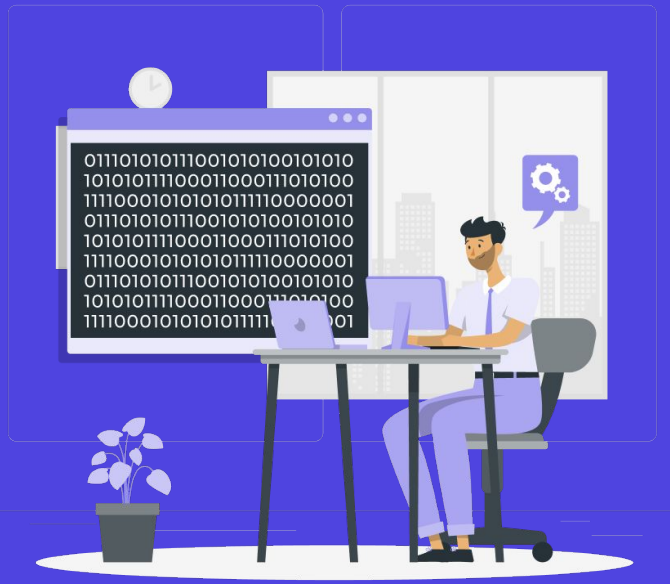
Introduction to Binary Tree



Relevel
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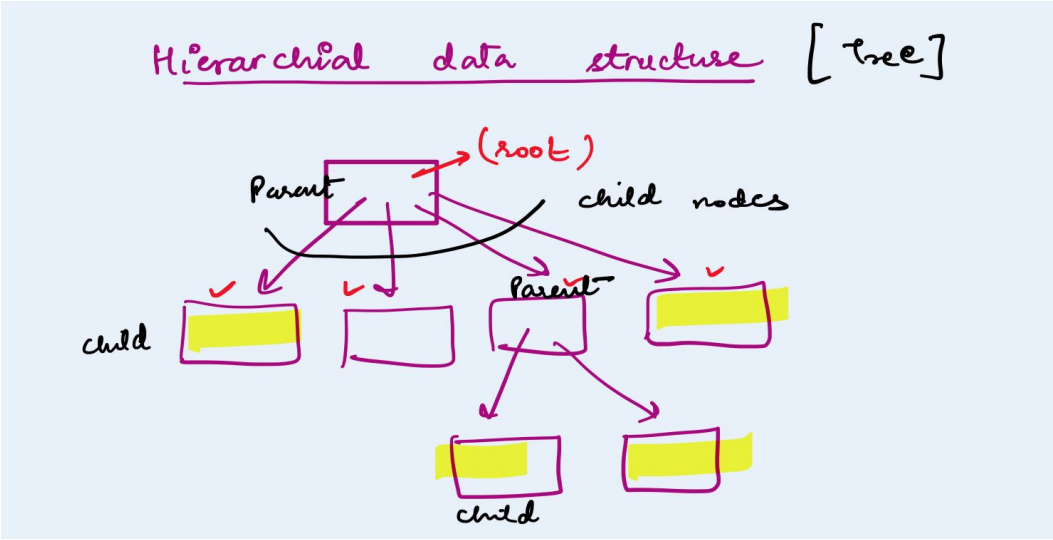
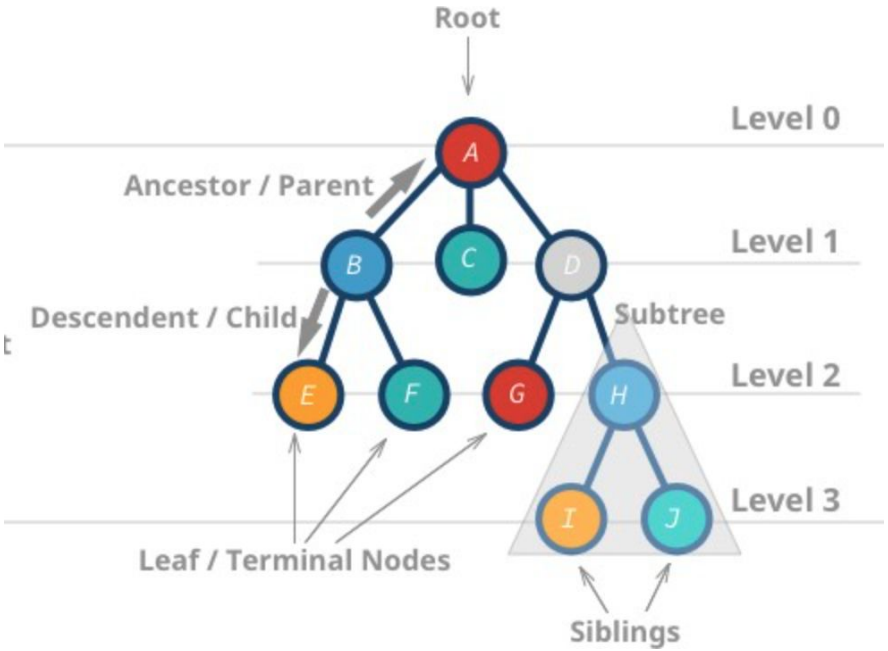
Hierarchical Data Structure

