**Overview:**

* Work in the file BinarySearchTree.java found in the **Exam2** Eclipse project downloaded from Moodle
* When finished, upload BinarySearchTree.java to the CSSE230 Moodle site, the *Exam 2 – Computer Part* assignment
* *Reference*: The two trees below are used in some of the JUnit test cases (see Testing.java)

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| **Fruit Tree Example** | **ABC Tree Example** |

* To simplify this exam, the BST used in BinarySearchTree.java is a BST of String
* You are required to use recursion in your implementation. There are three methods for class **BinarySearchTree**. For each of these you are permitted to write recursive helper operations which can reside in either the **BinarySearchTree** class or in the **BinaryNode** class.
* You may add methods to the BinaryNode class, but not add/remove/change any of its fields

**Performance Requirements:**

* If the operation to be implemented is a BST “traversal” operation, then it must run in O(N) time and traverse the tree no more than one time, where N = number of nodes in the tree
* If it is a “navigation” operation, it must run in O(Height(T)) time and navigate to its destination no more than once

**The Required Operations:**

1. (16 points) – Implement int countNodesWithOddLengthLabels() whose job is to count and return the number of nodes in the tree that have a label (i.e., the String stored as data in the node) whose length is an odd number.
   * For the *Fruit Tree* example, the answer should be 4 (by counting “Apple”, “Guava”, “Mango”, and “Peach”)
   * For the *ABC Tree*, it should be 12.
2. (20 points) – Implement **void** deleteNodesWithOneChild() whose job is to remove all nodes from the BST that have only one child. The resulting tree must be a BST containing all the nodes from the original tree that had either zero or two children.
   * For the *Fruit Tree* example, the nodes labeled with “Guava”, and “Peach” should be removed.
3. (20 points) – Implement ArrayList<String> getDirectionsToItem(String x) whose job is to return an ArrayList of String containing navigation directions to the value passed in as a parameter to ‘x’.
   * For the *ABC Tree*, and “D” as the parameter, the result should be:  
     [left at H, right at B, left at G, D found]
   * For the For the *Fruit Tree*, and “Asian Pear” as the parameter, the result should be:  
     [left at Kiwi, left at Banana, right at Apple, Asian Pear not found]

**Testing:**

* Utilize the JUnit tests provided in the file Testing.java