

Homework 7

CSCI-SHU 210 Data Structures

John Iacono

Fall 2014

Your task is to code, visualize, and test a new type of balanced binary search tree presented here. It is called *rebuild tree*.

Description of rebuild tree. The basic operation is the *rebuild* operation which takes a node and replaces its subtree with a completely balanced binary search tree. You already did basically the same thing for recitation. For each node you keep two numbers: the current number of nodes in the subtree, and the number of nodes in the subtree at the time it was last rebuilt. As we will be implementing insertion and not deletion, the current size will always be at most the size at last rebuild. You run the rebuild operation whenever the current size is double the size at last rebuild.

What you must do. You need to create code for a `rebuildTree` class. You can either use and extend the binary search tree code from the book, or wrote your own from scratch. I only require that the constructor and insertion work, so if you code it from scratch that is all you need to have working, though you will certainly have a number of other helper functions. You have much flexibility here in how you decide to code it.

You also need to create an interactive viewer that shows the current state of the tree, and allows the user to insert items of their choosing. It should draw not only the data in the node but also the current size and size at last rebuild.

You should also test the code by inserting the numbers $1 \dots N$ in sequential order, for various N , and timing how long the code takes. Plot this. Try to figure out what the asymptotic runtime is, and write up your answer and reasoning behind it.

What is the maximum height of a rebuild tree with N nodes? Write your answer if full detail. Make sure to look at the book's arguments as to why AVL and Red-Black trees have the height they do to understand how to come up with and write such an argument.

1 When and how due

Hand in everything the same way you did for HW1. Due date is Thursday November 13th at 11:55PM. You will go over the HW in personal meetings on Friday the 14th.

2 Help!

Please do not hesitate to contact Ben or John if you have any questions. We are here to help! Next week Ben will be out of town on Monday, and John will be away from Wednesday after class-Sunday, but please feel free to reach out to us electronically with your questions.