So far we have been studying linear data structures like Arrays, LinkedList and Queues. But the data that we need to store is not always going to be linear in nature, sometimes it is hierarchical depicting a parent child relationship. In Those situations, we use a hierarchical data structure like Tree.

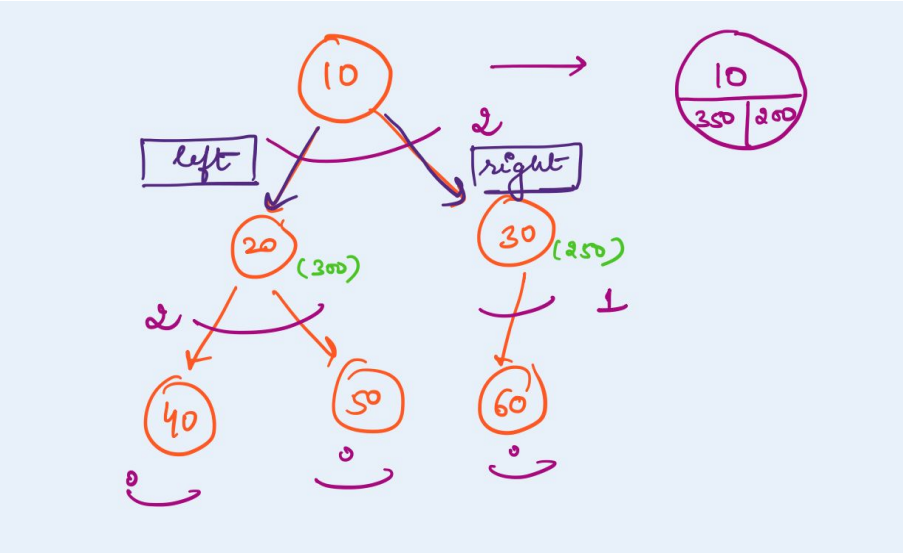


Hierarchical Data Structure



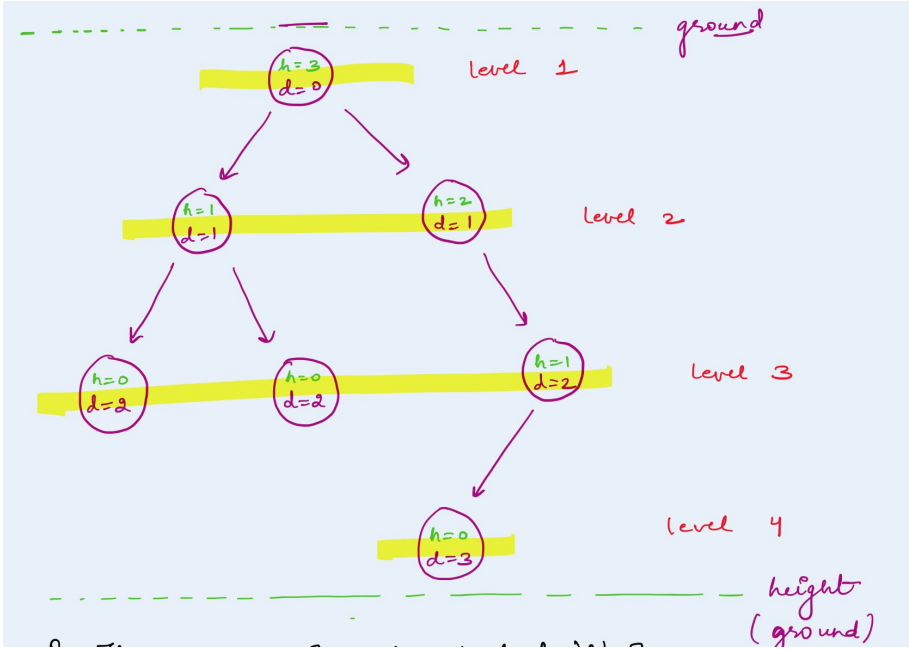
Binary Tree

The binary tree is the kind of tree in which most two children can be found for each parent. The kids are known as the left kid and right kid.

