

Algorithms and Data Structures

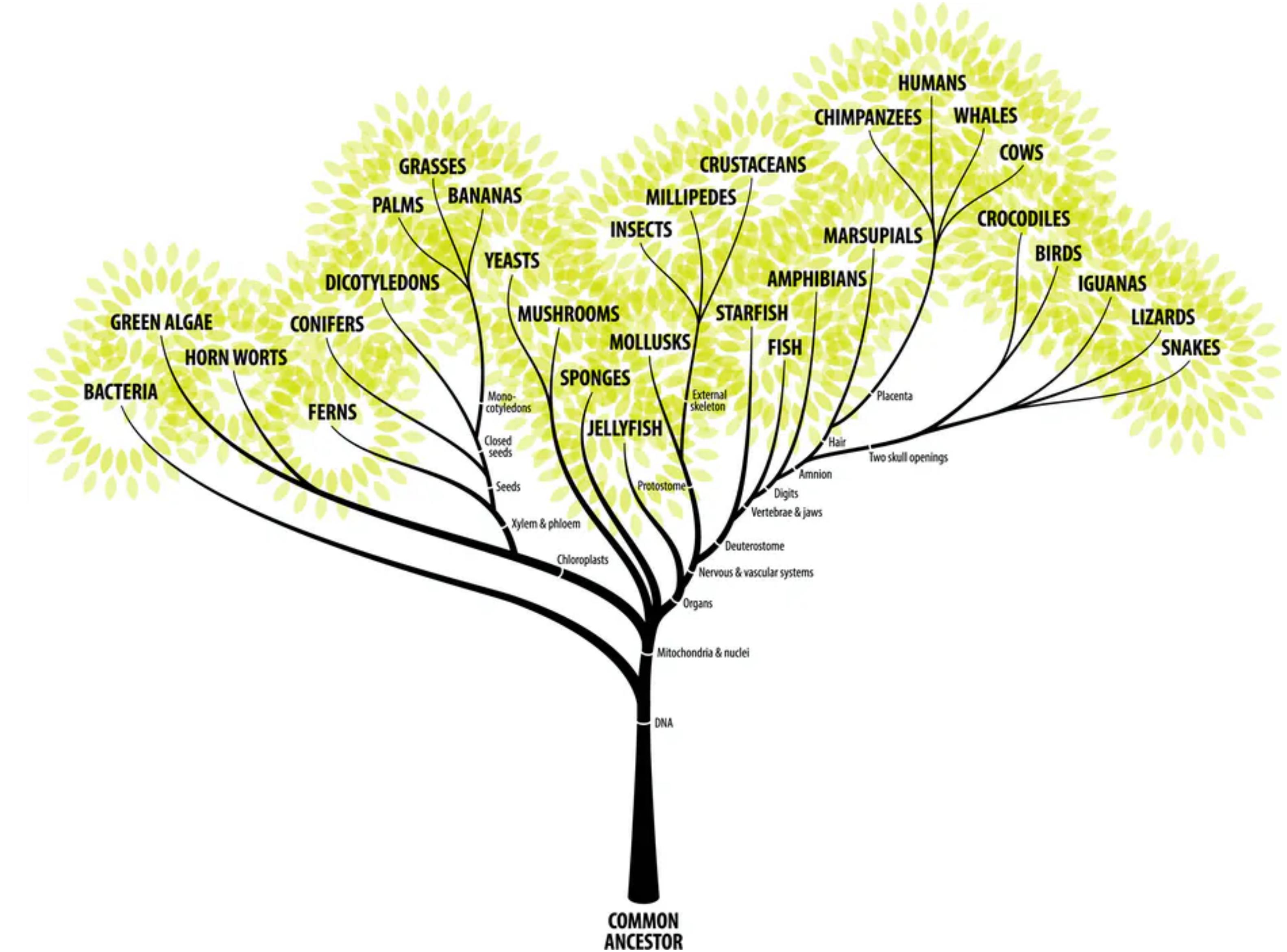
Tree

WELCOME

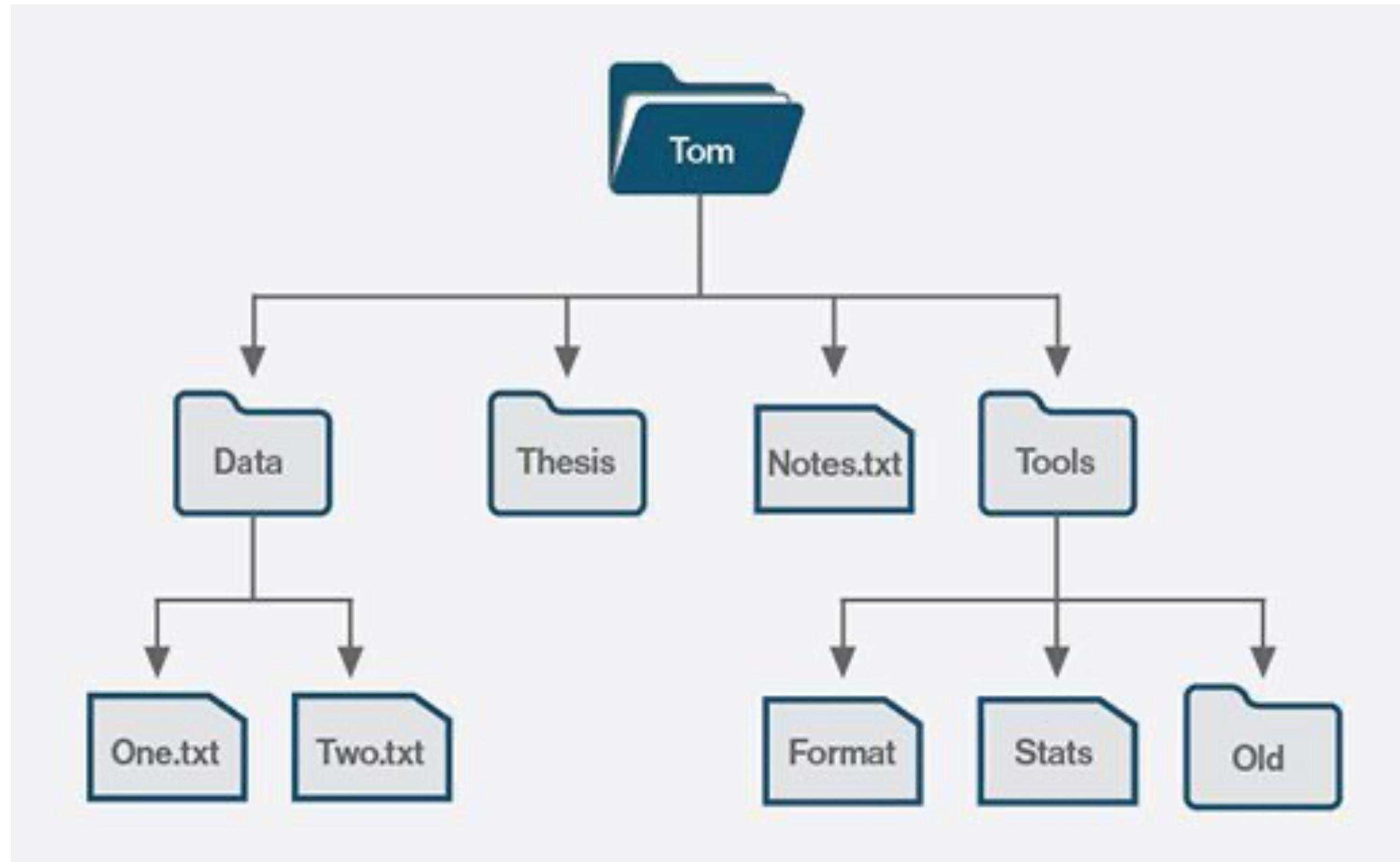


Part I: Basic Tree

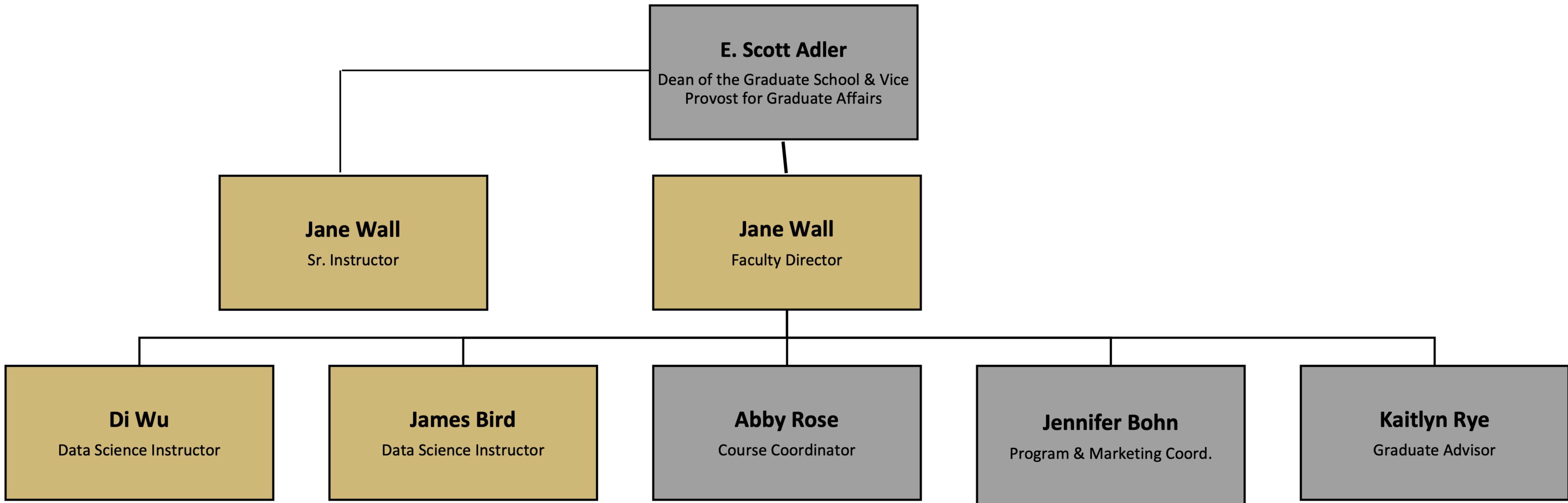
BioTrees



File Tree



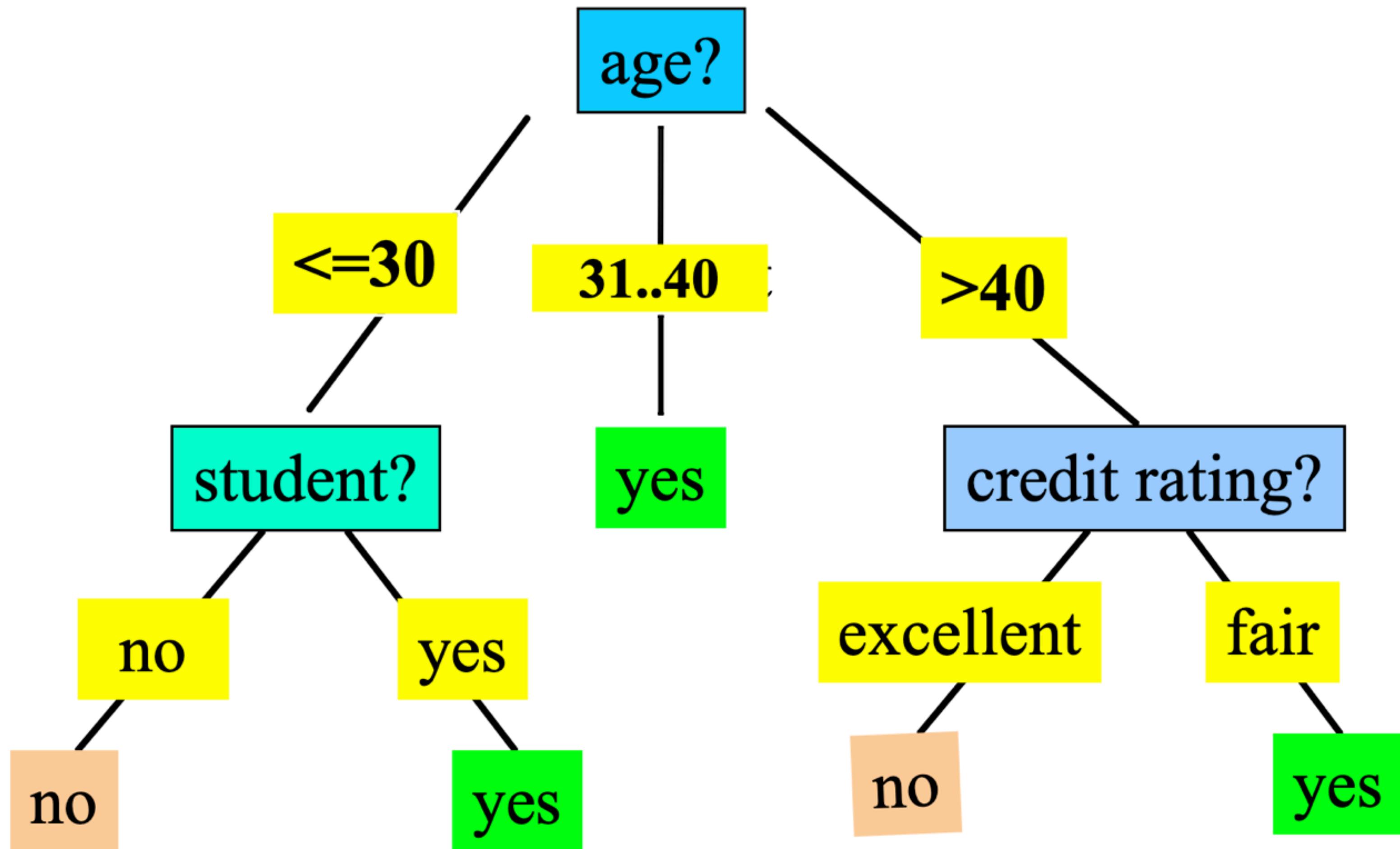
Organization Tree



Family Trees



Decision Tree



Tree in MET



Man Ray. American, 1890–1976

Obstruction, original 1920, Moderna Museet
edition 1961 (13/15)

Sixty-three wood coat hangers

