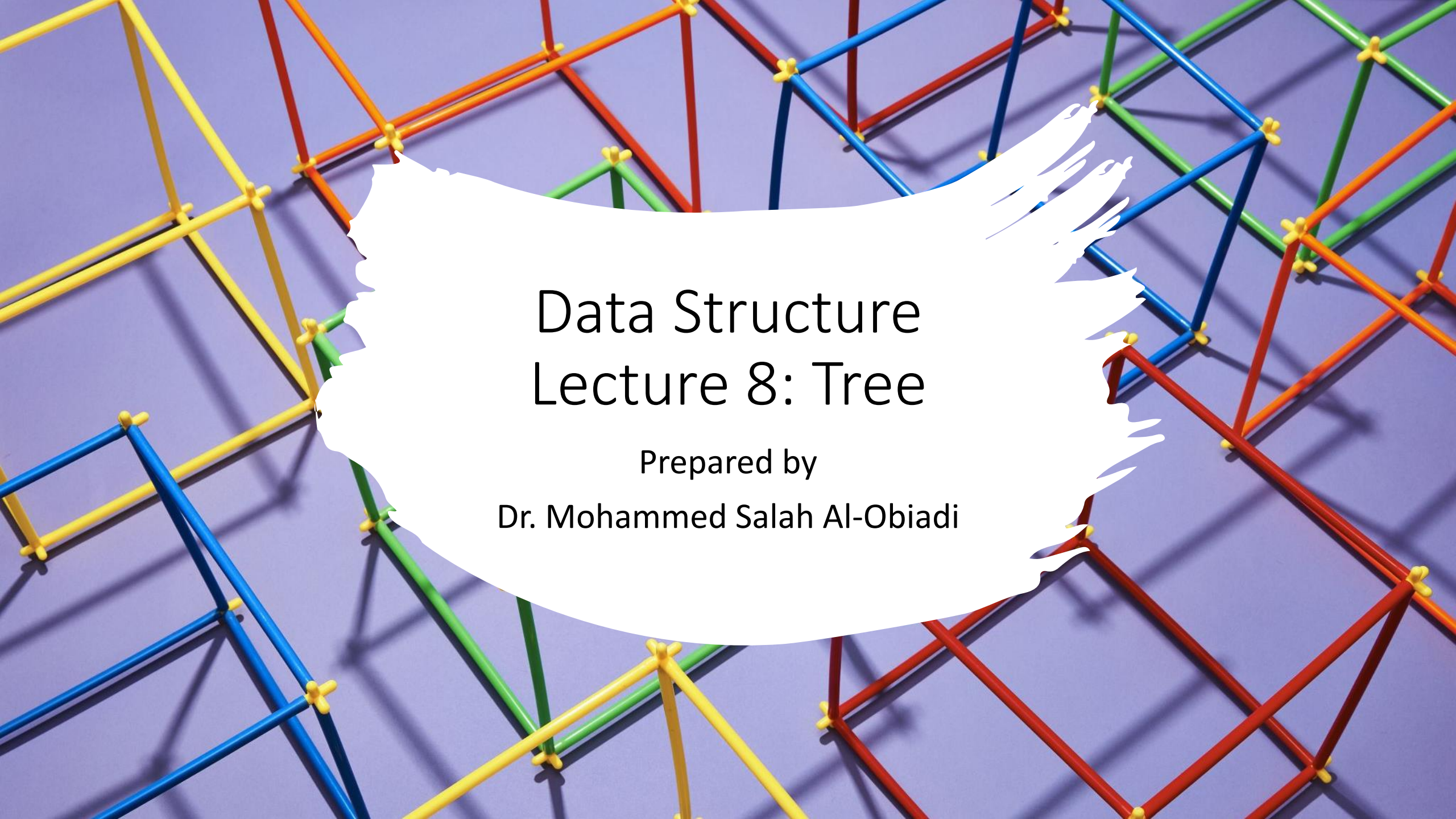

Data Structure
Lecture 8: Tree

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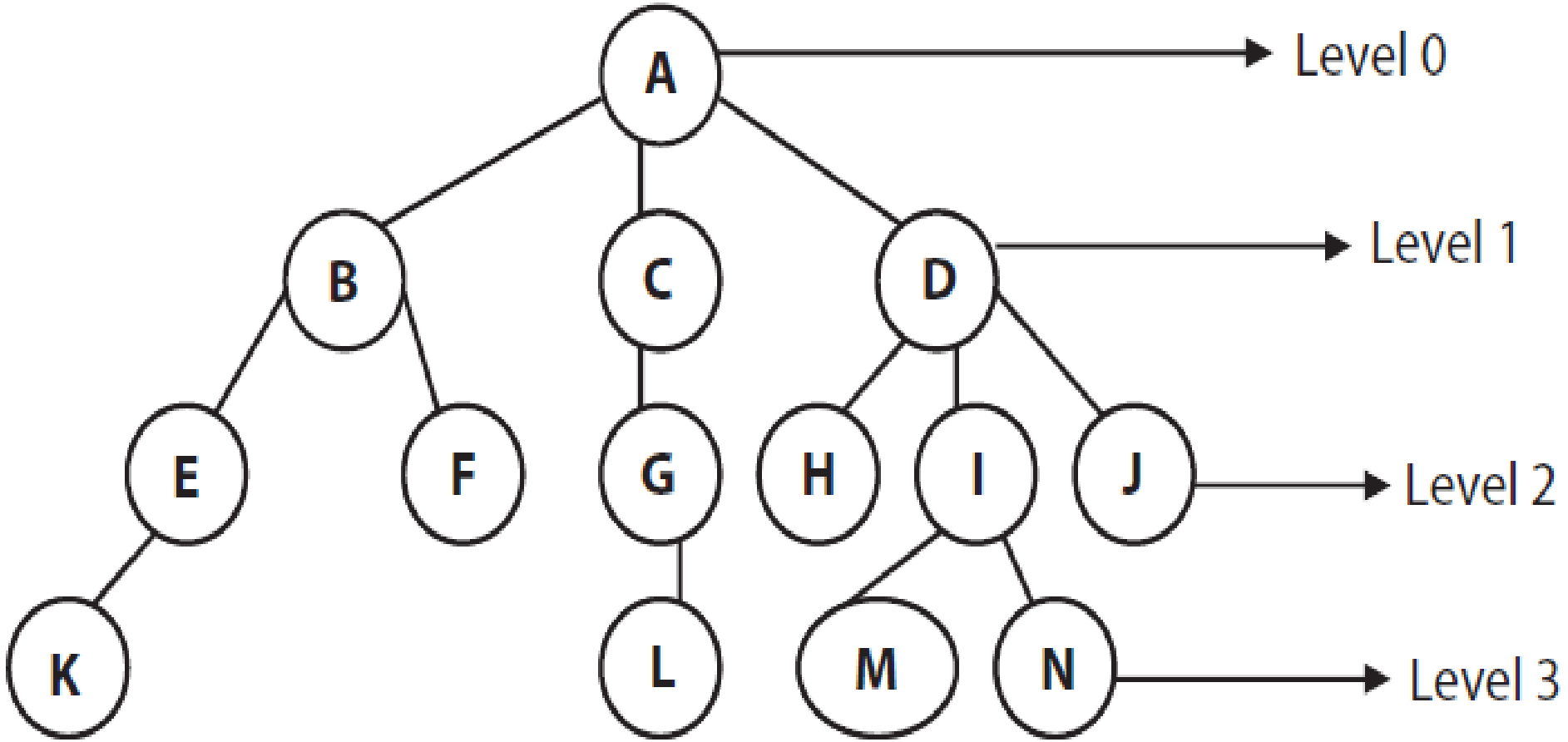
TREE

- A TREE is a dynamic data structure that represents the hierarchical relationships between individual data items.
- It’s a data structure in which the elements are arranged in the parent and child relationship manner.
- In a tree, nodes are organized in a hierarchical way in such a way that:
  - Root is the beginning of the tree.
  - Branches are Lines that connecting the nodes.
  - Leaf nodes are nodes that have no children.

