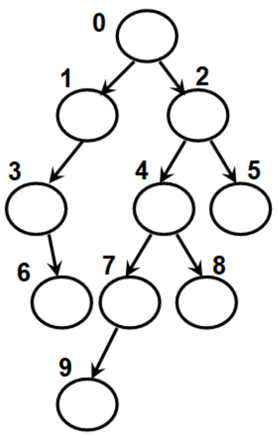
CSC 228 Data Structures and Algorithms
Fall 2017
Instructor: Dr. Natarajan Meghanathan

Project 6: Height-Balanced Binary Trees

Due: October 27, 1 PM

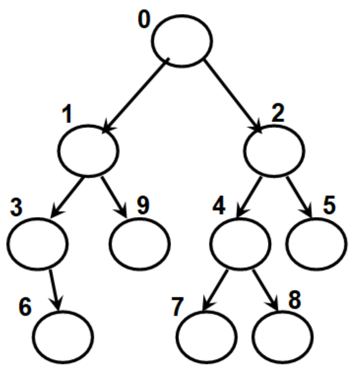
In this project, you will determine whether a binary tree input by the user (in the form of an edge file, as discussed in the slides/class) is height-balanced or not. A binary tree is said to be height-balanced if each internal node (including the root) in the tree is height-balanced. A node is said to be height-balanced if the absolute difference in the heights of its left sub tree and right sub tree is at most 1. The binary tree (a) below is not height-balanced (as nodes 1 and 2 are not balanced), whereas the binary tree (b) below is height-balanced.

Note that the height of a leaf node is 0 and the height of a non-existing tree (or sub tree) is -1.



Node	Height of Left subtree	Height of Right subtree	Abs. Diff.	Height Balanced
0	2	3	1	YES
1	1	-1	2	NO
2	2	0	2	NO
3	-1	0	1	YES
4	1	0	1	YES
7	0	-1	1	YES

(a) A Binary Tree that is "not" Height-Balanced



Node	Height of Left subtree	Height of Right subtree	Abs. Diff.	Height Balanced
0	2	2	0	YES
1	1	0	1	YES
2	1	0	1	YES
3	-1	0	1	YES
4	0	0	0	YES

(b) A Binary Tree that is Height-Balanced

You are given the code for the binary tree implementation discussed in class. You could first find the height of each node in the tree and then test for each internal node: whether the difference in the height of its left child and right child is at most 1. If this property is true for every internal node, then we exit the program by printing the binary tree is indeed height-balanced.

Come up with files for storing the edge information of the two binary trees (a) and (b), and demonstrate the execution of your code to determine whether a tree is height-balanced or not.

Add any member variable (an array) to keep track of the height of the individual nodes in the tree as well as use the information in this array to determine whether the binary tree is height-balanced or not.

Submission (through Canvas as a single word document):
(1) Complete code of the binary tree program, extended to determine if the tree is height-balanced or not.
(2) Screenshot of the outputs when the program is run for the above two binary trees (a) and (b).