Data Structures
COMP 2100
Fall 2022

# Lab 6: I Can't See the Forest…

In this lab, you will be modifying the BST.java source implementation of the Binary Search Tree from the textbook website.

## Tasks

1. Add a private method `median()` to the BST that returns a reference to the node in the tree that represents the median key value using this definition:
   a. The median of an empty tree is null
   b. If the number of nodes is odd, then median is the key for which the number of keys smaller and the number of keys larger is equal. For example, the median of [9, 2, 4, 5, 8] is 5.
   c. If the number of nodes is even, then the median is the key for which the number of keys smaller is one less than the number of keys larger. For example, the median of [9, 2, 4, 5] is 4.

2. Add a method `toString()` to the public API of BST that produces a comma separated, ordered list of the keys in the tree, enclosed in square brackets. For example,
   a. If the tree is empty, `toString` should return "[]"
   b. If the tree contains the keys 9, 2, 4, 5, and 8, `toString` should return "[2,4,5,8,9]"

3. Add a private method `distance(key1, key2)` that computes the path distance in the tree between the nodes containing key1 and key2.
   a. If one or both of the keys is not in the tree you should return -1.
   b. The distance between a key and itself is 0
   c. The distance between a parent and a child is 1
   d. And so on…

4. Add a private method `random()` to the BST that returns a reference to a random node in the tree.
   a. An empty tree should return null
   b. All other trees should produce each node with equal probability.

5. Add a static method `balance(BST<Key, Value> t)` to the public API of BST that returns a new tree containing the same key/value pairs as parameter `t`, but that is balanced.

6. Modify the main method in BST to provide a test driver of all your new methods. Make multiple tests on each method that exercise each possible execution path through your code.

Remember that individual work is expected on the lab projects!

**To Submit:** Email your source files as attachments to dstucki@otterbein.edu