Lila Acheson Wallace Gift, 2015 (2015.242.1–.63)

Man Ray worked in a wide range of media, including photography, painting, and sculpture, often blurring the boundaries between these practices. *Obstruction*, an assemblage of sixty-three wood coat hangers, is an example of a type of artwork that Dada artist Marcel Duchamp called a *readymade*, a term that suggests Man Ray's appropriation and manipulation of pre-existing, common objects. The sculpture playfully mimics a chandelier, but, as the hangers seemingly divide and multiply, *Obstruction* quickly evolves into a dense tangle of overlapping forms. Cast shadows serve as distorted, immaterial extensions of its physical presence. Man Ray first created *Obstruction* in 1920, but the present work belongs to an edition of fifteen reproductions he created in 1961 for an important exhibition of kinetic art.

Trees

- Tree is a natural data structure we use in our daily life:
 - File System
 - Biology tree of life
 - Family trees
 - Company departments
 - Decision tree
 - Object Oriented Programming - Class Tree



What is a Tree?

- A **Tree** organizes values hierarchically.
 - Values are carried by **TreeNode**
 - Each **TreeNode** has Zero or More sub/**child** **TreeNodes**
 - A **TreeNode** is the root of all its sub/**child** **TreeNodes**
 - The root of a Tree is the **TreeNode** that on top-most
 - A **TreeNode** cannot have two super/**parent** Nodes.

