Trees

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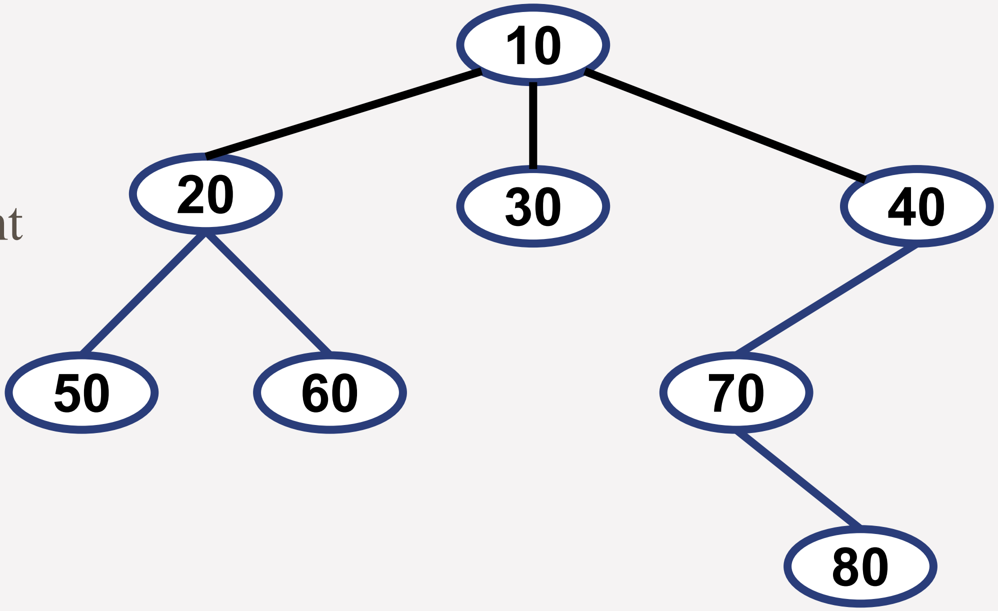
Tree

1. Introduction
2. Basic terms/Terminology
   1. Definition of Tree
   2. Node
   3. Degree
   4. Leaf Nodes
   5. Interior Nodes
   6. Children and Parent
   7. Siblings
   8. Degree of tree
   9. Level
   10. Height of tree



