DSA using Python

Tree

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Agenda

1. Tree
2. Real world Analogy
3. Degree, leaf, parent-child
4. Siblings, Ancestors and descendants
5. Level number, height, Generation

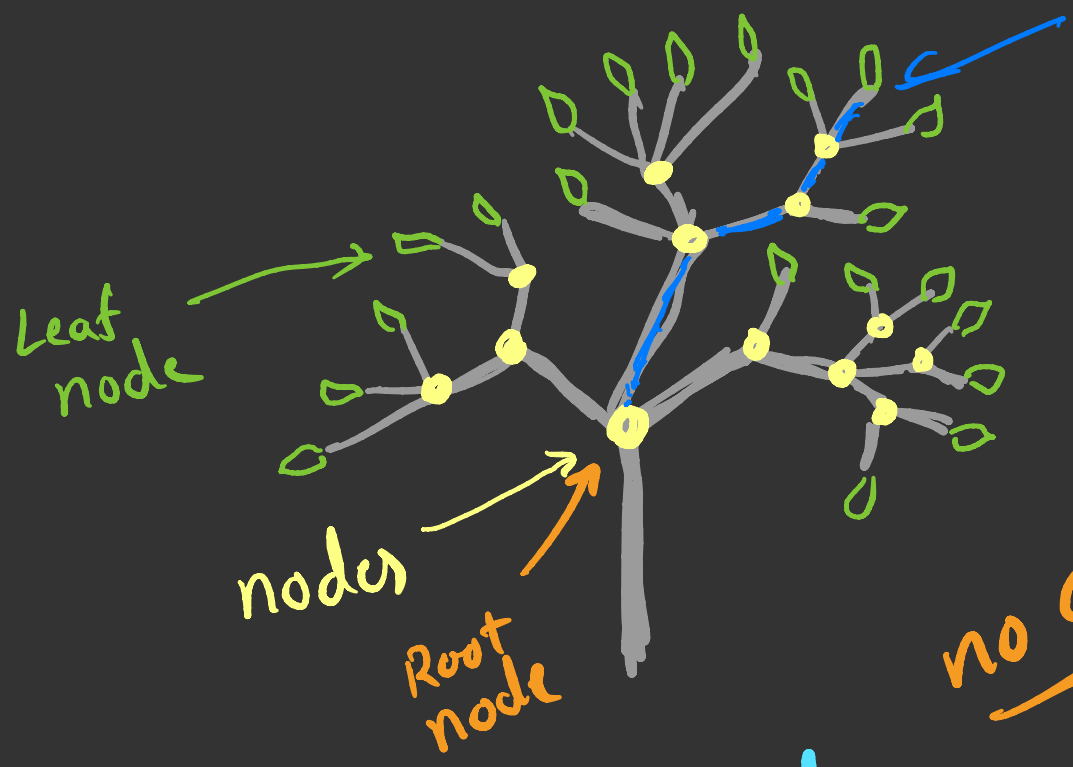
Tree

A tree is defined as a finite set of one or more data items (nodes), such that:

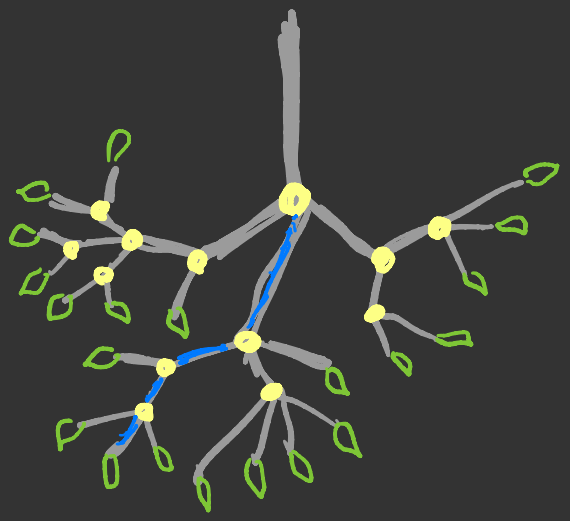
There is a special node called the root node of the tree.

