CS 2233 : Data Structures : Practice Problems

IIT Hyderabad

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Questions

1. Below, n denotes the total number of nodes and ℓ denotes the number of non-leaf nodes. In a binary tree where every non-leaf node has exactly two children, prove that $2\ell - n = 1$.

2. Given the in-order and post-order traversal sequences of a binary tree T, write an algorithm to reconstruct the tree T.

3. What is the binary tree whose in-order traversal sequence is
   $11, 28, 9, 25, 66, 67, 100, 71, 6, 95, 39, 38, 25$ and post-order traversal sequence is
   $11, 9, 28, 66, 25, 100, 6, 95, 71, 25, 38, 39, 67$?

4. Construct a binary search tree by repeatedly inserting the elements
   $33, 55, 45, 23, 78, 12, 8, 90, 25, 67, 89, 30$ in the given order.

   - Provide an order for the same set of elements such that the BST created has the smallest possible height.
   - Provide an order for the same set of elements such that the BST created has the largest possible height.

5.
   - State the definition of a 2-3-4 tree.
   - Construct a 2-3-4 tree by repeatedly inserting elements $1, 10, 6, 90, 47, 23, 99, 33, 89, 38, 30, 22$ in the given order. Use the simple insertion algorithm (not the one with pre-emptive split). Clearly show the 2-3-4 tree after each insertion.

6. Given that a root of a red-black tree has black height 10, what is the maximum number of elements it can hold? What is the minimum? You can write your answer in mathematical expressions.