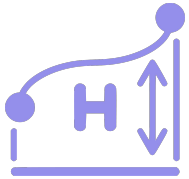


Binary Tree

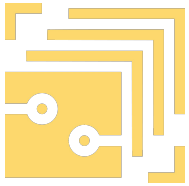
Common Terminologies to use in Trees



Binary Tree



Height:
Height of node – The height of a node is the number of edges on the longest downward path between that node and a leaf.



Depth:
Depth –The depth of a node is the number of edges from the node to the tree's root node.

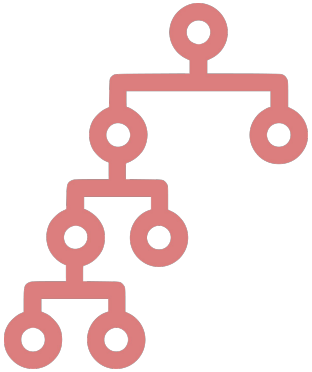
Level:
Level – The level of a node is defined by 1 + the number of connections between the node and the root.

Now that we know some terminologies, let’s answer a few questions.

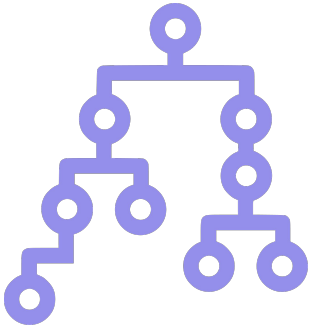
Binary Tree

Types of Binary Tree

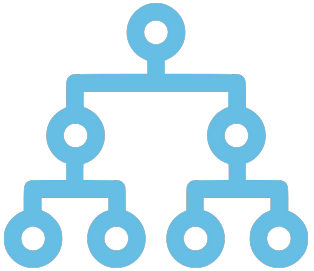
Full Binary Tree



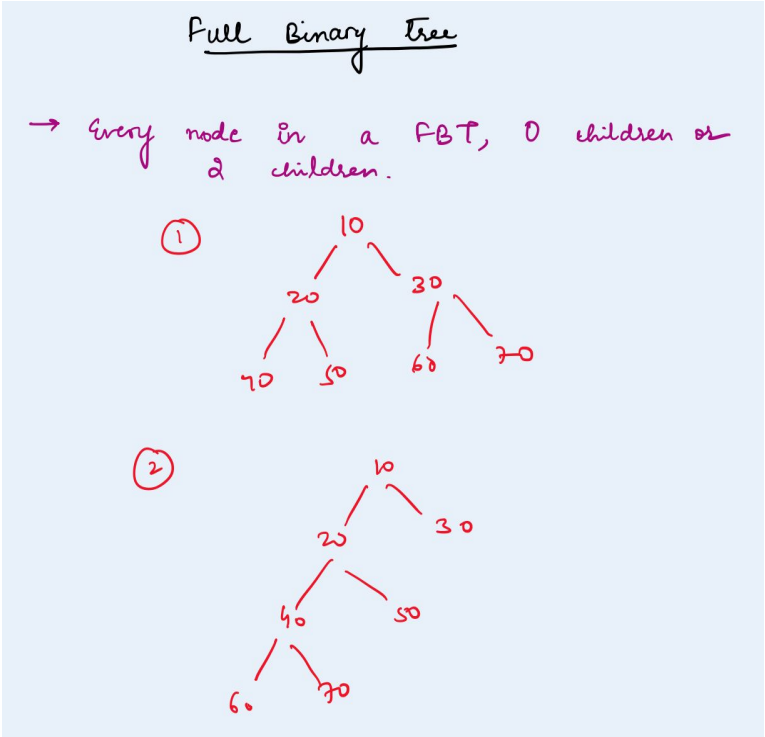
Complete Binary Tree



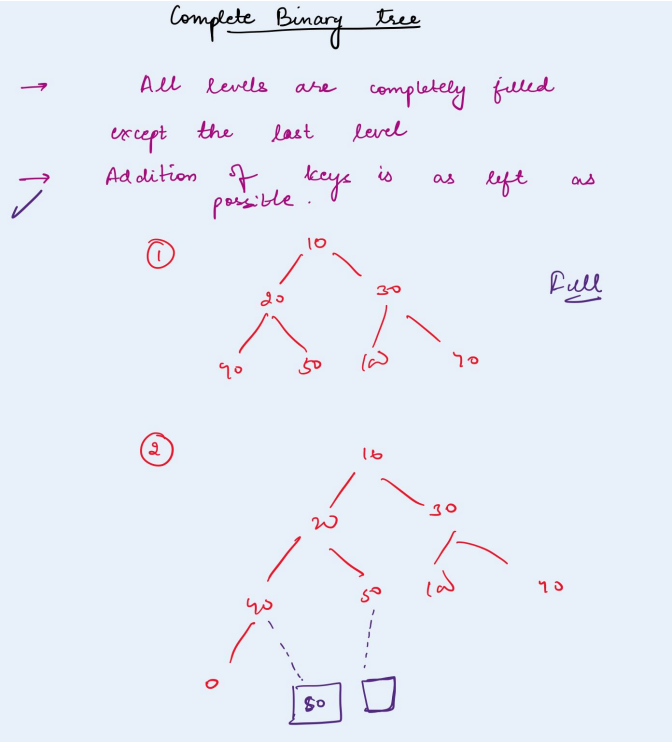
Perfect Binary Tree



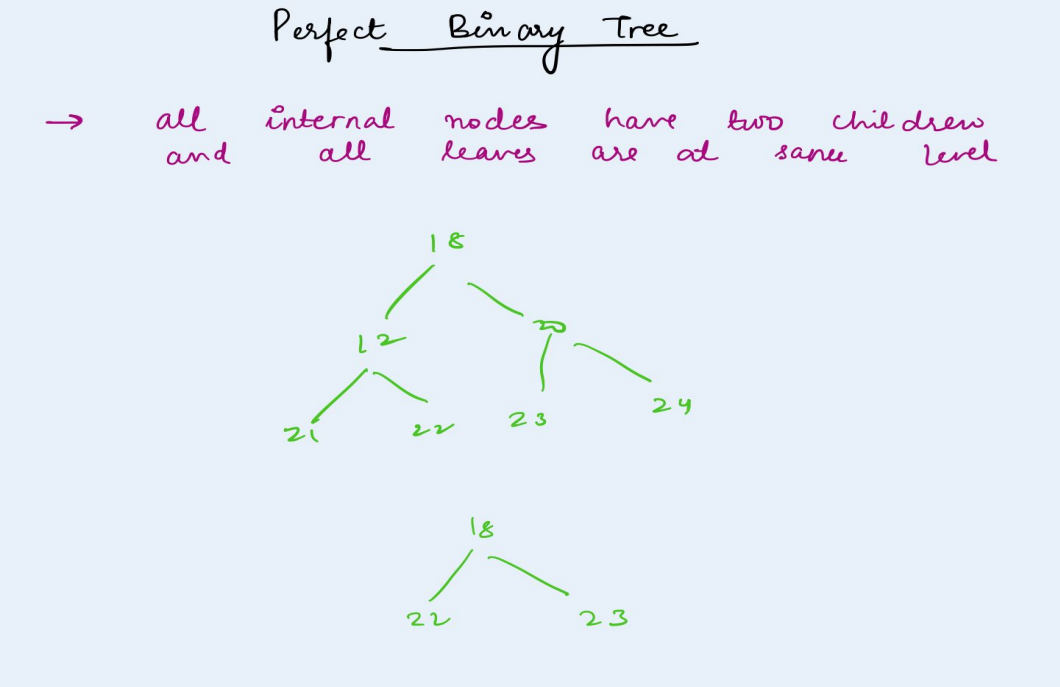
Binary Tree


Full Binary Tree
→ Every node in a FBT, 0 children or 2 children.
1
10
20
30
40
50
60
70
2
10
20
30
40
50
60
70

Binary Tree


Complete Binary tree
All levels are completely filled except the last level
Addition of keys is as left as possible.
Full

