CS 1410 Introduction to Computer Science – CS2
Section 1: MWF 9:30 a.m. – 10:20 a.m.
Instructor: Xiaojun Qi
Programming Assignment #13

Given: Saturday, April 20, 2013
Due: 11:59 p.m. Saturday, April 27, 2013
Total Points: 50 points

You are required to develop a spell checker using a binary search tree, which makes the performance of testing each word in a document to be very fast. You are supplied with a dictionary of about 14,000 words, which are saved in a file "**dictionary.txt**" in alphabetic order.

You must create a binary search tree, which contains the following public methods:

- **[5 points] Copy Constructor**
- **[5 points] Destructor**
- **[3 points] Insert**: Insert a string into the binary search tree.
- **[3 points] Find**: Return true if the string is found in the tree. Return false otherwise.
- **[5 points] Size**: Return a count of the number of nodes in the tree.
- **[5 points] Height**: Return the height of the tree, which is defined as the length of the path from the root to the deepest node in the tree (i.e., the maximum distance from all leaf nodes to the root).
- **[7 points] Traverse:** Traverse the tree using the **breadth-first search strategy**. That is, it begins at the root node and explores all the neighboring nodes (e.g., the two children nodes). For each of those neighboring nodes, it explores their unexplored neighboring nodes (e.g., the two children nodes), and so on, until all nodes are traversed.

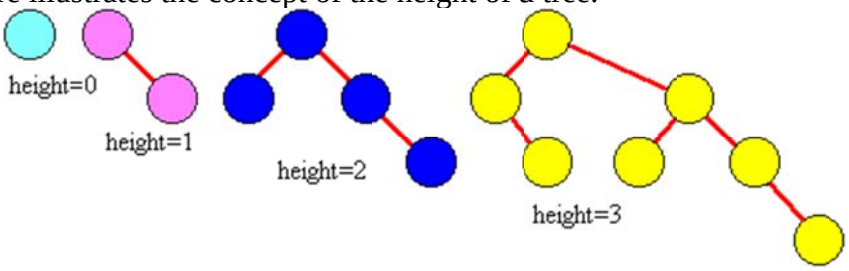
Write a driver program to do the following tasks:

1. **[7 points]** Read the file "**dictionary.txt**", where each word is on a separate line, and store these words into a binary search tree. **After reading the dictionary into the tree, have your program report the size of the tree (i.e., the number of nodes) and the height of the tree.** Since the dictionary is in the alphabetic order, you cannot sequentially read in each word and insert these words in the tree (i.e., it will essentially be a linked list if doing so). **In other words, you must insert words in a random order to make a tree that can be efficiently searched.**
   Hint: One suggestion is to read the dictionary words into a `vector<string>` and then use the member function `random_shuffle` of the vector library to accomplish the goal. Refer to Section 16.5 (Introduction to the standard template library) for detailed explanation on the member functions (pages 1006 through 1009).
2. **[7 points]** Read the file "**letter.txt**" and output to the console all the misspelled words (i.e., any word not found in the dictionary). Keep in mind the grader will use a different file when doing the grading. You'll need to remove any punctuation characters from the words in the "**letter.txt**" file, the following eight characters should be sufficient: **" , : . ! ? ( )**
   Hint: One suggestion is to read the word into a string and then use the member functions of the string class to remove any of the eight characters. Finally, convert the word into all small letters

before searching the word in the binary search tree. Refer to pages 809 and 810 for detailed explanation on the string class member functions.

3. **[3 points]** Demonstrate the correctness of all the public member functions.

The following figure illustrates the concept of the height of a tree.



The traverse result using the breadth-first search strategy for the following tree is: a b c d e f g h