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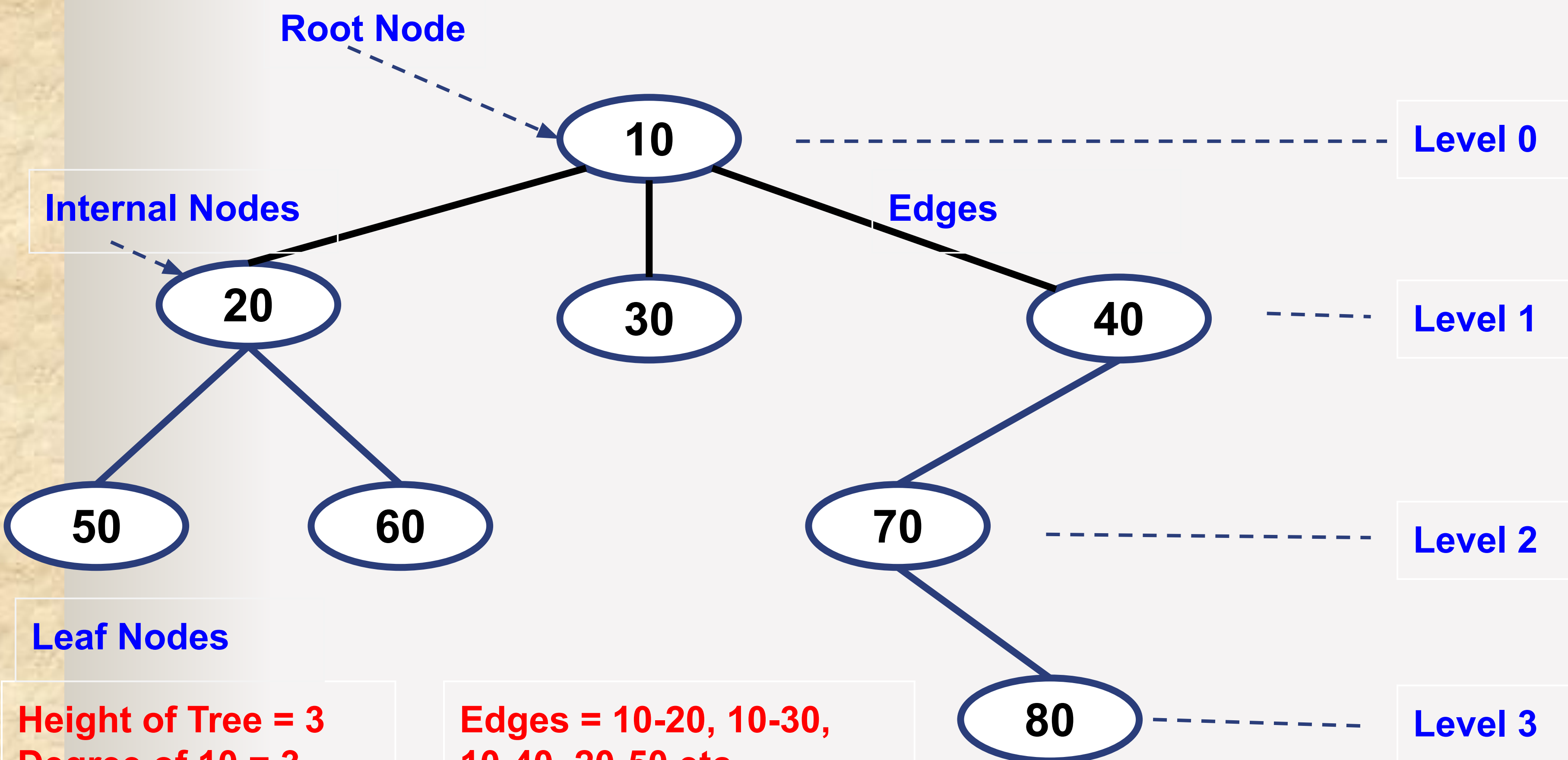

Height of Tree = 3
Degree of 10 = 3
Degree of 40 = 1
Degree of Tree = 3

Edges = 10-20, 10-30, 10-40, 20-50 etc

Height of Tree = 3

Internal Nodes = 20, 40, 70
Leaf Nodes = 50, 60, 30, 80

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A tree is a DS with set of one or more nodes. There is a special node called root and remaining nodes are partitioned into disjoint groups T1,T2….Tn. Where Ti- sub tree

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Each item in a tree called Node

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Number of subtrees of a node in a given tree

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Maximum degree of node in a given tree

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A node with degree zero

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Any Node except root node whose degree not zero

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Root of sub tree is parent & sub tree is its children

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Children's of the same parents

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Maximum degree of nodes in a given tree

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Root is at level 0
If node is at level ‘n’, then its children’s are at level n+1

