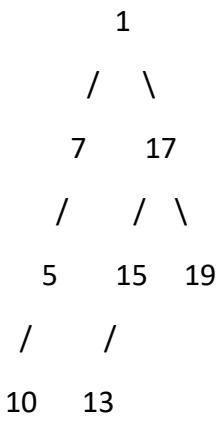
Recover Two Misplaced Nodes of Binary Search Tree

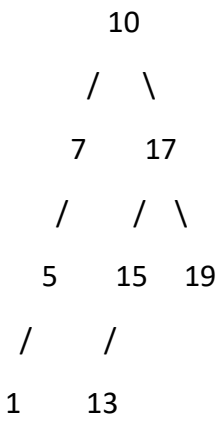
LeetCode

You are given the root of a binary search tree (BST), where the values of **exactly** two nodes of the tree were swapped by mistake. *Recover the tree without changing its structure*.

Example:



Output:



Approach 1: Recover a binary search tree (BST) with two swapped nodes

- **Function Purpose**:
  - The **recoverTree** function recovers a BST with two swapped nodes.
- **Explanation**:
  - It performs an in-order traversal of the BST and stores the values in a vector.
  - The vector is sorted, and the BST is updated with the sorted values.
- **Time Complexity**:
  - **O(N log N), where N is the number of nodes in the BST due to sorting.**

- **Space Complexity:**
    - **O(N), for the vector storing in-order traversal results and call stack space for recursion.**

Approach 2: Recover a binary search tree (BST) with two swapped nodes using an optimized approach

- **Function Purpose**:
    - The **recoverTreeOptimized** function recovers a BST with two swapped nodes using an optimized approach.
- **Explanation**:
    - It uses a helper function **recoverBSTHelper** to identify the misplaced nodes.
    - The function keeps track of the first and last misplaced nodes and then swaps their values.
- **Time Complexity**:
    - **O(N), where N is the number of nodes in the BST, as it traverses all nodes once.**
- **Space Complexity:**
    - **O(H), where H is the height of the BST, for the call stack space.**

Conclusion:

- Approach 2 is more efficient with a lower time complexity, making it the preferred approach.