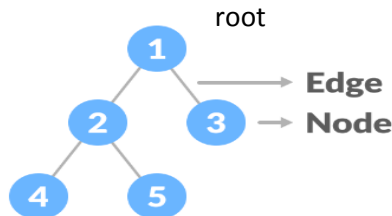
node 1 is the root node and parent of node 2 and node 3. Node 5 is the parent of node 6, 7, and 8

Tree Terminology:

Node: Each element of a tree is called a node. It specifies the information (data) and links (branches) to other data elements.

Example: There are 8 nodes in the example tree above.

Edge: It is the link between any two nodes.



Root: It is first node in the hierarchical arrangement of data items at the top of the tree.

Example: In the above tree node 1 is the root node

Parent of node n: The parent of node n is the unique node with an edge to node n. i.e. immediate predecessor of a node.

Example: Parent of node 4 in above figure is node 2.

Note: The root is the only node with no parent. Except the root, each node in the tree has one parent.

Child of node n: A child of node n is a node for which node n is the next node on the path. i.e. each immediate successor of a node.

Example: Node 4 and node 5 are child nodes of node 2.

Note: Each node may have 0 or more children.

Siblings: Nodes with the same parent are siblings.

Example: In the above figure node 4 and node 5 are siblings.

Leaf node: A leaf node is a node with no children.

Example: node 3, 4 and 5 are leaf nodes in above figure

Degree of node n: The degree of node n is the number of children node n has.

Example: degree of node 2 in above figure is 2.

Degree of a tree: The maximum degree of nodes in a given tree.

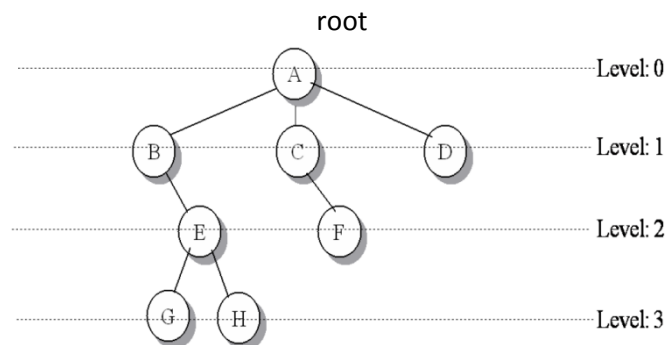
Example: degree of above tree is 2.

Depth of node n: The depth of node n is the length of the path from root to node n.

Example: root is at depth 0, depth of node 2 is 1.

Level: The tree is levelled in such a way that the root node is always at level 0. Its immediate children are at level 1, and their immediate children at level 2 and so on.

Example:



height of a node: Height of a node is the length of the longest path from the node to a leaf node.

Example: height of node B in above figure is 2, height of node F is 0.

height of a tree: The height of tree is the largest depth of any node in the tree.

i.e. the height of the tree is equal to the height of the root node.

Example: height of the above tree is 3.

Example: height and depth of nodes in a tree