Figure 1 shows Example of a Tree



Tree Terminologies

Node: Each element of a tree is called as node. In the previous figure there are 14 nodes.

Root is the beginning of the tree. In figure 1: A is the root node.

Parent: Parent of a node is the immediate predecessor of a node. In figure 1: B is the parent of E and F.

Child: Each immediate successor of a node is known as child. In figure 1: B, C, D are children of A.

Siblings: The child nodes of a given parent node are called siblings. In figure 1: H, I, J are siblings.

Degree of a Node: The number of sub-trees of a node in a given tree. In figure 1:

- The degree of node A is 3
- The degree of node B is 2
- The degree of node G is 1
- The degree of node F is 0

Tree Terminologies

Degree of Tree: The maximum degree of nodes in a given tree. In the figure the maximum degree of nodes A and D is 3. So the degree of Tree is 3.

Terminal Node: A node with degree zero is called terminal node or a leaf.

Level: The entire tree structured is leveled in such a way that the root is always at the level 0, then its immediate children are at level 1, and their immediate children are at level 2 and so on up

Path: Path is the sequence of consecutive edges from the source node to the destination node path between A and M is (A,D),(D,I),(I,M).

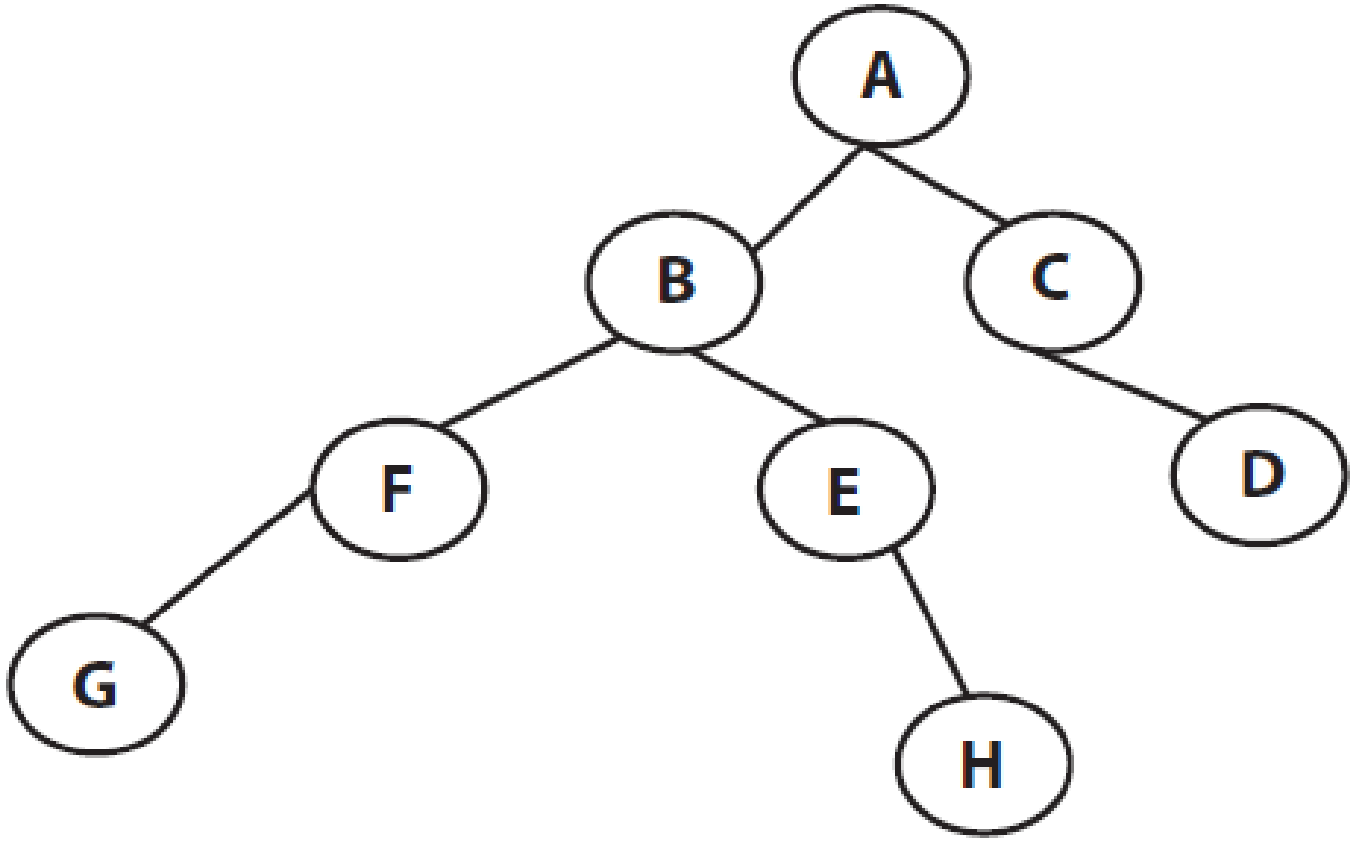
Height: The height of node n is the length of the longest path from n to leaf. The height of B is 2 and F is 0.