The remaining nodes are partitioned into $n \geq 0$ disjoint subsets, each of which is itself a tree, and they are called subtrees.

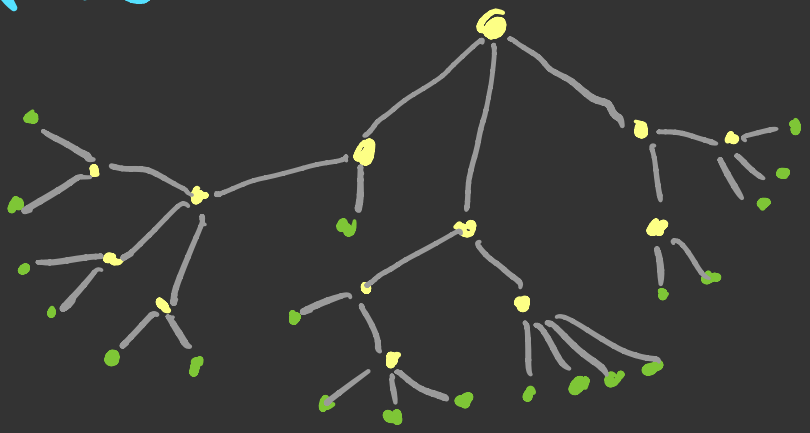
What is a Tree in Real world?

