CS 61B Lab 11
April 10-11, 2014

Please make sure you have a partner for this lab.

Copy the Lab 11 directory by doing the following, starting from your home directory.

```
cp -r ~cs61b/lab/lab11 .
```

All the code is in the dict package. You can compile it from your lab11 directory with

```
javac -g dict/*.java
```

Some test code is provided and can be run with

```
java dict.BinaryTree
```

Familiarize yourself with the fields and methods of the BinaryTree and BinaryTreeNode classes. BinaryTree is an implementation of the Dictionary interface (which you also used in Homework 6) as a binary search tree. Note that BinaryTree uses Comparable objects as keys (since it is an ordered dictionary), whereas in the Dictionary abstract class, keys are declared as plain Objects. Thus you will occasionally need to cast Objects to Comparables.

Part I: Finding an Element in a Binary Search Tree (2 points)

Complete the implementation of the find() method in dict/BinaryTree.java by filling in the body of findHelper(). find() takes a key as its single parameter, and returns an element associated with that key, or null if there is none. (If there are several elements associated with a key, it doesn't matter which one is returned.) findHelper() helps by recursively finding and returning a node that contains the key (or null if no such node exists).

Take a look at insertHelper() for inspiration. find() should run in O(d) time on a tree with depth d.

Part II: Removing an Element with a Given Key (2 points)

Fill in the body of remove() method in BinaryTree.java. remove() takes a key as its single parameter, and removes one item having that key if the tree contains one. (If there are several elements associated with a key, it doesn't matter which one is removed and returned.) remove() returns the same value that find() returns, but should not call find(). However, remove() SHOULD use the findHelper() method you wrote for Part I.

remove() should run in O(d) time if the depth of the tree is d.

Check-off

Show your TA or Lab Assistant the code you have written, and run the test program. You'll receive points for each part that runs correctly.

2 points: If find() works correctly.
1 point: If remove() works for nodes that have no child or one child.
1 point: If remove() works for nodes that have two children.