Unit - III


DATA STRUCTURES
ALGORITHMS
COMPUTER NETWORKS
DATABASE SYSTEMS


#include <iostream>
using namespace std;
int main()
{
cout << "Hello, World!";
return 0;
}

U3

Linked List.

* **Linked List -**

A Linked List is a linear data structure in which elements are stored in a non-contiguous memory locations.

Each element of a Linked List is called as node, and every node contains two parts:

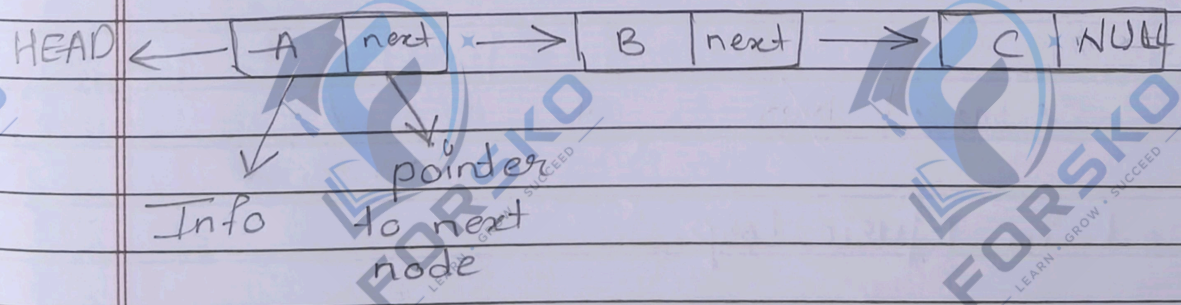
data and a Link (pointer) to the next node.

Node Structure. | Info | next |

- Data part - Stores the actual value
- Link part - stores the address of the next node.

The last node of the Linked List contains NULL in its Link part.

Representation -



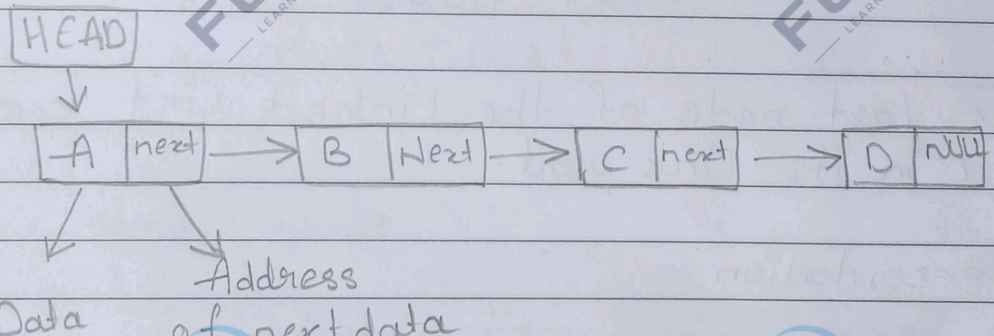
* Types of Linked List.

i) Singly Linked List.

Singly Linked List is the simplest type of Linked List in which every node contains some data and a pointer to the next node of the same data type.

The node contains a pointer to the next node means that the nodes stores the address of the next node in the squence.

A singly linked list allows the traversal of data only in one way.

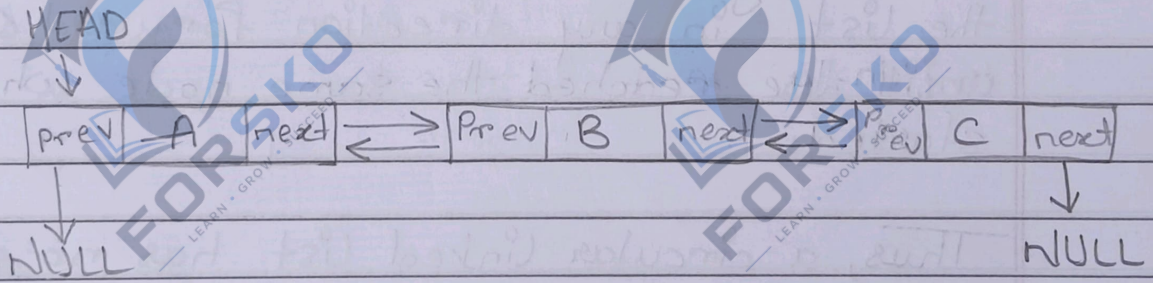


iii) Doubly Linked List -

A doubly linked list or a two way linked is a more complex type of a linked list that contains a pointer to the next as well as previous node in sequence.

Therefore, it contains three parts, a data and a pointer to the next node and a pointer to the previous node.

This would enable us to traverse the list in the backward direction as well.

