Prove that for a full binary tree of height $h$:
- The total number of nodes is $n = 2^h - 1$
- The total number of branches is $2^h - 2$
- The total number of leaves is $2^{h-1}$
- The total number of internal nodes is $2^{h-1} - 1$
- The average search cost for a node is $O(\log n)$

Draw a binary tree with 10 nodes labeled 0, 1, . . . , 9 in such a way that the inorder and postorder traversals of the tree yield the following lists: 9, 3, 1, 0, 4, 2, 7, 6, 8, 5 (inorder) and 9, 1, 4, 0, 3, 6, 7, 5, 8, 2 (postorder).

(a) A full binary tree has a total of 32767 nodes.
- What is the height of the tree?
- What is the number of internal nodes in the tree?
- What is the number of leaves in the tree?
(b) In a football cup match, the defeated team goes out. If the initial number of teams is 128, how many matches will be played to get the final winner of the cup?

Traverse the shown tree in:
- Inorder Traversal
- Preorder Traversal
- Postorder Traversal

Assume binary trees in which the leaf nodes hold integer numbers and the non-leaf nodes hold the binary operations ‘+’, ‘-’, ‘*’, and ‘/’. Provide an algorithm that, when given the root of a tree, evaluates the expression represented by the tree.