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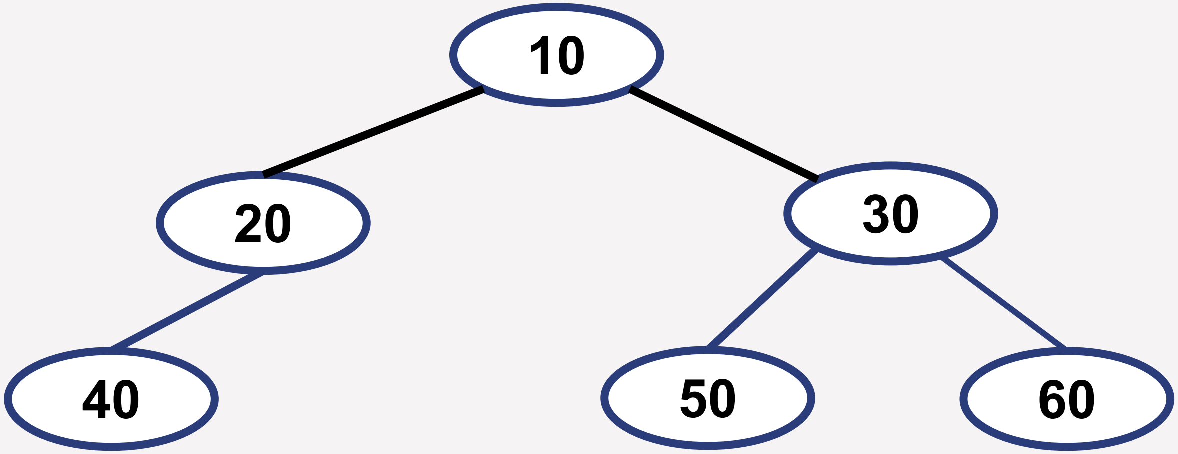
Maximum level of any node in a given tree

Binary Tree

- Definition
- Properties of Binary tree
- Types of Binary Tree
    1. Skewed Binary tree
    2. Complete Binary Tree
    3. Full Binary Tree



Binary Tree

- Definition
- Properties of Binary tree
- Types of Binary Tree
  1. Skewed Binary tree
  2. Complete Binary Tree
  3. Full Binary Tree

Properties of BT:

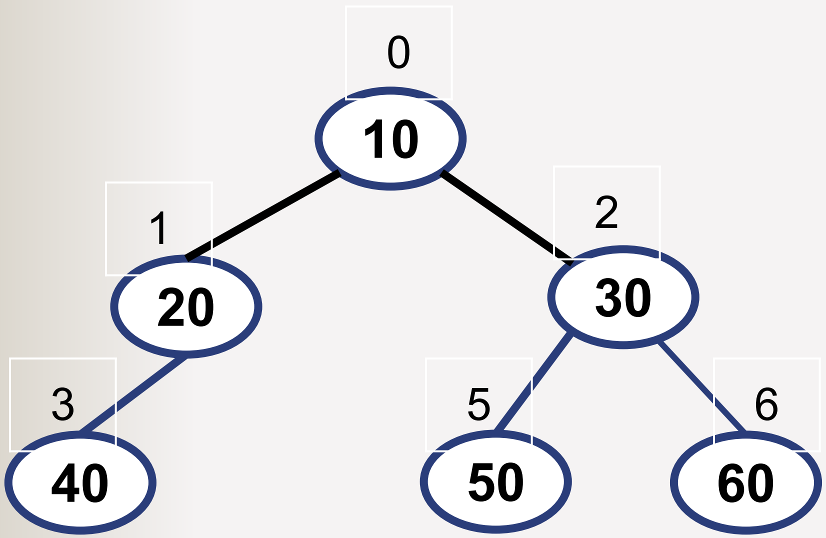
1. For Binary Tree, maximum number of nodes at level L are 2^L
2. A full Binary tree of height 'h' has **($2^{h+1} - 1$)** total nodes
3. Total number of external nodes in a binary tree are internal nodes + 1.

   i.e. E = I + 1

Rules:

- Parent (i) = floor(i-1)/2
- Leftchild (i) = (2i+1)
- Rightchild(i)= (2i + 2)