Binary Tree

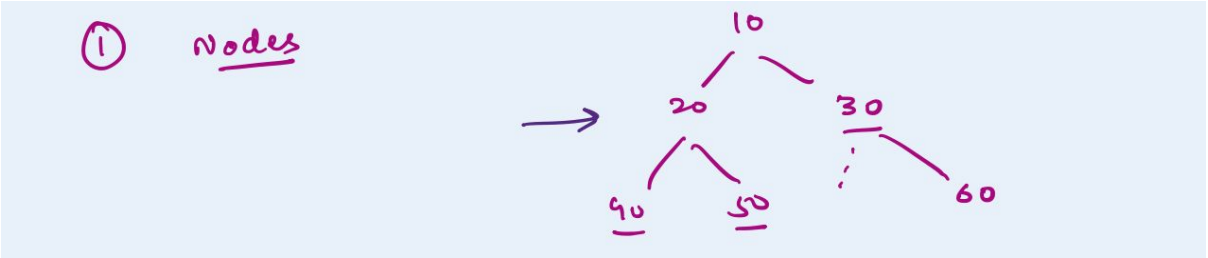

Perfect Binary Tree
→ all internal nodes have two children and all leaves are at same level
18
12
20
21
22
23
24
18
22
23

Implementation of Binary Tree

Now that we have a fair idea about what Binary Tree is, let's see how we can implement it programmatically.

1. Using Nodes

We can implement trees using nodes which store the information about the current node as well as the information about the child nodes.

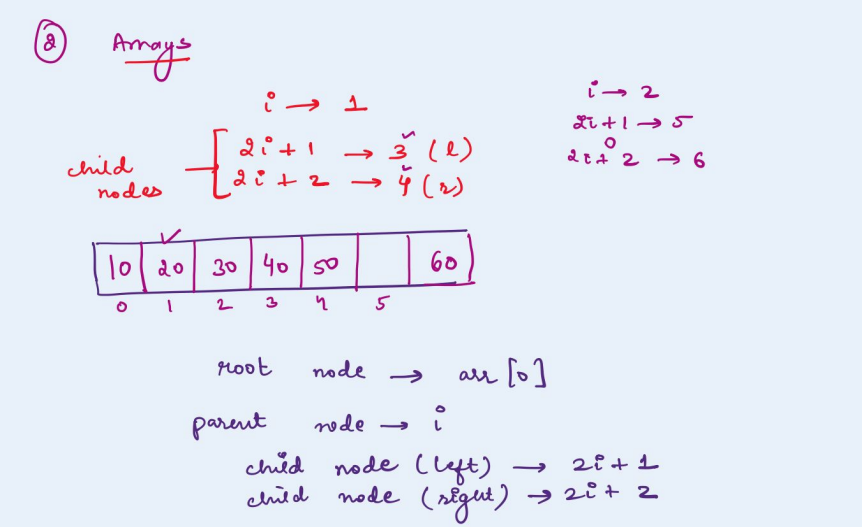


Implementation of Binary Tree

2. Using Arrays

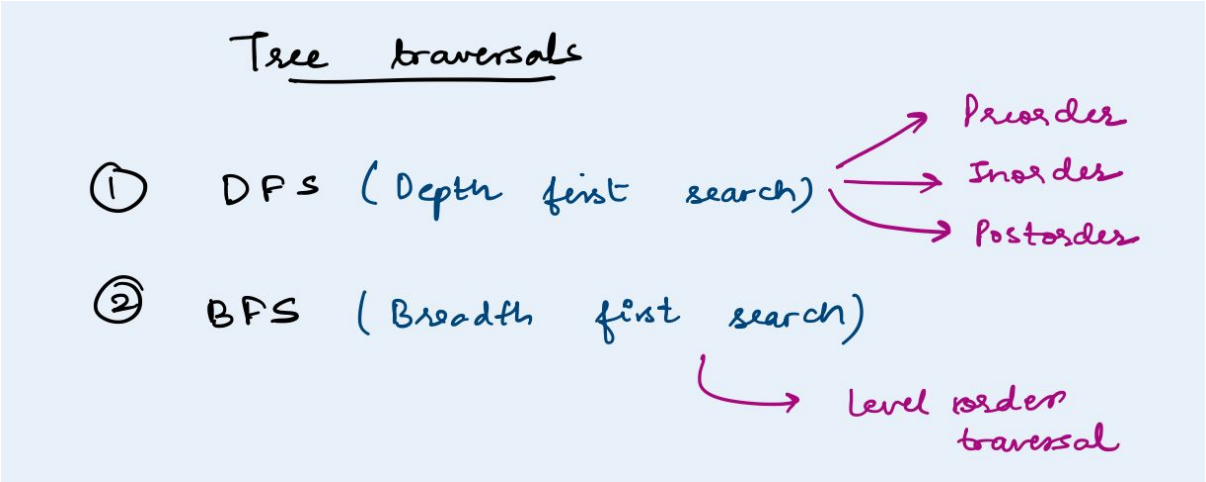
We can also store the information about Binary Tree using Arrays.

