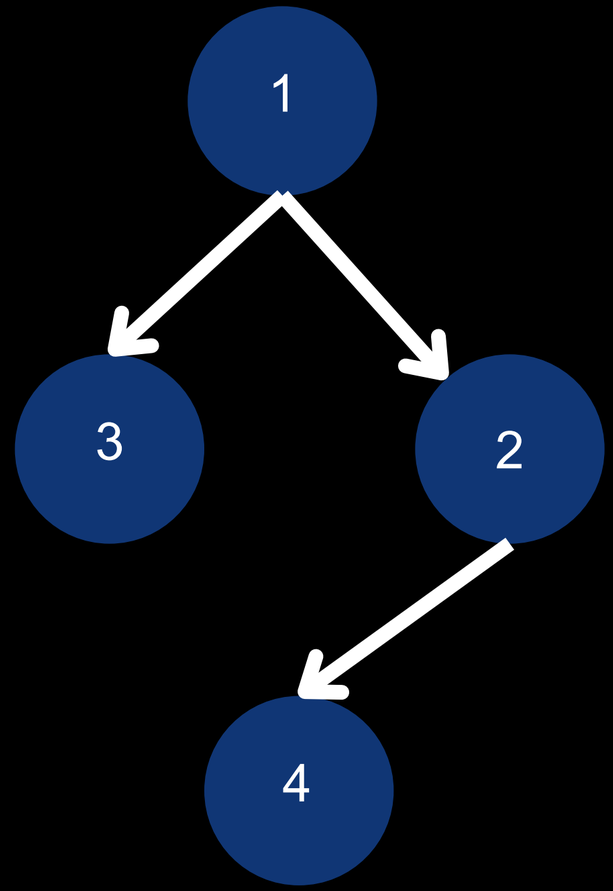
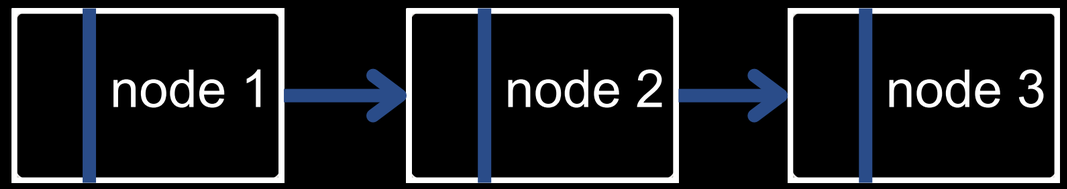
# DATA STRUCTURE

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# graphs

A graph is a non-liner data structure  that consists of two main components:

- Vertices (Nodes): The entities in the graph, often represented as points.
- Edges: The connections between vertices, represented as lines or arrows.

Types of Graphs

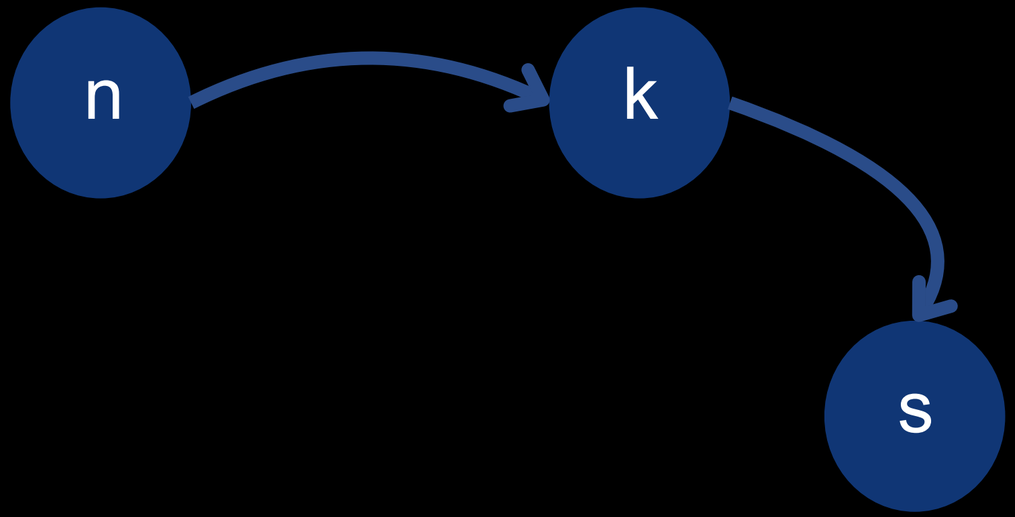
- Directed Graph (Digraph): The edges have a direction
- Undirected Graph: The edges do not have a direction