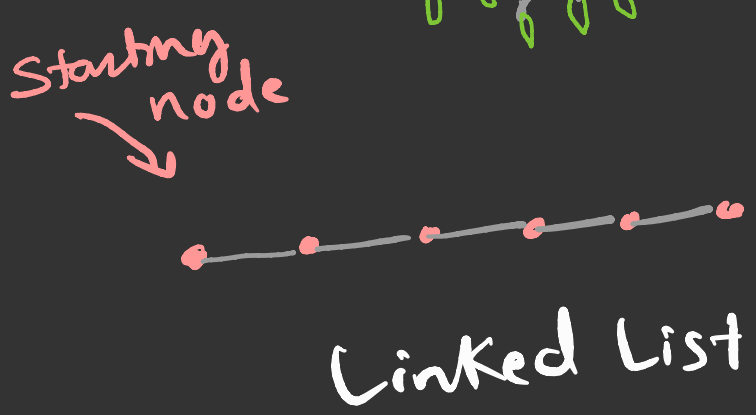


no Cycle in tree



Tree is a hierarchical data structure

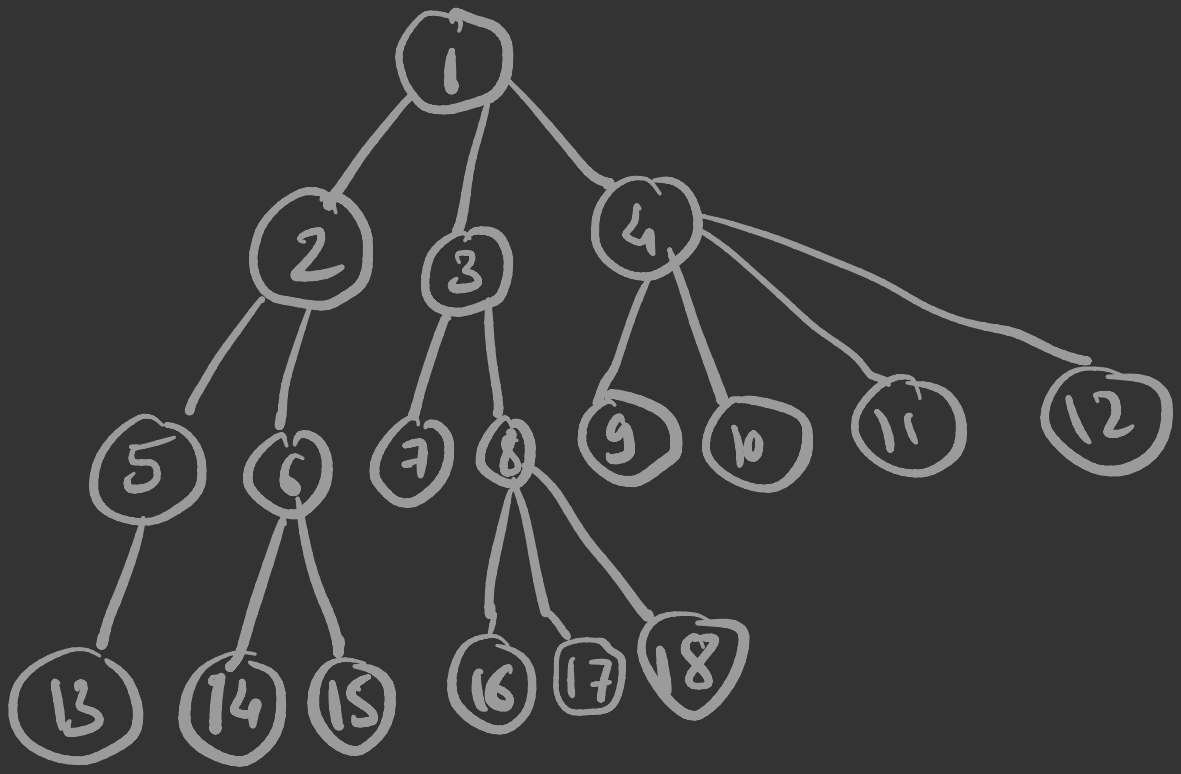




A tree is a non-linear data structure, which is used to represent hierarchical relationship existing among several data items.

Degree

The number of subtrees of a node is called its **degree**.