BINARY TREE

- A binary tree is a special form of a tree in which every node of the tree can have at most two children.

OR

- In a binary tree the degree of each node is less than or equal to 2.

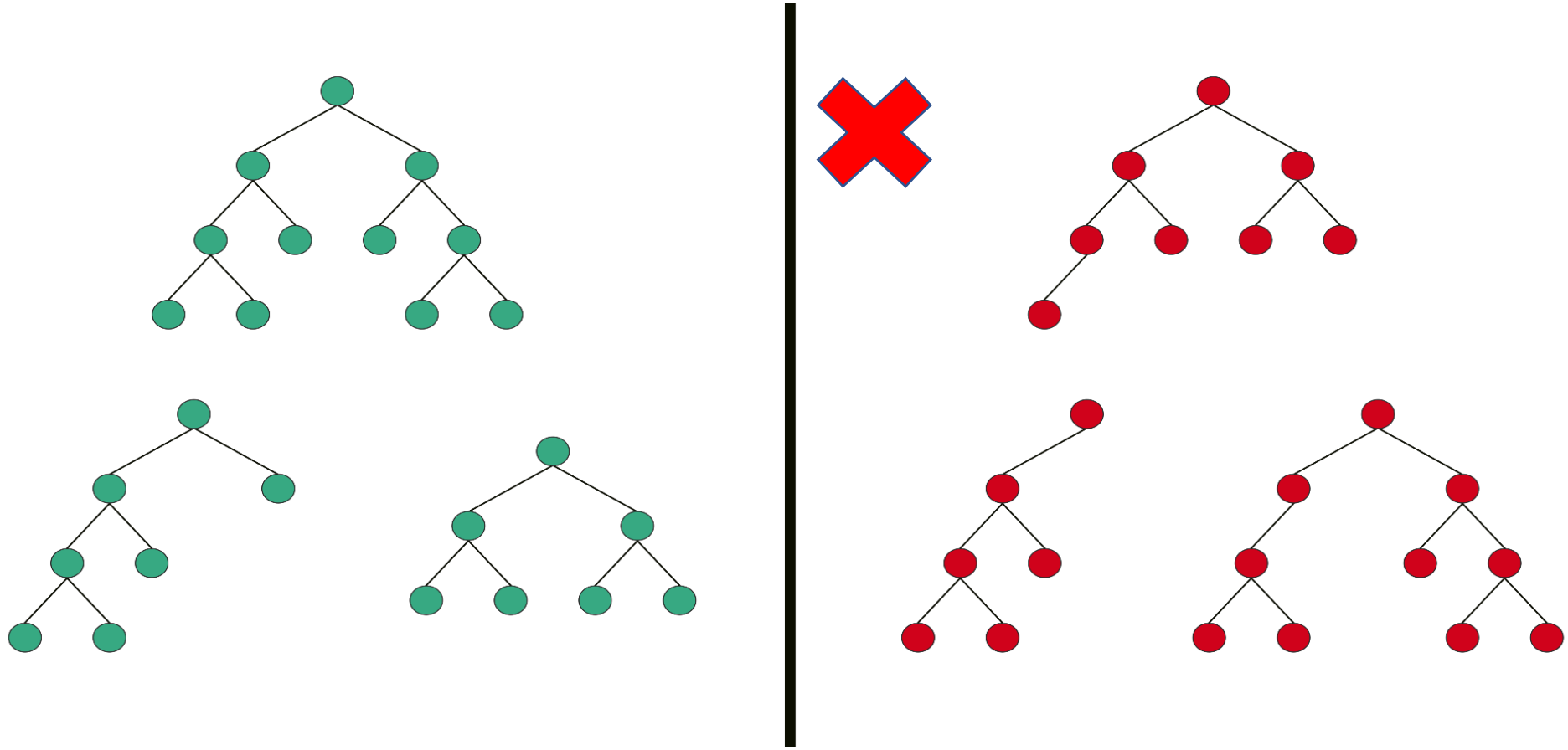


Types of Binary Tree

1. Full Binary Tree
2. Perfect Binary Tree
3. Pathological Binary Tree

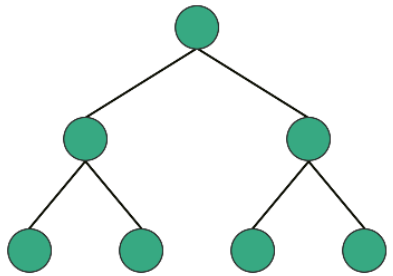
Full Binary Tree

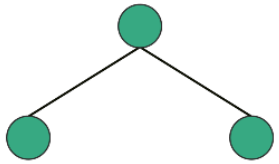
In a Full Binary Tree the out degree of every node is either 2 or Nil.