Vertice (Node)

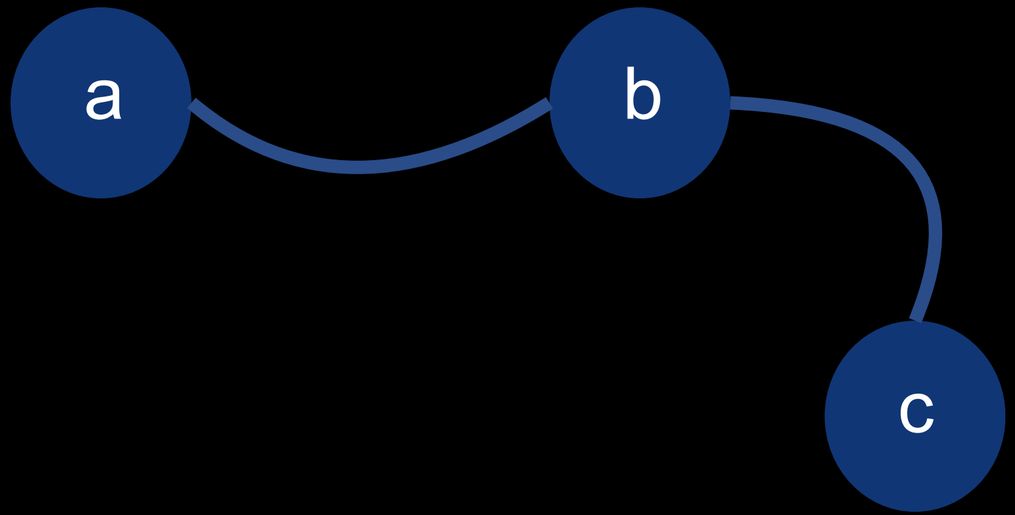
Edge

Undirected Edge

Directed Graph




Undirected Graph



# Trees

a tree is a specialized type of graph data structure, but it is commonly discussed using hierarchical terminology

## Definitions of Tree Components

root Node: The top-most node in the tree hierarchy ,It has no parent.

Node: single entity in the tree containing data and links

Parent:  node that has one or more child nodes.

Child: node directly connected to its parent node

# Definitions of Tree Components (count.)

Leaf (External Node): node that has no children.