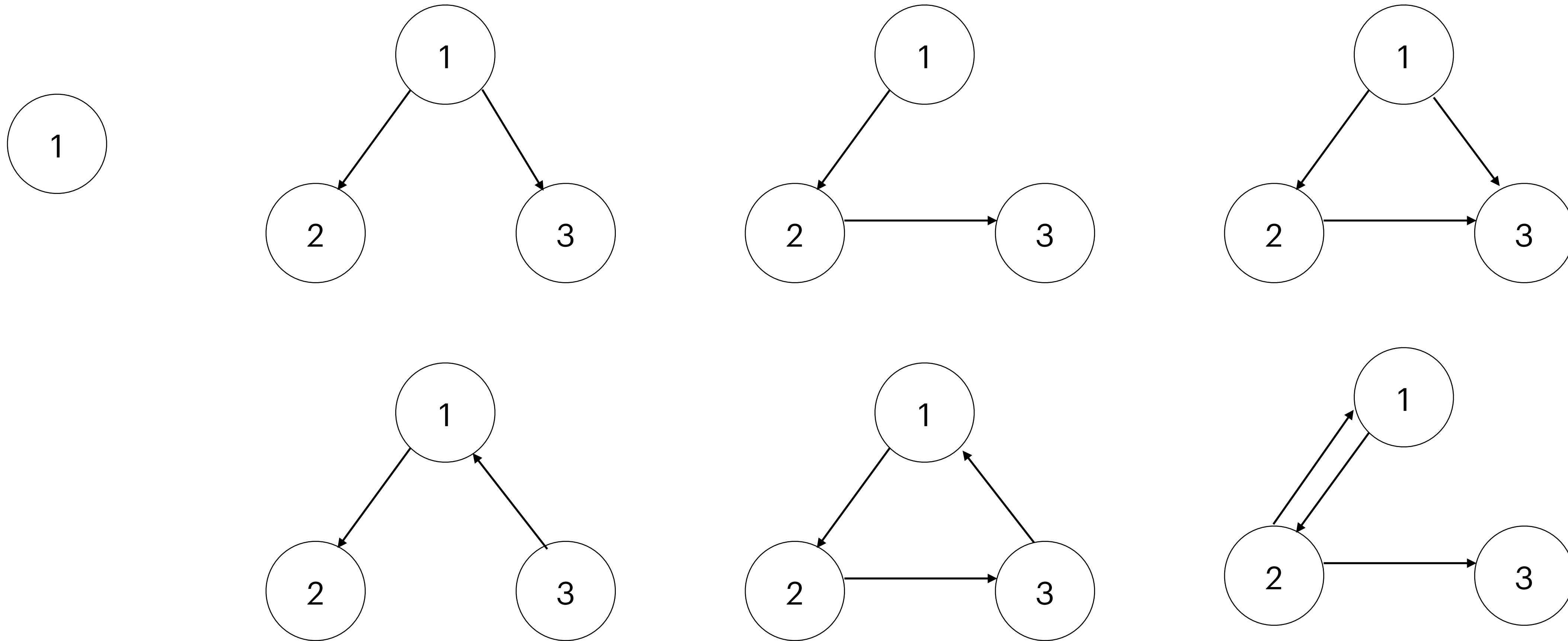


Terminology

- Root
 - The node on top of a tree.
- Leaf
 - The node has no child/sub nodes.
- Depth
 - The depth of a node is the number of links from the root to the node.
- Height
 - The max node depth
 - The number of links from the root to its furthest leaf.