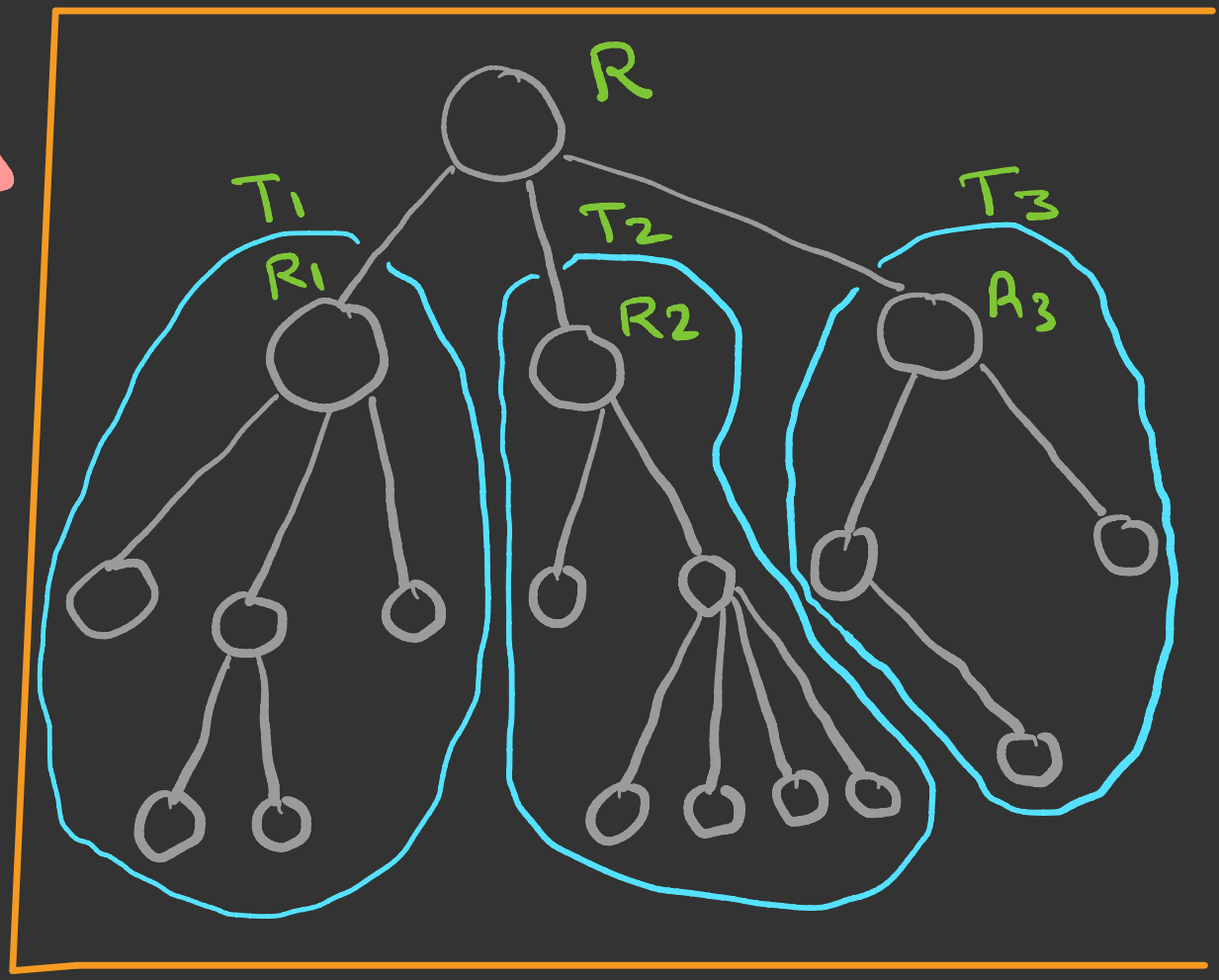
Leaf node

A node with degree zero is called leaf.

The leaf nodes are also called terminal nodes.

Parent - Children

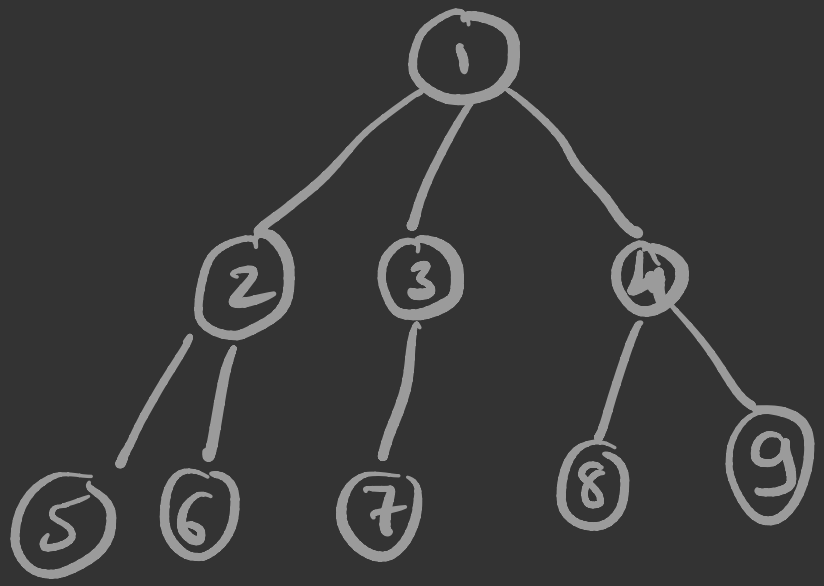
If R is a root node and its subtrees are T1, T2, T3 and root of the subtrees are R1, R2, R3, then R1, R2, R3 are called children of R and R is called parent of R1, R2, R3



Siblings & Degree of tree

Children of the same parent are called Siblings

The degree of the tree is maximum degree of the nodes in the tree.