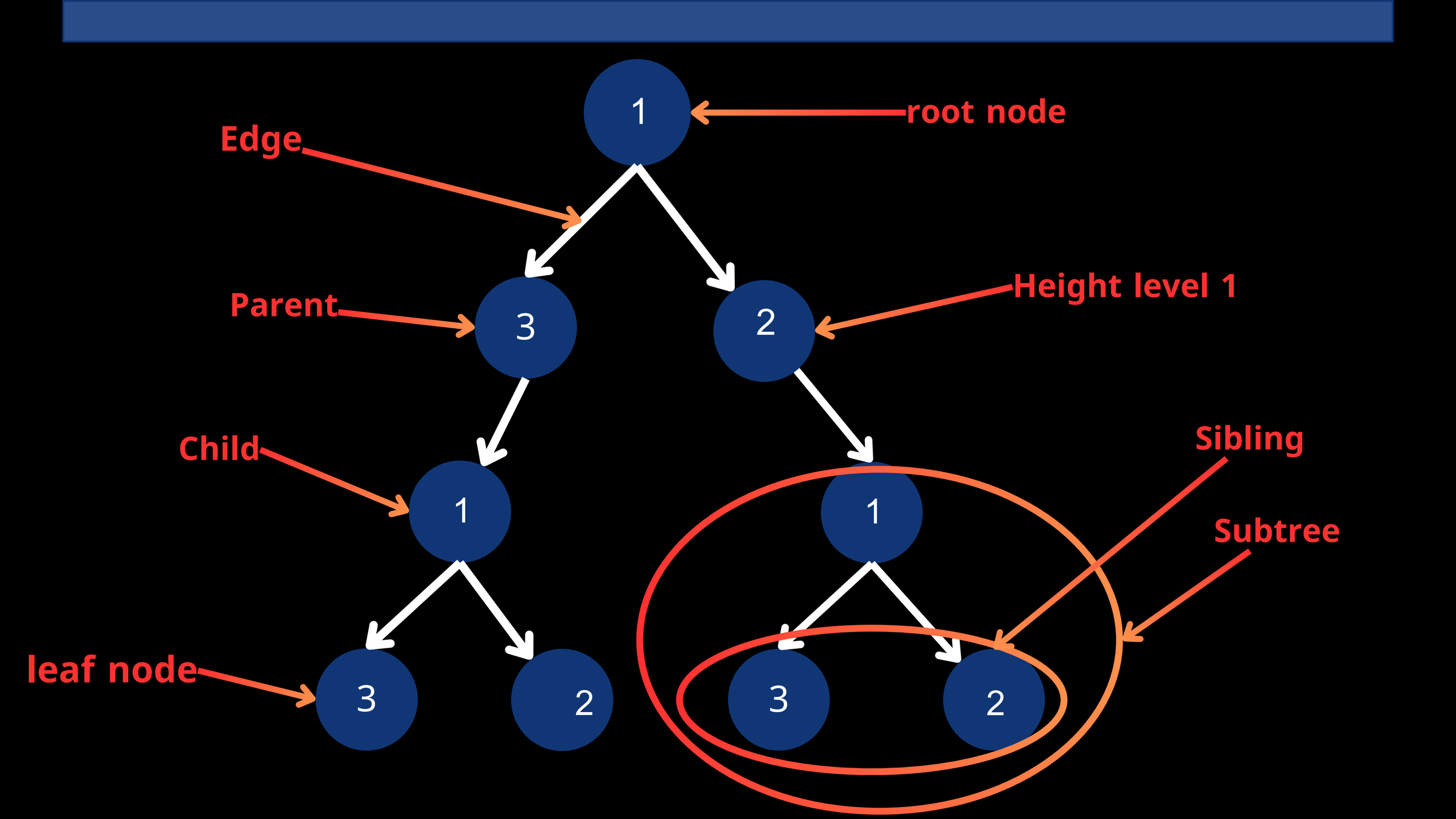
Edge: connection between two nodes (parent to child).

Sibling : Nodes that share the same parent.

Height : The length of the longest path from the root to a leaf.

Subtree : tree formed by any node and its descendants.

Level: The depth or distance of a node from the root.


1
root node
Edge
Parent
3
2
Height level 1
Child
1
1
Sibling
Subtree
leaf node
3
2
3
2

# Types of Trees

Binary Tree:
Each node has at most two children, referred to as the left and right child.

Binary Search Tree (BST):
A binary tree where the left child contains smaller values, and the right child contains larger values.

Complete Binary Tree:
All levels except possibly the last are fully filled, and the last level's nodes are as far left as possible.

A perfect binary tree is a type of binary tree in which: All internal nodes have exactly two children. All leaf nodes are at the same level.

# Binary Search Trees (BST)

A Binary Search Tree (BST) is a specialized type of binary tree with the following

Properties of a BST

- Node Value Rule:
- For each node nnn:
- Left Subtree: All values in the left subtree are less than the value stored in nnn.
- Right Subtree: All values in the right subtree are greater than or equal to the value stored in nnn.

Unique Structure:

- This property allows for efficient searching, insertion, and deletion of nodes..

Recursive Definition:

- Both the left and right subtrees of a BST are themselves binary search trees

# Thanks

All code and examples can be found on GitHub https://github.com/ESSAMMOHAMED1