

Binary Trees

1. Inorder and Reverse Inorder

In a binary tree, the inorder successor of a node N is defined as the node N' that we encounter immediately after N during an inorder traversal of the tree. (That is, this is exactly the successor we know from the lecture.) Analogously, one can define the inorder *predecessor* function.

- Write pseudocode for the predecessor function.

We have seen code for the inorder traversal of a binary tree in the lecture. We now want to use the successor function to print all nodes that follow a given node.

- Write pseudocode for a recursive procedure `printFollowingNodes (node n)` that prints the argument node and all nodes following it in the inorder traversal. Use the successor function.

Analogously to an inorder traversal, one can traverse in reverse inorder.

- Write a recursive procedure `reverseInorder (tree t)` that takes as input a binary tree and prints the content of the nodes in reverse inorder. Modify the inorder traversal appropriately.

We now to write a second version of inorder traversal, which uses the predecessor function.

- Write a function `last (tree t)` that returns the last node with respect to inorder traversal.
- Write a second procedure `reverseInorder2 (tree t)` that first finds the last node and then consecutively accesses the predecessor.

2. Successor in Binary Trees with Duplicates

Consider a binary search tree that may contain duplicate entries (that is, nodes with the same key values).

- Write a function `nextValueNode (node n)` that returns the first node following the input node that has a strictly greater key value.

3. Tree Height

The height of a tree is the length of the longest path from a leaf to the root.

- Write pseudo code for the function `height (tree t)`.

4. Counting the Nodes

Write pseudo code for the function `count (tree t)` that returns the number of nodes in a tree.

5. Virtual Deletion

We assume now that nodes in our binary trees have a boolean field `deleted`. We implement the function `delete (node n)` by setting `deleted` to `true`.

- Write new functions `inorderTraversal`, `insert`, `minimum`, and `successor` for this new variety of trees.