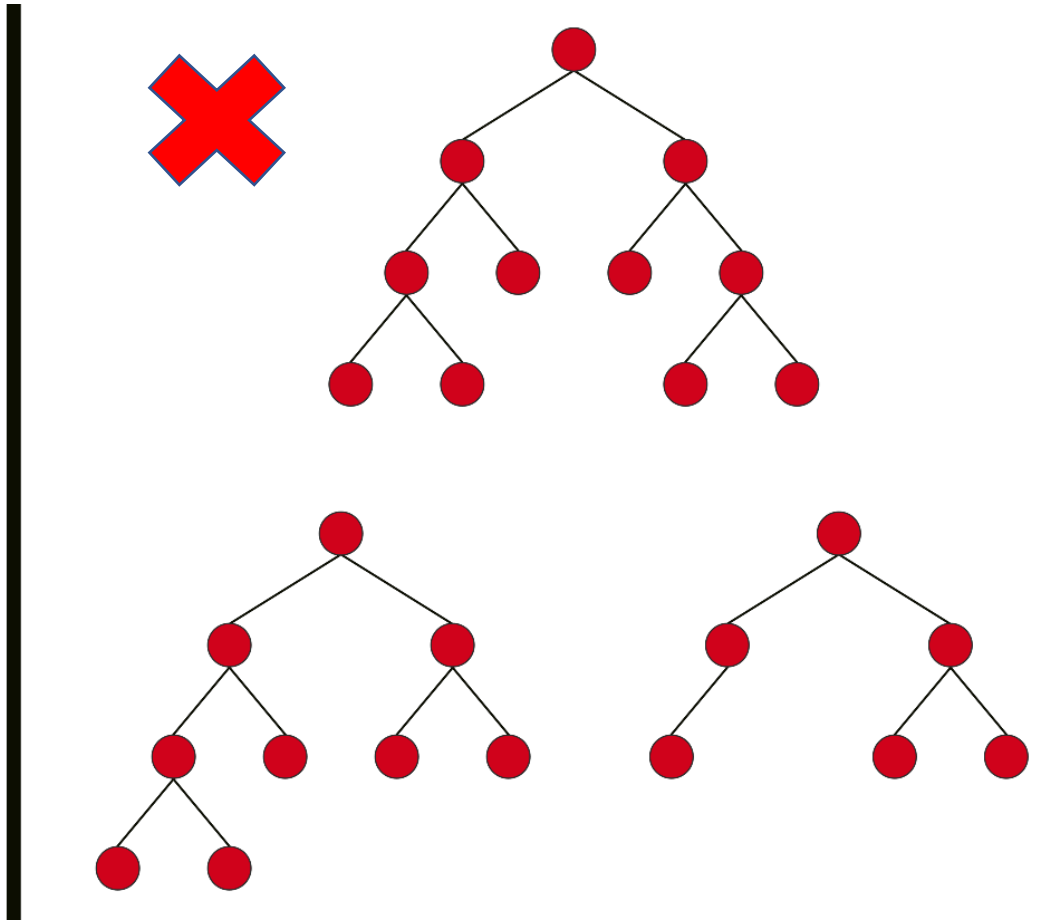


Perfect Binary Tree

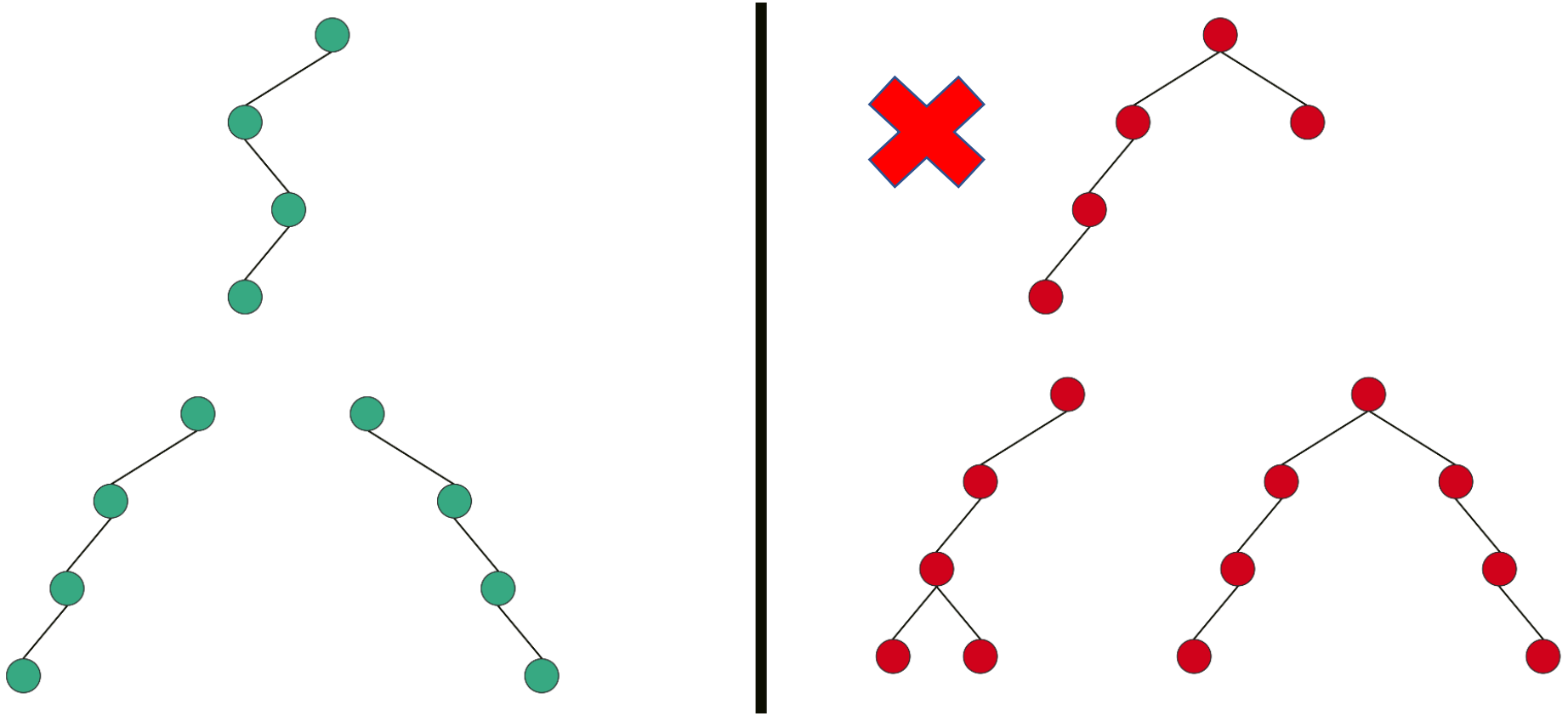
Perfect Binary Tree is a Binary Tree in which all nodes have 2 children and all the leaf nodes are at the same depth or same level.