Binary Tree



Level 0 = 2^0 = 1
Level 1 = 2^1 = 2
Level 2 = 2^2 = 4

Total Nodes = $2^{(h + 1)} - 1$
= $2^3 - 1 = 7$

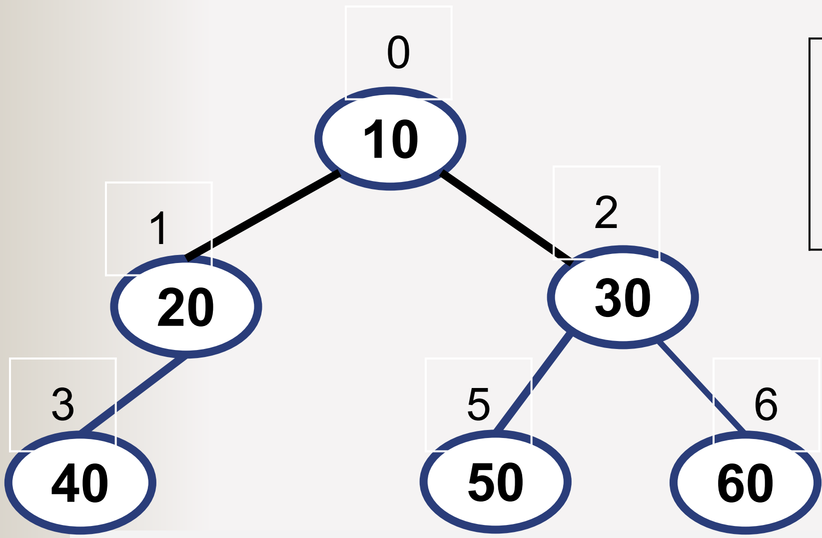
Properties of BT:

1. For Binary Tree, maximum number of nodes at level L are **2^L**
2. A full Binary tree of height ‘h’ has **($2^{h+1} - 1$)** total nodes
3. Total number of external nodes in a binary tree are internal nodes(Including Root) + 1.

   i.e. E = I + 1

E = I + 1
E = 3 + 1 = 4

Array Representation Binary Tree



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0	1	2	3	4	5	6
10	20	30	40		50	60

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- Parent (i) = floor(i-1)/2
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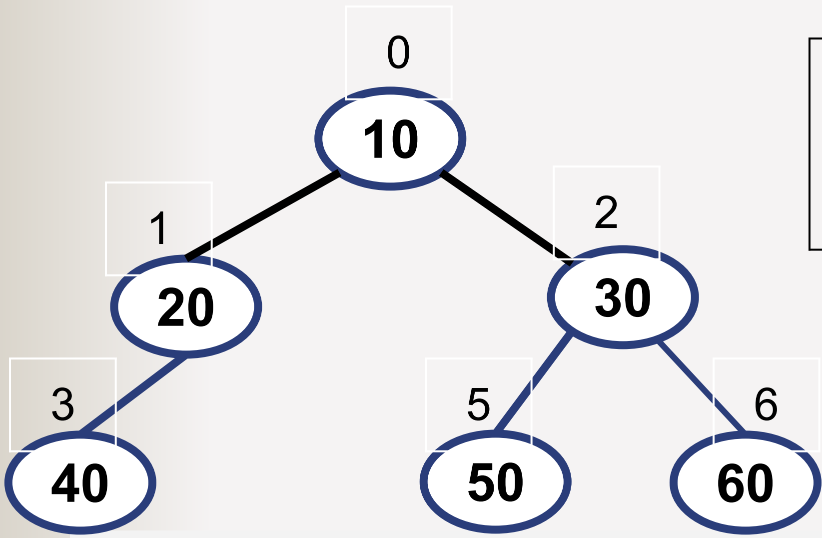

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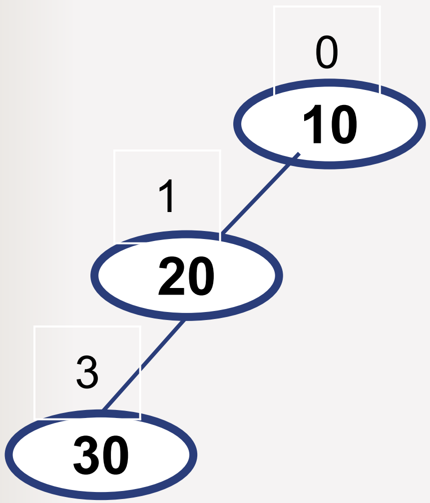