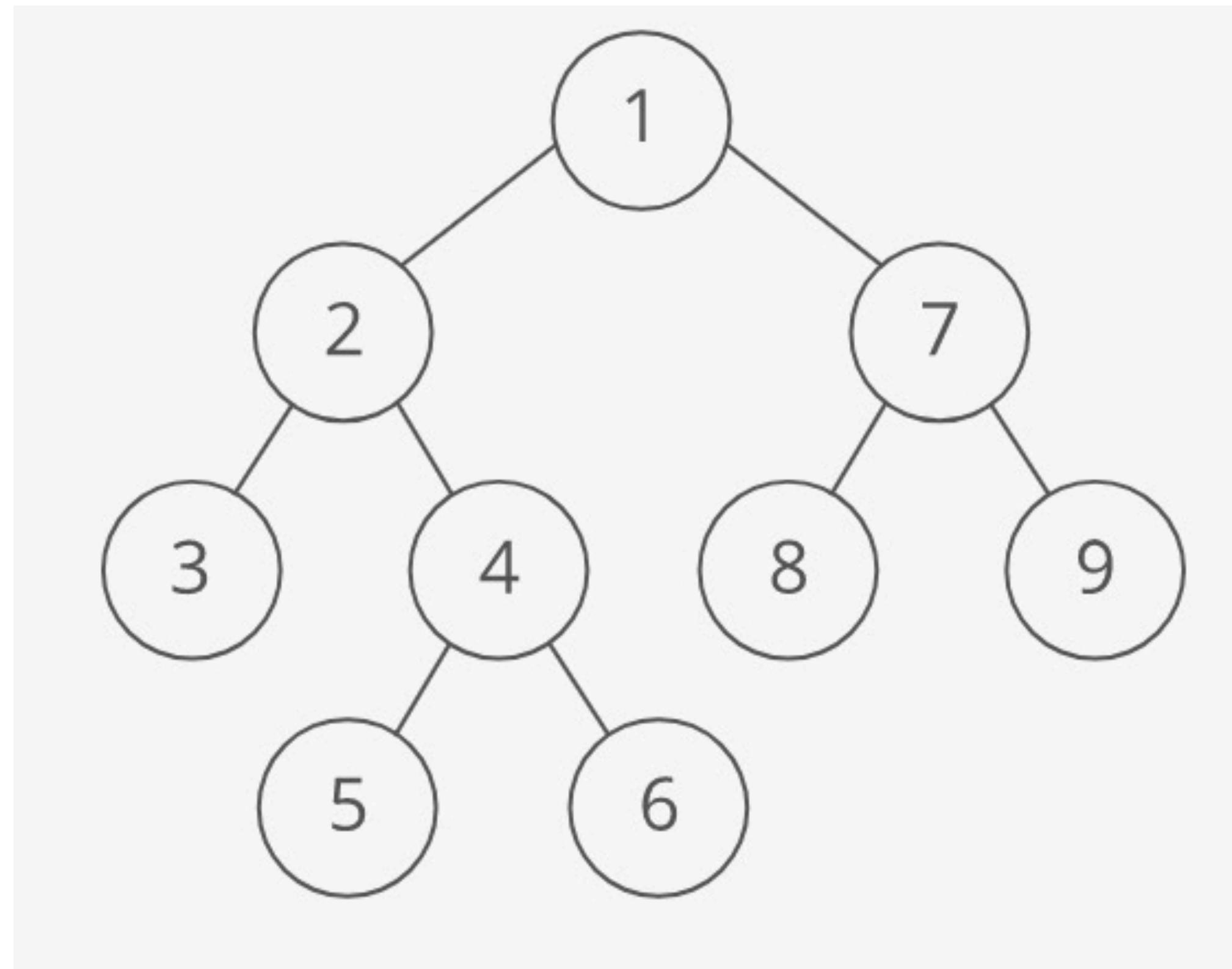


Is It A Tree?