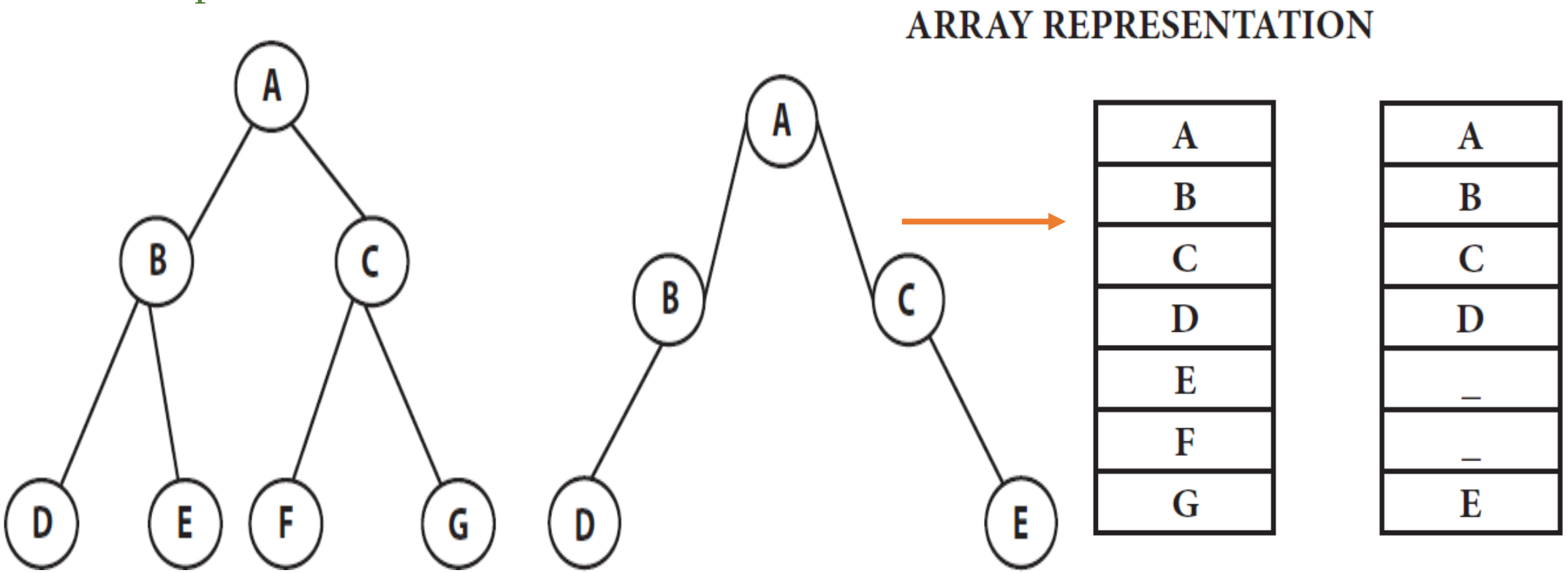


Pathological Binary Tree

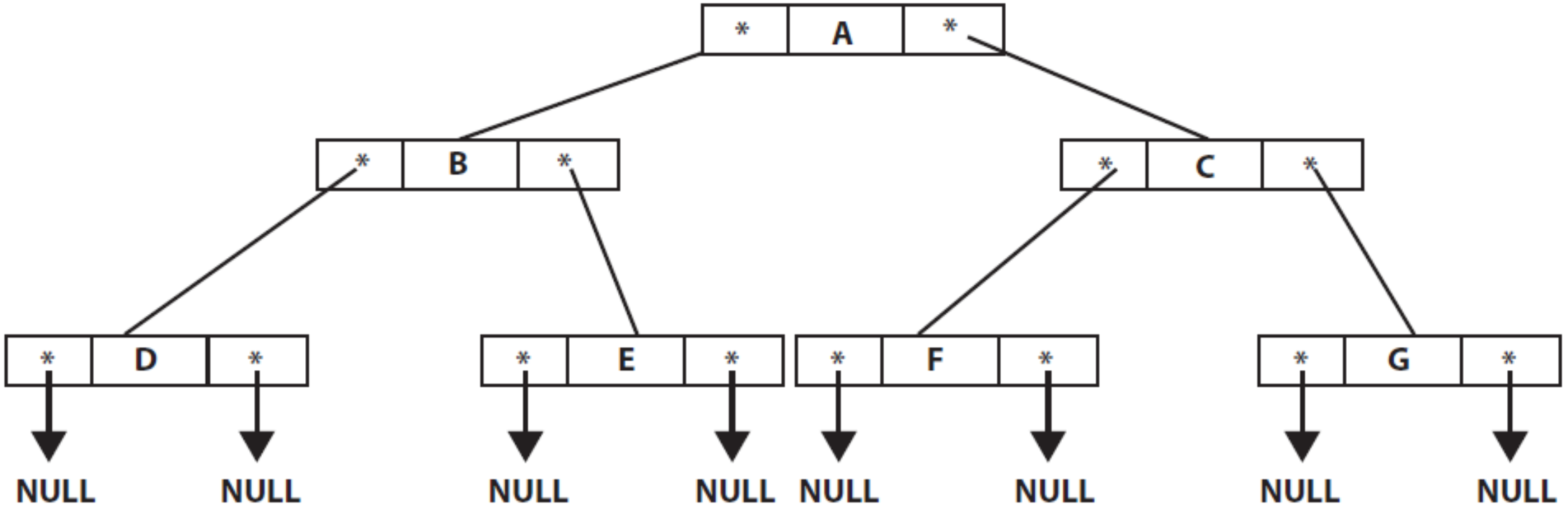


Array Representation of a Tree

- The ROOT node is always kept as the FIRST element of the array i.e/ in the 0-Index the root node will be store. Then, in the successive memory locations the left child and right child are stored.
- Example:



Linked List Representation of a Tree (Double Linked List)



Operations Performed With the Binary Tree

- Creation
- Insertion
- Deletion
- Searching
- Copying
- Merging
- Updating

Algorithm for Creation of Binary Tree

Create (node, info) [node is the structure having both left and right pointer. info is data]
Step-1 : if (node = null) then:
    Node := new Node() allocate a memory to node
    Node → info := info
    Node → left := null
    Node → right := null
    return
Step-2 : if node → info>= info then:
        create(node → left, info)
    else:
        create(node → right, info)
Step-3 : return(node)