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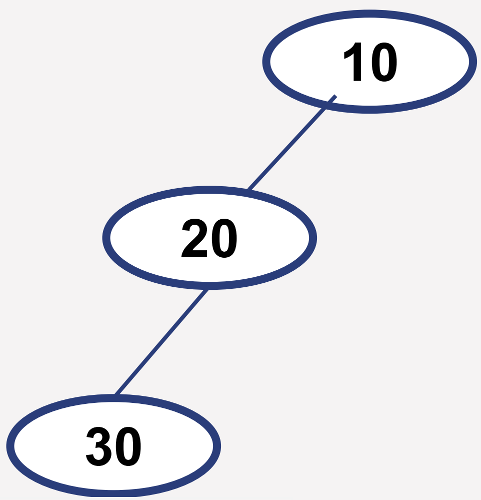
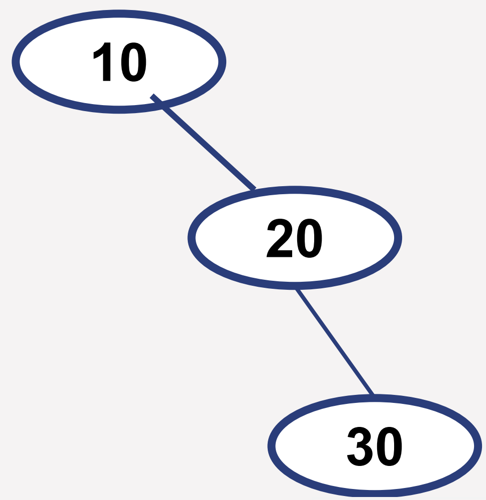
Binary Tree

- Definition
- Properties of Binary tree
- Types of Binary Tree
    1. Skewed Binary tree

Every node is having either only left or right subtree



Left Skew Tree

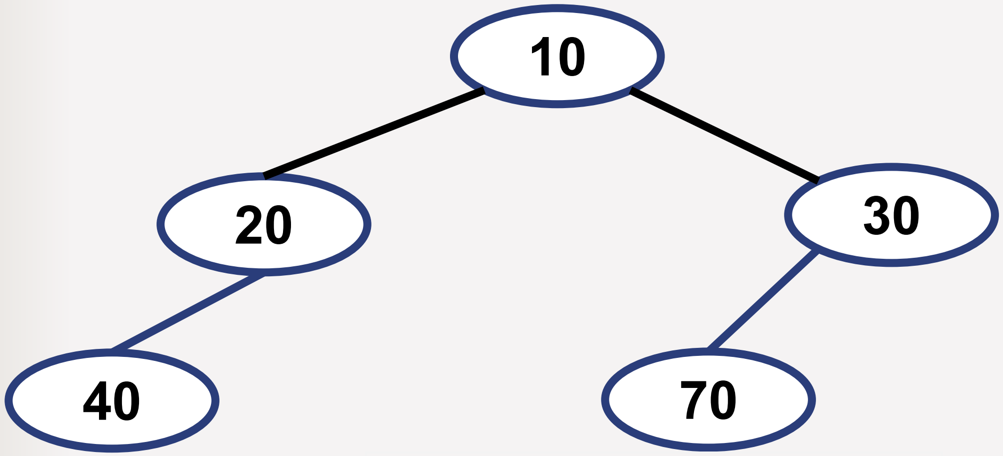


Left Skew Tree

Binary Tree

- Definition
- Properties of Binary tree
- Types of Binary Tree
  1. Skewed Binary tree
  2. Complete Binary Tree

