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# **Preorder, Inorder, Postorder — Study Guide**

## **1. Overview**

Depth-First Search (DFS) on a **binary tree** can be done in three classical orders: **Preorder**, **Inorder**, and **Postorder**. These traversals visit every node **exactly once**. The only difference between them is **when** the root (current node) is visited relative to its left and right subtrees.

## 2. Definitions

### Preorder (Root → Left → Right)

* **Rule:** Visit the root first, then the left subtree, then the right subtree.
* **Steps:**
  1. Visit node
  2. Preorder(left)
  3. Preorder(right)
* **Use:** Copying a tree, prefix expressions.

### Inorder (Left → Root → Right)

* **Rule:** Traverse left subtree, then visit root, then traverse right subtree.
* **Steps:**
  1. Inorder(left)
  2. Visit node
  3. Inorder(right)
* **Use:** In a Binary Search Tree (BST), Inorder traversal returns the nodes in **sorted order**.

### Postorder (Left → Right → Root)

* **Rule:** Traverse left subtree, then right subtree, then visit the root.
* **Steps:**
  1. Postorder(left)
  2. Postorder(right)
  3. Visit node
* **Use:** Deleting a tree, postfix expressions.

## 3. Example Tree

A  
 / \  
 B C  
 / \ \  
 D E F

* **Preorder:** A B D E C F
* **Inorder:** D B E A C F
* **Postorder:** D E B F C A

## 4. Why these are DFS

* In all three traversals we go **depth-first**: we follow a branch down (left or right) as far as possible before backtracking.
* The difference is **only the timing of visiting the node** (before, between, or after exploring its children).

## 5. Time & Space Complexity

* **Time complexity:** O(n) for all three.
* **Space complexity (recursive):** O(h) where h is the tree height.

## 6. Comparison Table

| Traversal | Order (visit point) | Use | Example Output |
| --- | --- | --- | --- |
| Preorder | Root first | Copy tree, prefix expressions | A B D E C F |
| Inorder | Root middle | BST → sorted order | D B E A C F |
| Postorder | Root last | Delete tree, postfix expr. | D E B F C A |