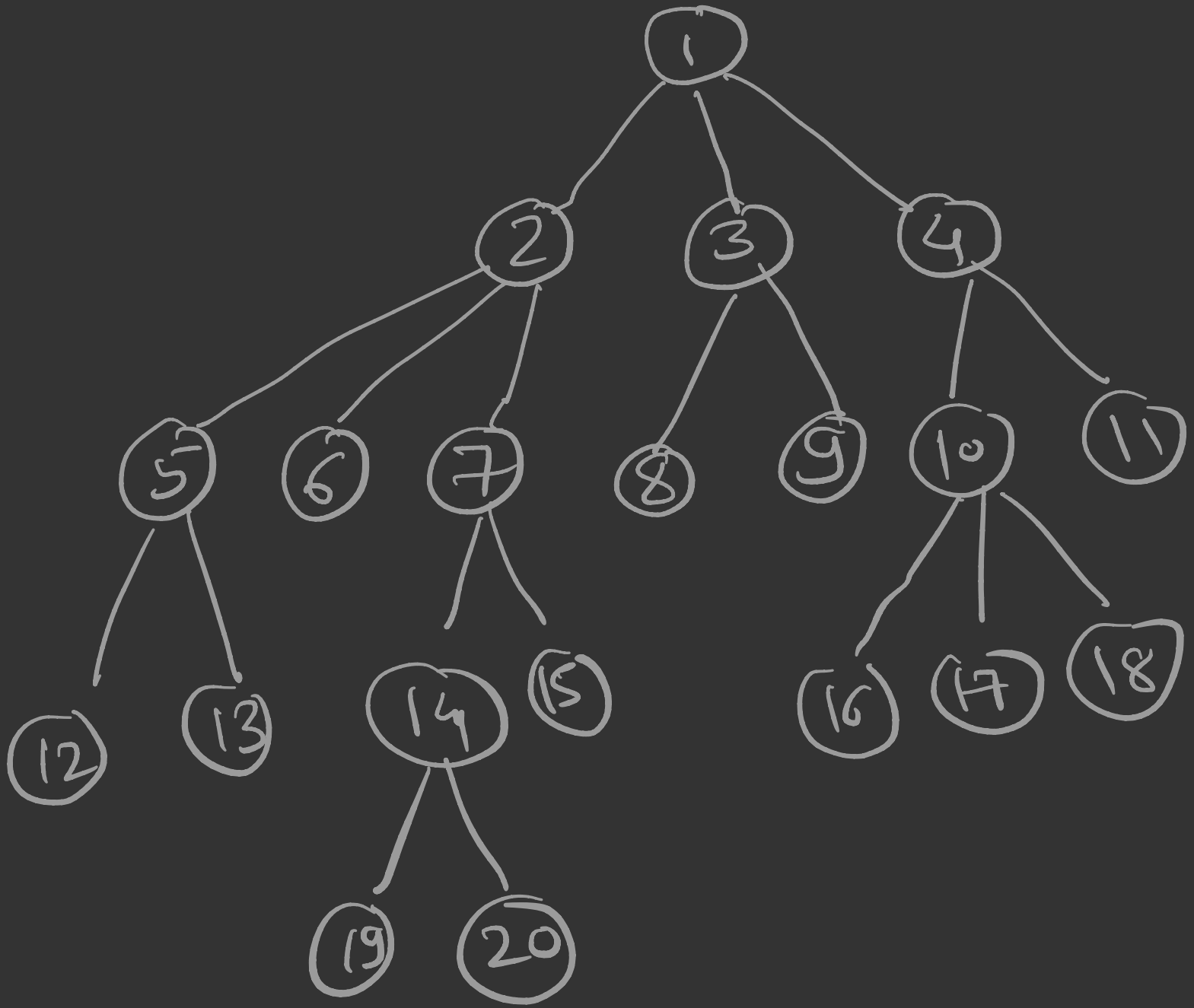
Ancestors and Descendants

The ancestors of a node are all the nodes along the path from the root to that node.

The descendants of a node are all the nodes along the path from node to terminal node.

Level Number

- Each node is assigned a level number
- The root node of the tree is assigned a level number 0.
- Every other node assign a level number which is one more than the level number of its parent.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Generation

Nodes with the same level number are said to belong to the same generation.

