CSCI 433/502 Algorithms
Homework 3 - Spring 2014

Due: Friday, April 11th at the beginning of class. Grads should do all five questions. Undergrads may omit any one question.

1. Do exercise 6.1 #7. You have an array of \( n \) real numbers and another integer \( s \). Find out whether the array contains two elements whose sum is \( s \). (For example, for the array 5, 9, 1, 3 and \( s=6 \), the answer is yes, but for the same array and \( s=7 \), the answer is no.) Design an algorithm for this problem with a better than quadratic time efficiency.

2. Insert the values 1, 2, 3, 4, 4, 5, 6, 7, 8, 9, 10, 11, 12 into an initially empty AVL tree. Perform rotations as described in the text. Show your work at each step.

3. Do exercise 6.4 #1.
   
   (a) Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by the bottom-up algorithm.
   (b) Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by successive key insertions (top-down algorithm).
   (c) Is it always true that the bottom-up and top-down algorithms yield the same heap for the same input?

4. Do exercise 6.4 #2. Outline an algorithm for checking whether an array \( H[1..n] \) is a heap and determine its time efficiency.

5. Write a recursive function that is given two binary trees, \( T_1 \) and \( T_2 \). The function should return \( True \) if the trees are identical, and \( False \) otherwise. Note that two binary trees are identical if they have the same structure and the same key value at each node.