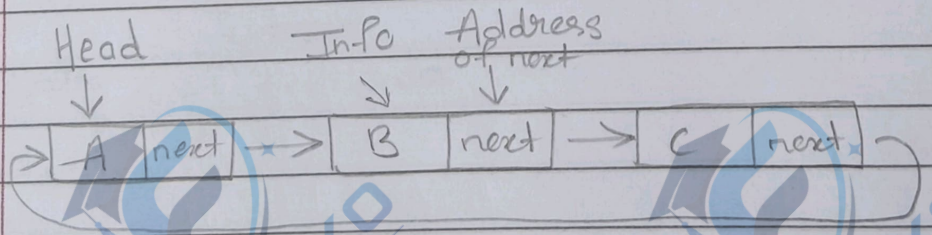


iii) Circular Linked List -

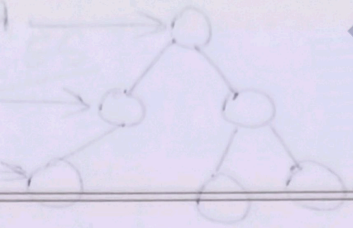
A circular linked list is a type of linked list in which the last node's next pointer points to the first node of the list, creating a circular structure. Thus it allows for continuous traversal of the list, as there is no null to end the list.

While traversing a circular linked list we can begin at any node and traverse the list in any direction forward & backward until we reached the same node where we started.

Thus, a circular linked list has no starting and no ending.



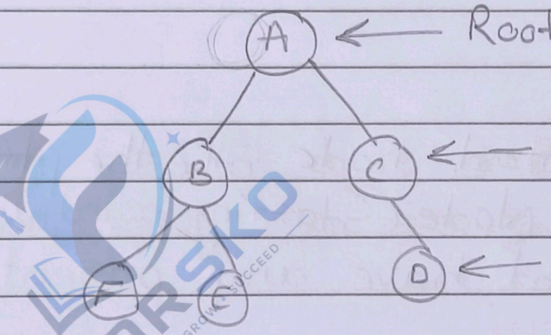
Used in Music Loop.



* Tree -

A tree is a non-linear data structure which is used to represent data in a hierarchical form / Network form.

It is consist of nodes connected by edges where one node is called the root and every other node is connected directly or indirectly to the root node.



* Tree Terminologies

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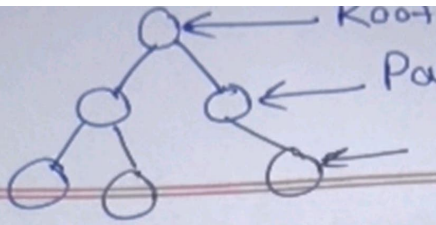


Tree Terminologies.

The following terms are commonly used in a tree data structure to describes the relationship between nodes.

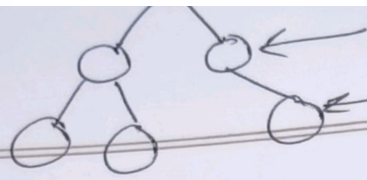
1) **Node-**
A node is a basic unit of a tree that contains data and links to its child nodes.

2) **Root Node-**
The topmost node of the tree is known as Root Node. (Starting point)
It does not have any parent node

3) **Parent Node-**
A node that has one or more child nodes is known as Parent node.

4) **Child Node-**
A node that are the deskends from parent is known as child node.

5) **Siblings-**
Nodes that have the same parents are called siblings.



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12) Level

A Level of a node represent its position in the tree.

13) Hight of Tree

The length of the longest path from root to any leaf node.

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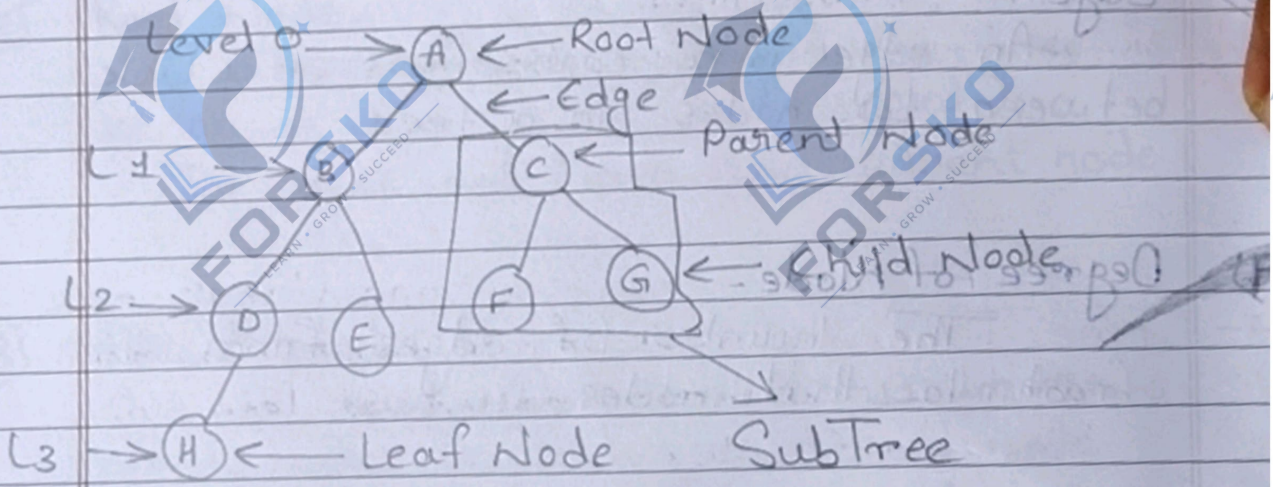