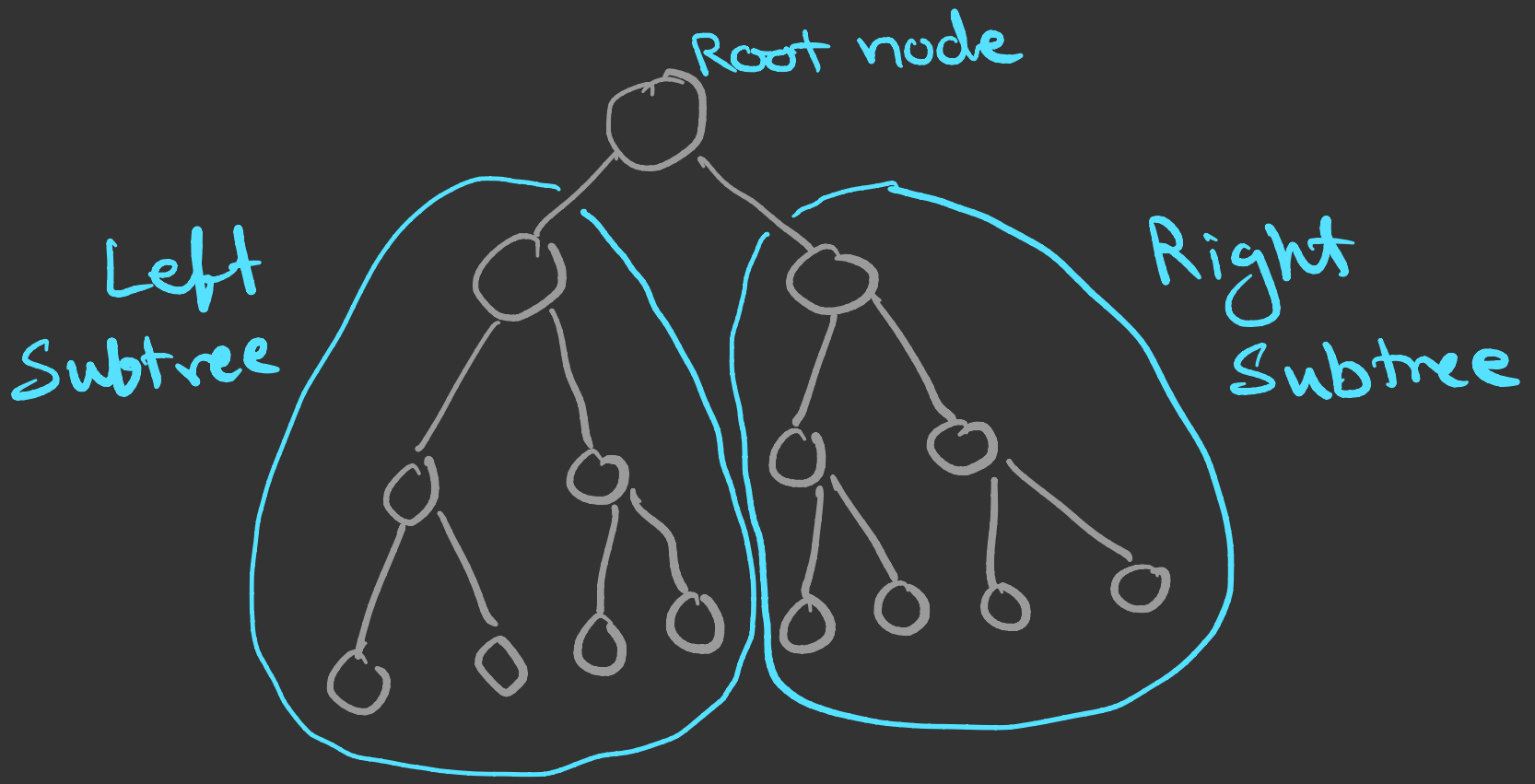
Height or Depth

- The height or depth of a tree is the maximum number of nodes in a branch
- A line drawn from a node to its children is called an edge.
- Sequence of consecutive edges is called path
- Path ending in a leaf is called a branch.

