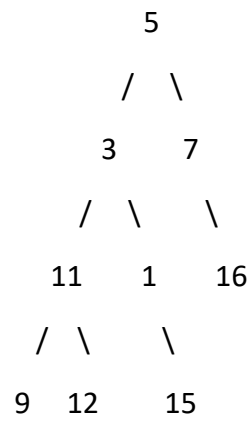
Finding Paths with Target Sum in Binary Tree LeetCode

Given the root of a binary tree and an integer targetSum, return *all **root-to-leaf** paths where the sum of the node values in the path equals* targetSum*. Each path should be returned as a list of the node **values**, not node references*.

A **root-to-leaf** path is a path starting from the root and ending at any leaf node. A **leaf** is a node with no children.

Example 1:



Target Sum = 28

Output: The Paths with Total Sum: 28 = [[5,3,11,9], [5,7,16]]

Approach 1: Function to find all paths in a binary tree that sum up to the target sum using a recursive approach

- The recursive approach explores the tree by recursively traversing both the left and right subtrees.
- At each node, it subtracts the current node's value from the target sum and appends the node's value to a temporary path.
- If it reaches a leaf node and the target sum is 0, it adds the path to the answer.
- The recursion continues until all nodes have been visited.
- The final answer represents all paths with the target sum.

Time Complexity:

- **The time complexity is O(N), where N is the number of nodes in the tree, as each node is visited once.**

Space Complexity:

- **The space complexity is O(H), where H is the height of the tree, due to the recursive call stack.**

Approach 2: Function to find all paths in a binary tree that sum up to the target sum using an iterative approach

- The iterative approach uses a level-order traversal with a queue.
- It starts at the root and explores nodes level by level.
- While processing each node, it maintains the current sum.
- If it reaches a leaf node and the current sum is equal to the target sum, it adds the path to the answer.
- The process continues until all levels have been traversed.
- The final answer represents all paths with the target sum.

Time Complexity:

- **The time complexity is O(N), where N is the number of nodes in the tree, as each node is visited once during traversal.**

Space Complexity:

- **The space complexity is O(N) in the worst case due to the queue storing all nodes at a level.**

Conclusion:

Both the recursive and iterative approaches effectively find all paths in a binary tree that sum up to the target sum. They share the same time complexity of O(N), ensuring efficient traversal of all nodes. However, their space complexities differ.

- The recursive approach has a space complexity of O(H).
- The iterative approach has a space complexity of O(N) due to the queue.

In terms of memory efficiency, the recursive approach is preferable when memory is a concern, as it has a lower space complexity. However, the iterative approach provides a straightforward solution and is suitable for relatively small trees.