All Leaves are at the same depth / level

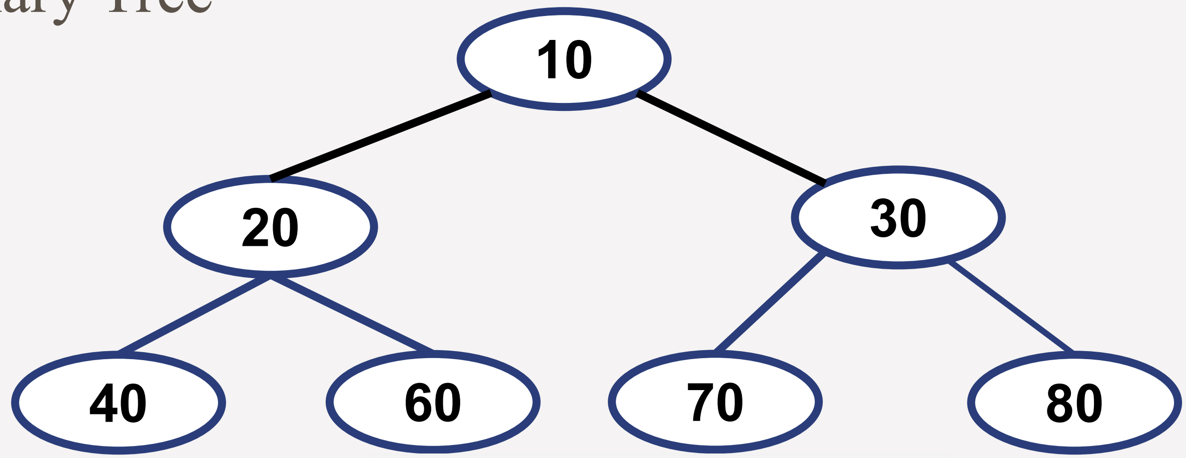


Complete Binary Tree

Binary Tree

- Definition
- Properties of Binary tree
- Types of Binary Tree
    1. Skewed Binary tree
    2. Complete Binary Tree
    3. Full Binary Tree

Every node has zero or two children.
- Also called Strictly B.T.