Binary Tree

A binary tree is defined as a finite set of elements, called nodes, such that

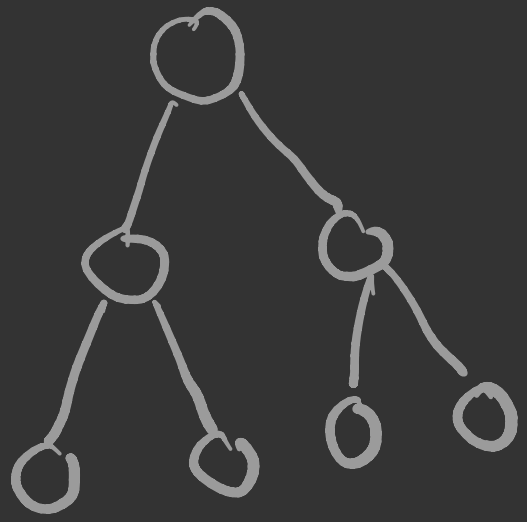
- T is empty (called the Null tree or empty tree), or
- T contains a distinguished node R, called the root of T, and the remaining nodes of T form an ordered pair of disjoint binary trees T_1 and T_2



Any node in the binary tree has either 0, 1 or 2 child nodes.

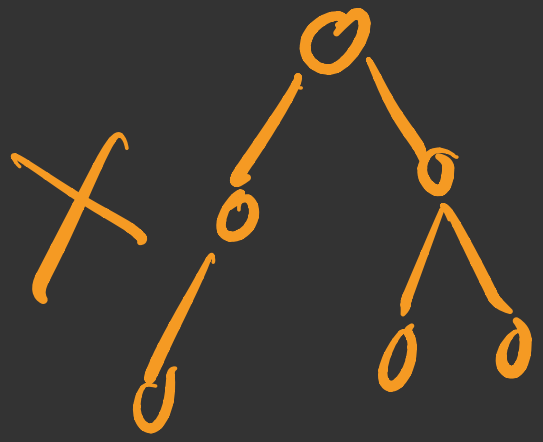
Complete Binary Tree

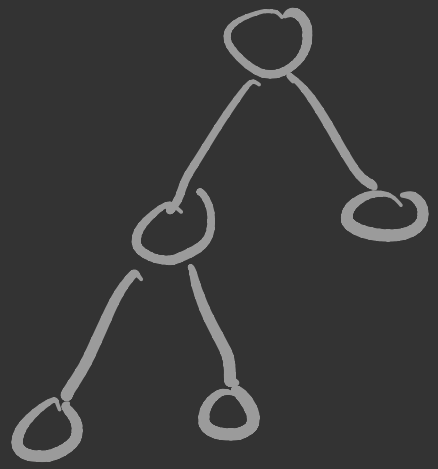
All levels are completely filled.



Almost Complete Binary Tree

All levels are completely filled, except possibly the last level and nodes in the last level are all left aligned.

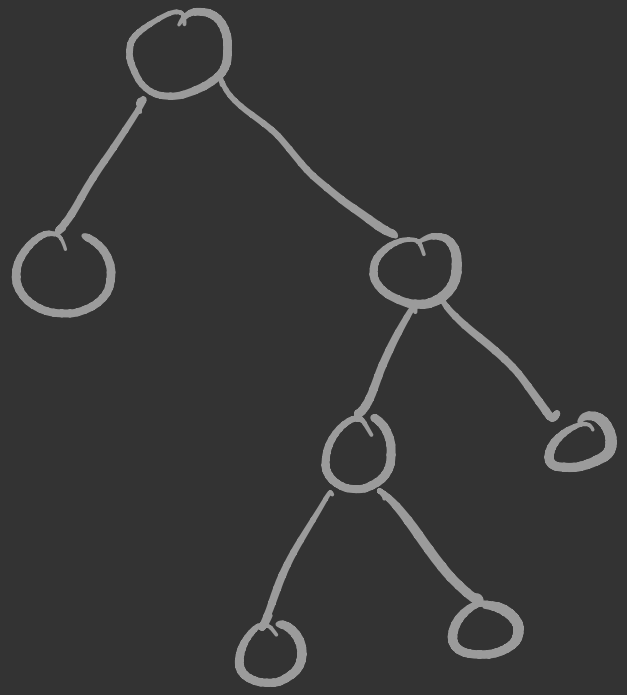




Strict Binary Tree

Each node of a strict Binary Tree will have either 0 or 2 children.

Full Binary Tree



Representation of Binary Tree

There are two possible representations of binary tree

1. Array Representation
2. Linked Representation (by default)