PROLOG ACADEMY

- **DATA STRUCTURE**

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- Book followed - Data structures by Seymour Lipschutz (Schaum Series)

LET’S START!

Tree

- Trees are hierarchical data structures.
- Non linear data structure
- Implemented as a double link list or array.
- Tree 'T' can be defined as-
- 1.T is empty
- 2. T contains a distinguished node 'R' called as root of the tree and the remaining nodes of tree forms an ordered pair of disjoint tree T1 and T2.

Types of trees

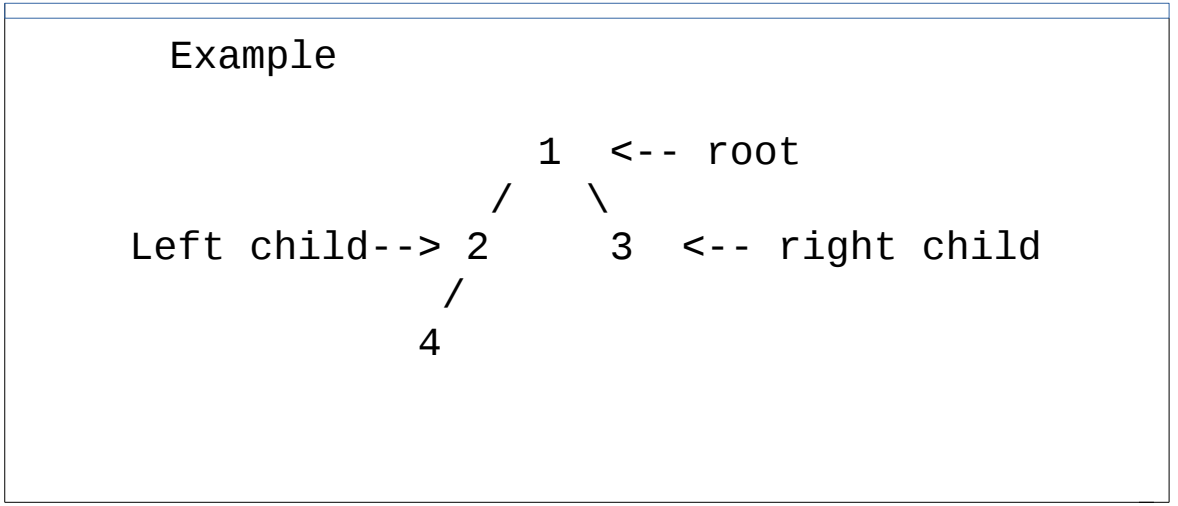
- Binary tree
- Binary Search tree
- Height balanced tree(AVL)
- Heap tree
- Threaded tree
- Expression tree
- Huffman tree
- M-way tree

Why trees?

- To store information that naturally forms a hierarchy. For example, the file system on a computer
- provide moderate access/search (quicker than Linked List and slower than arrays)
- provide moderate insertion/deletion (quicker than Arrays and slower than Unordered Linked Lists)
- don’t have an upper limit on number of nodes as nodes are linked using pointers.

Binary tree

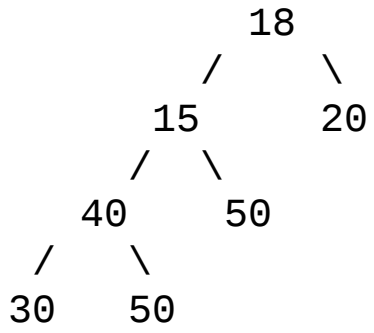
- A tree whose elements have at most 2 children is called a binary tree
- we typically name them the left and right child

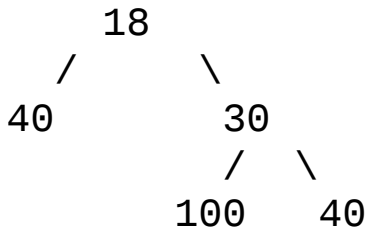


Types of binary tree

- Full / Proper binary tree / Extended binary tree / 2-Tree / Strictly binary tree

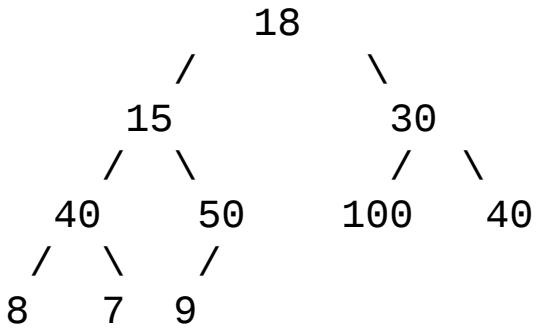
  A Binary Tree is full if every node has 0 or 2 children Or A full binary tree is a tree in which every node other than the leaves has two children.

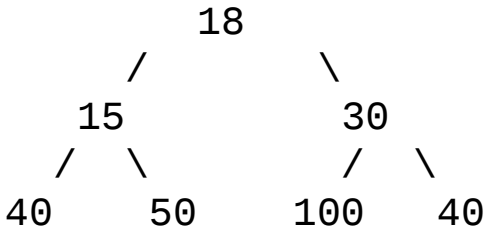




Complete Binary Tree

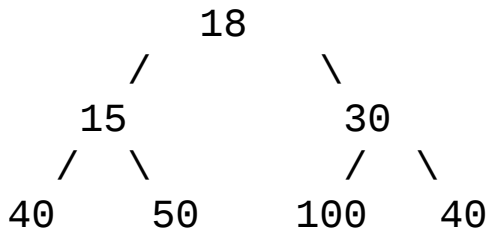
A Binary Tree is complete Binary Tree if all levels are completely filled except possibly the last level and the last level has all keys as left as possible





Perfect Binary Tree

1.A Binary tree is Perfect Binary Tree in which all internal nodes have two children and all leaves are at same level
2.A Perfect Binary Tree of height h has 2h – 1 node.



Some keywords

- Leaf node – Leaf node is the node with zero child.
- Internal node- All the other nodes except leaf nodes are called internal nodes.
- Height or Depth – height or depth of a tree is the maximum number of nodes in a path from root to leaf node.
- Level – Root 'R' is assigned a level 0. Every other node in the tree is assigned a level number which is one more than the level number aassigned to its parent.

- Height = level + 1

Properties of binary tree

- The maximum number of nodes at level ‘l’ of a binary tree is 2^l
- Maximum number of nodes in a binary tree of height ‘h’ is (2^h) – 1.
- In a Binary Tree with N nodes, minimum possible height/depth is
  $\lceil \text{Log}_2(N+1) \rceil$
- In Binary tree, number of leaf nodes is always one more than nodes with two children.

Similar Trees

- Binary tree T and T' are said to be similar if they have the same structure or if they have the same shape.

Copies

- Binary tree T and T' are said to be copies if they are similar and they have the same contents at the corresponding nodes.