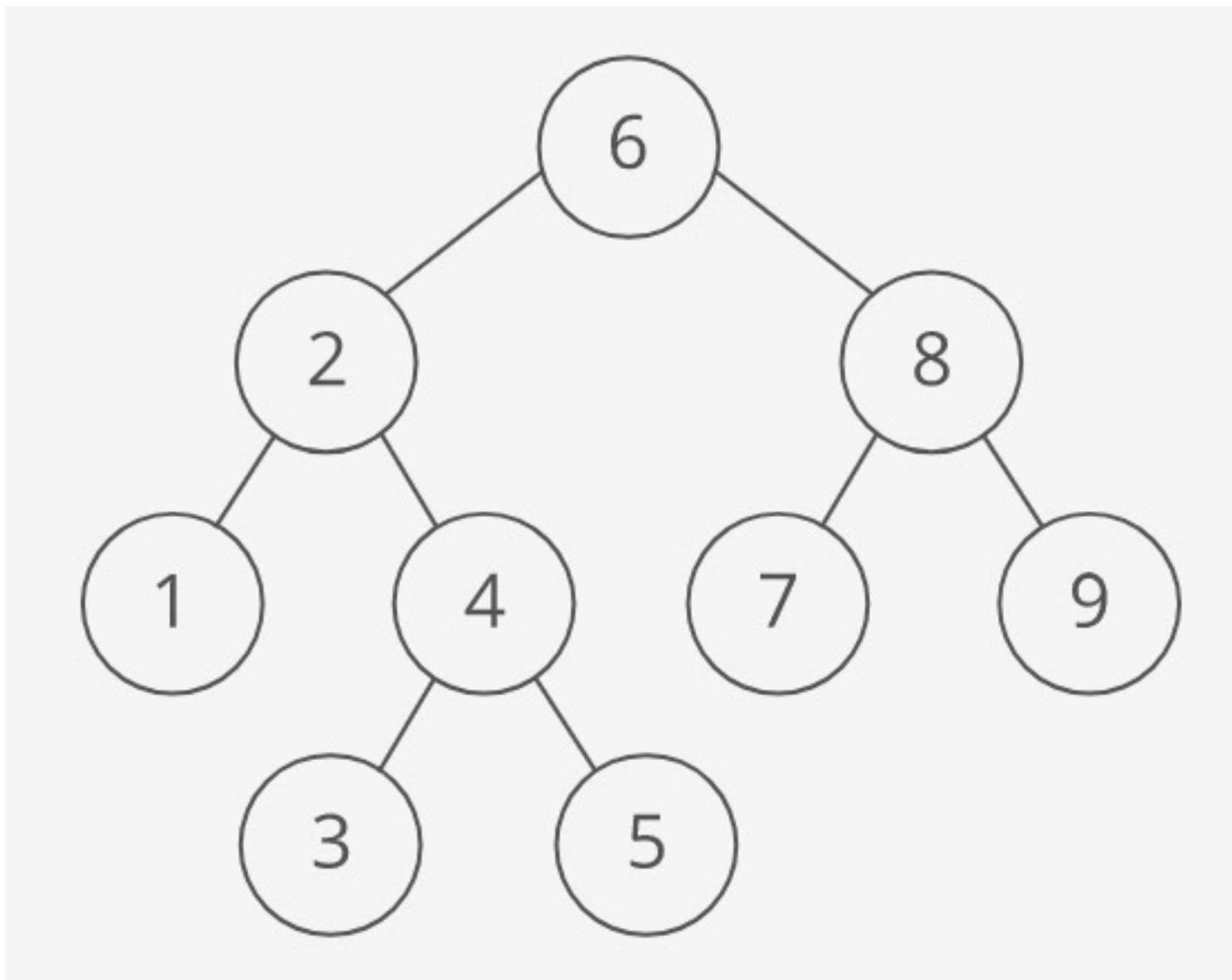
Pre Order Traversal

- Visit the **current node**, then walk the left subtree, and finally walk the right subtree.



