

ECE-250 – Algorithms and Data Structures (Winter 2012)
Tutorial 4 (2012-02-09)

1 - Given two nodes in a binary tree (the two nodes are assumed to be nodes inside the same tree):

Write a C++ function that determines if one is an ancestor of the other one, and discuss the runtime of such function for the following two cases:

- (a) The definition of the tree includes a member parent.
- (b) Does not include a member parent.

In both cases, the function declaration would be as follows:

```
template <typename Type>
bool ancestor (const Binary_node<Type> * node1, const Binary_node<Type> * node2);
```

2 - Given a general tree, with an implementation similar to the one shown in the course slides, write a function that, given a node, searches the path from the root to that node and returns the smallest value greater than the value in the node.

3 - Write a recursive function that determines whether a given binary tree is a binary search tree. The function declaration would be as follows:

```
template <typename Type>
bool is_bst (const Binary_node<Type> * tree);
```

4 - A *Weight-balanced binary tree* is defined as follows:

- A binary tree with 1 element is a weight-balanced binary tree.
- A binary tree with n elements is a weight-balanced binary tree if the two sub-trees are weight-balanced binary trees and the number of nodes of each differ by at most 1.

Write a recursive function that determines whether a given binary tree is a weight-balanced binary tree. The prototype of the function would be as follows:

```
template <typename Type>
bool balanced (const Binary_node<Type> * tree);
```