1 Introduction & Instructions

This lab is another timing analysis, this time between the global tree balancing algorithm (DSW) and the balance as you go AVL the algorithm.

When you are finished submit all your work through the MyClasses page for this class. Create a directory called Lab06, put each programming exercise into its own subdirectory of this directory, zip the entire Lab06 directory up into the file Lab06.zip, and then submit this zip file to Lab #6.

Make sure that you include a makefile, check the contents of the zip file before uploading it, and that the file was submitted correctly to MyCLasses.

2 Exercise

1. Create a single program that incorporates the following.

   (a) Take the templated AVL tree class from the example code (`AVLTree.h` from the `AVLTrees` directory) and the Red-Black tree class from the example code `RBTree.h` from the `RBTreeEx` directory.

   (b) In the main, create two trees, one AVL and one Red-Black.

   (c) Let the user select:

       i. The number of nodes to insert into the tree (call it n).
       ii. The range of integers values to insert, the interval $[0, m)$.
       iii. The number of insertion/deletion cycles they want to do. In an insertion/deletion cycle, you will insert a random number into the tree, then you will find a different random number and check if it is in the tree and if so delete the value. If the value is not in the tree you will find another random number and so on until you get one in the tree and delete it.

   (d) Set up a timing structure for each that will time,

       i. The insertion of the n random numbers into the AVL tree.
       ii. The insertion of the n random numbers into the Red-Black tree.
       iii. The time on the insertion/deletion cycles for the AVL tree.
       iv. The time on the insertion/deletion cycles for the Red-Black tree.

   (e) Have the program calculate the average IPL for the two trees after the initial insertion of n elements and before the insertion/deletion cycles.

   (f) Have the program calculate the average IPL for the two trees after the insertion/deletion cycles.

   (g) Have the program calculate the ratio of the average IPL values between the initial calculation and the insertion/deletion cycles. Do the after divided by the before.

2. Run the timing/IPL analysis on different tree sizes, different insert/delete cycles and different element sizes to obtain some meaningful data. Compare and contrast the results and draw as many empirical conclusions as you can. What are some pertinent questions you would answer? What does the data imply about the answers to those questions?

3. As usual, write a report summary including your data, graphs, analysis, and conclusions. PDF the document and upload it with your code.