Height - 4

Siblings - B, E / F G / B C

Leaf Node - H, F, G, E

Internal Node - B, C, D

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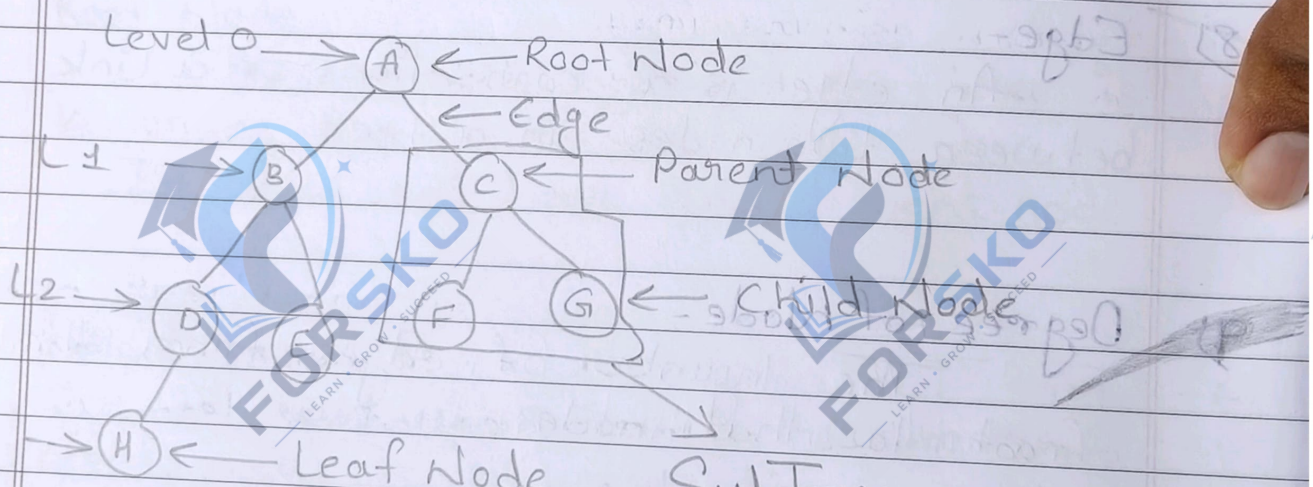

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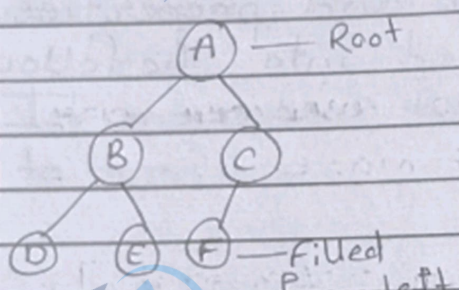
ii) Complete Binary Tree =

A complete binary tree is a type of binary tree in which all levels are completely filled expect possibly the last level and the last level are filled from left to right.



Application -

- Heap
- Priority Queue
- Heap Sort
- Implimentation of Binary Tree

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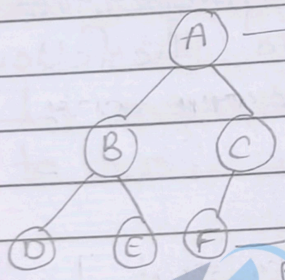

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* Tree Traversal-

Tree traversal is the process of visiting every node of a tree exactly once in a specific order to perform operations like displaying data, searching or updating values.

Following are the types of traverse

1) Preorder Traversal- Root → Left → Right
RoLeR

In preorder traversal, the root node is visited first, then the left subtree, and finally the right subtree.

Steps-
1) Visit Root
2) Traverse Left Subtree
3) Traverse Right Subtree

Eg-

Preorder -
A, B, D, E, C

Uses-
Used to copy tree.
Used for prefix expression evaluation

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Uses-

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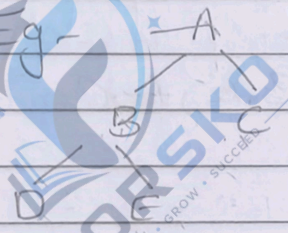
3) Postorder Traversal - (Left → Right → Root)

In postorder traversal, the left subtree is visited first, then the right subtree, and the root node is visited last.

Steps:

1) Traverse Left Subtree
2) Traverse Right Subtree
3) Visit Root.

Eg- 

PostOrder-

D, B, E, C, A

Uses-

Used to delete a tree
Used for postfix expression evaluation