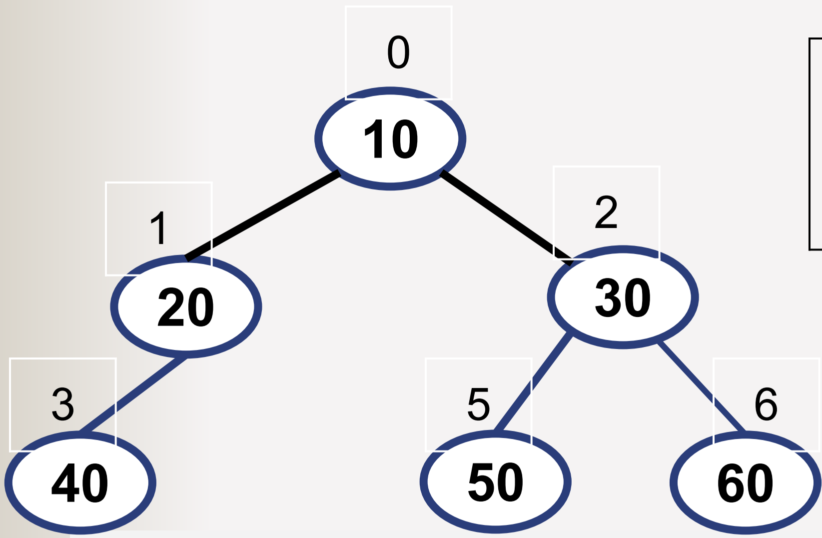


Full Binary Tree

Representation of Binary Tree

1. Sequential / Array Representation
2. Linked Representation
    - Structure Representation
    - Node Representation

Sequential / Array Representation Binary Tree



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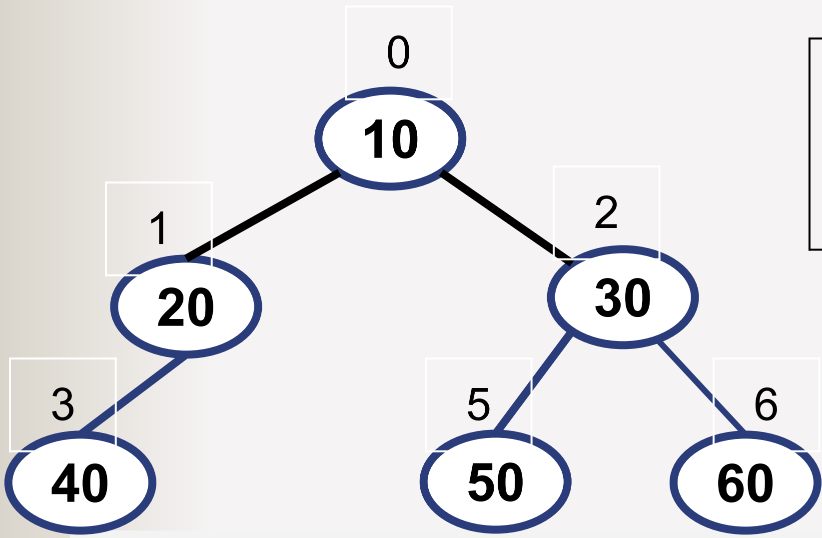
Sequential / Array Representation Binary Tree



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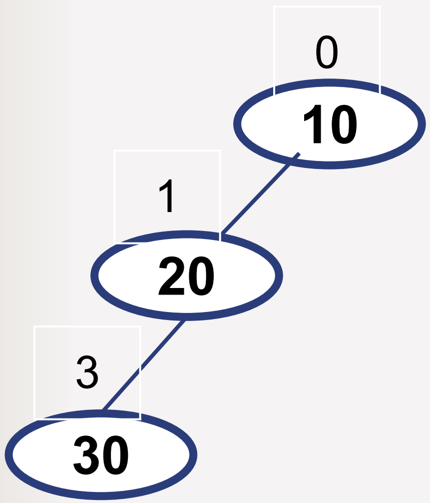

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Linked Representation of Binary Tree

Structure Representation:

```
struct node
{
      struct node *LC;
      int data;
      struct node *RC;
};
```

*LC	Data	*RC

Node Structure

Linked Representation of Binary Tree

Structure Representation:

```
struct node
{
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        int data;
        struct node *RC;
};
```
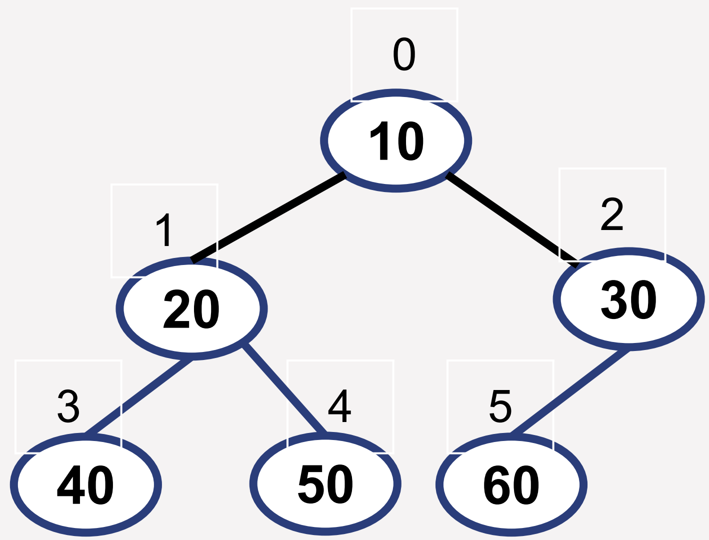

*LC	Data	*RC

Node Structure

e.g. 10,20,30,40,50



Linked Representation of Binary Tree

e.g. 10,20,30,40,50, 60