If a node is stored at an index i, it's child is stored at index 2*i +1 and 2*i + 2.

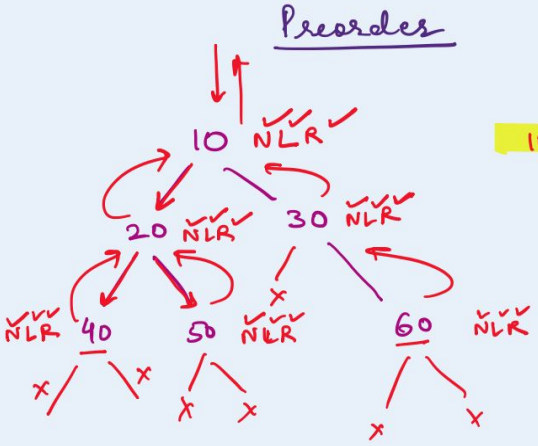


Tree Traversals

Now that we have covered what a Binary Tree looks like, we'll talk about how we can traverse a tree. Traversing a tree means visiting every node in the tree. There are two ways of tree traversal.



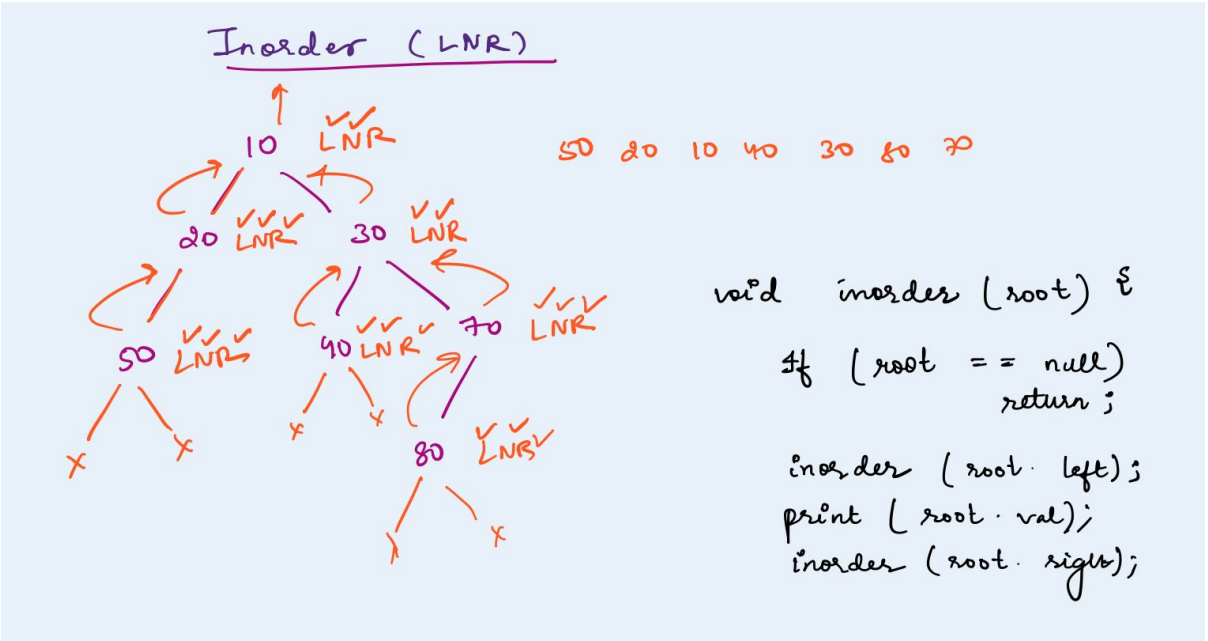
Tree Traversals



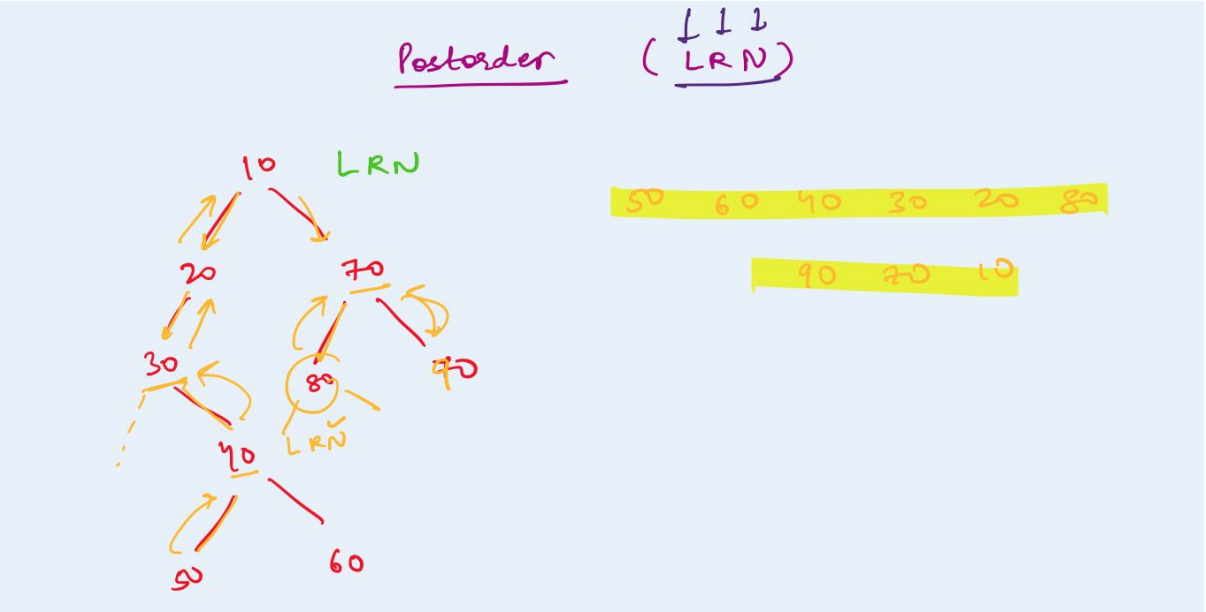
