CS 2420-001 Algorithms and Data Structures

Spring Semester, 2014

Assignment 4: AVL Trees

Due Date: Monday, Feb. 24, 2014 (at the beginning of CS 2420 class)

(**Note:** This assignment has only one programming exercise. Please submit **ONLY** your source files to Canvas.)

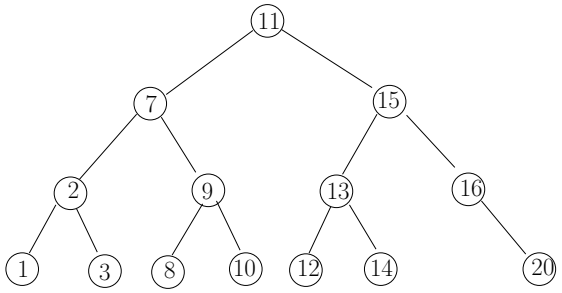
1. In this exercise, we will implement AVL trees we discussed in class. **(60 points)**

   Specifically, after each insert or remove operation, if the tree becomes unbalanced, then we need to perform rotations to re-balance the tree. As discussed in class, comparing with the ordinary binary search trees, we only need to add an additional function *balance*() at the end of the insert and remove functions.

   On Canvas, go to the following directory: homework/hw4/question1. There are a starter cpp file "hw4_Q1.cpp" and an input file "hw4_Q1_input.txt". Each line of the input file is either "insert x" or "remove x". The program reads the input file line by line and perform the operations accordingly. Finally, the program prints both pre-order and in-order traversal lists of the tree to the output file. The program also prints the root and the height of the tree to the output file.

   I have already finished the *insert*() and *remove*() functions and you only need to complete the function *balance*(). In order to do so, you also need to complete the following rotation functions: *rightRotate*(), $leftRotate()$, $doubleLeftRightRotate()$, $doubleRightLeftRotate()$, as we discussed in class. Therefore, you task is to complete the above five functions.

   To help you check whether your program runs correctly, I put a file "Wang_hw4_Q1_output.txt" in the same directory, which contains the correct output. The following figure shows the final tree. For convenience, all above files are also packed in a zip file.



   It might be a good idea for you to first do it "manually" on these operations in the input file one by one, which will help you understand how the rotations work. These operations are similar to the example we used in class (in the slides on Canvas) with a few additional removes and one more insert.

Your program will be graded using a different set of input operations.

Total Points: 60