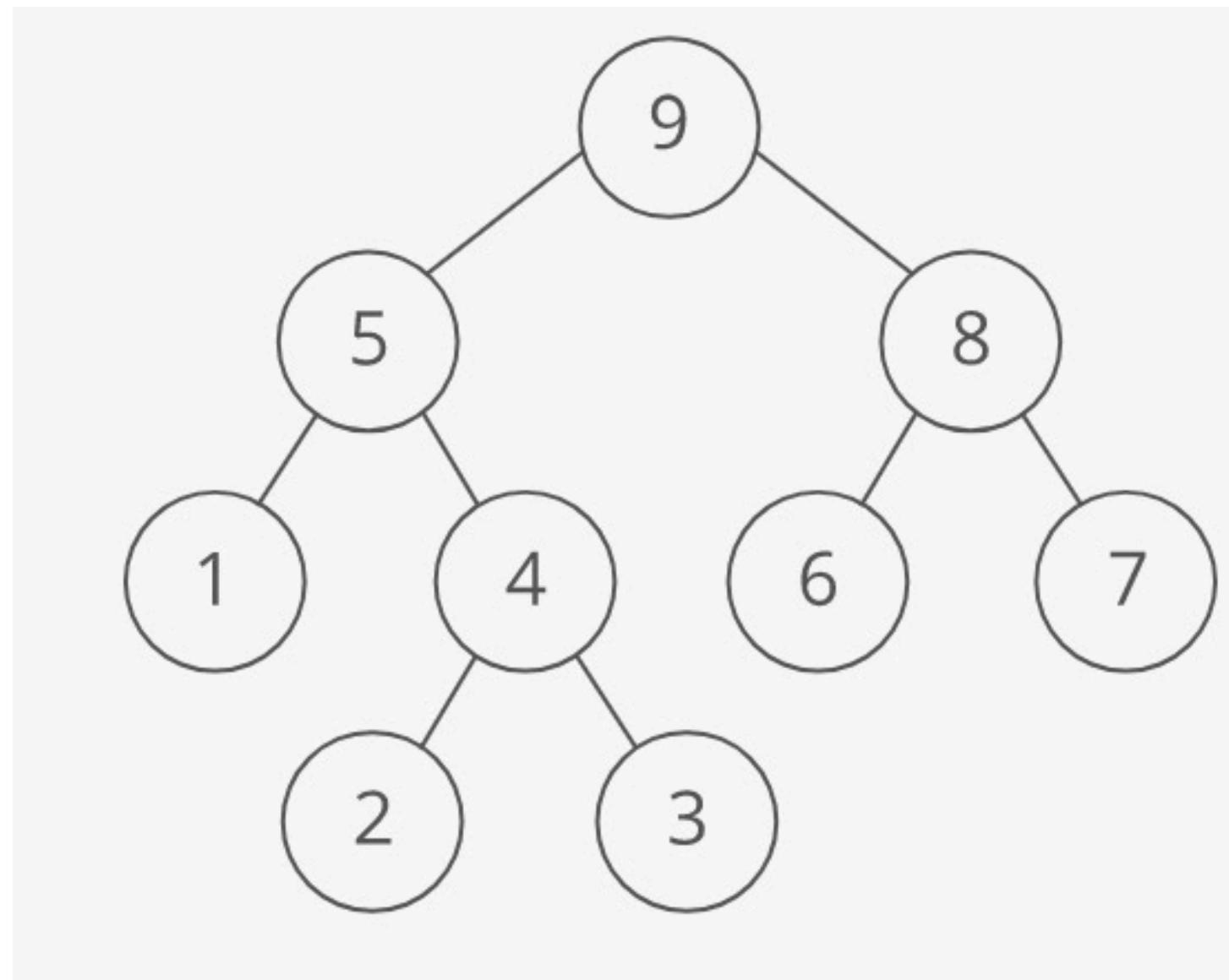
In Order Traversal

- Walk the left subtree first, then **visit the current node**, and finally walk the right subtree



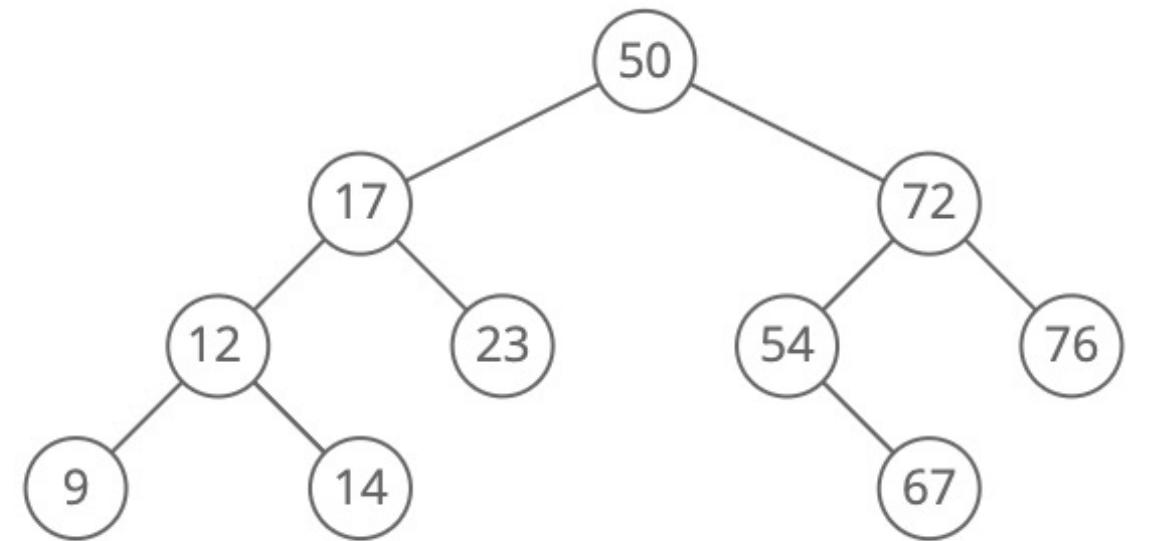
Post Order Traversal

- Walk the left subtree, then the right subtree, and finally **visit the current node**.



Exercise

- Given a tree as:



- Write the traversal of the tree in
 - Pre-order
 - In-order
 - Post-order

Tree Implementation

- It is very natural to implement a tree using the idea of Linked List
 - Depends on how many value a tree node can carry, it might be a list
 - Depends on how many child a tree node can have, it might be:
 - One?
 - Two?
 - More?



Tree Implementation

- Some special trees especially those are complete, might use arrays to implement
 - Balanced BST
 - Min/Max Heap tree
- Recursions are used a lot in building / maintaining trees, we are going to learn later on.



Thank you!