10 20 40 50 30 60

```
void preorder (root) {
    if (root == null)
        return;
    print (root.data);
    preorder (root.left);
    preorder (root.right);
```

Tree Traversals

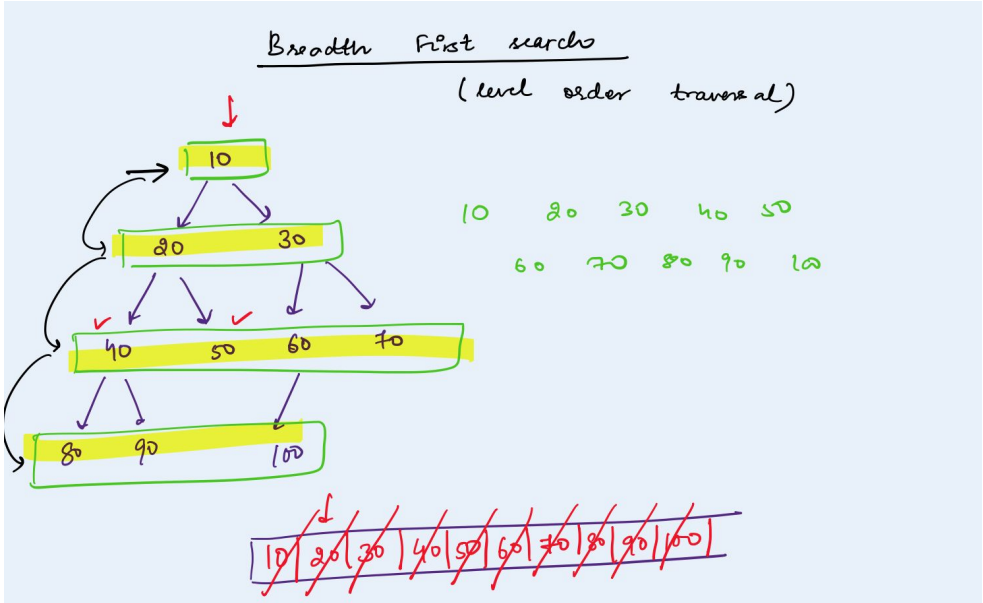


Tree Traversals



Breadth First Traversal

Level Order traversal is also known as Breadth-First Traversal since it traverses all the nodes at each level before going to the next level (depth).



Thank you!