Assignment

Course: Data Structure

Submission Deadline: 05/08/2021

1) One hundred integer elements are chosen at random and inserted into a sorted linked list and a binary search tree. Describe the efficiency of searching for an element in each structure, in terms of Big-O notation.

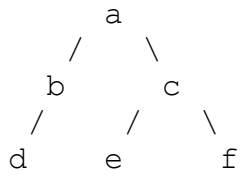
2) Consider the following situation:

   "Your friend is making a text editor for programmers. He is currently working on a feature that will find errors in the usage of different types of brackets. Code can contain any brackets from the set []{}(), where the opening brackets are [,{, and (and the closing brackets corresponding to them are],}, and).
   For convenience, the text editor should not only inform the user that there is an error in the usage of brackets, but also point to the exact place in the code with the problematic bracket. Apart from the brackets, code can contain big and small latin letters, digits and punctuation marks."

   Sample input:
   foo(bar[i);
   Sample output:
   10
   Explanation:) doesn't match [, so) is the first unmatched closing bracket, so we output its position, which is 10.

   Which data structure can be used to check for balanced parentheses for the above-mentioned situation? Justify your answer and write down the algorithm (not the code) to check for balanced parentheses.

3) It is often handy to store a binary tree in a file. Assume each node in the binary tree contains a character string. Assume also that all operations you need on strings are provided. For example, you do not need to design algorithms to test if a string equals ".", to write a string into a file, or to read a string from a file. To create the file in preorder file format do a preorder traversal of the tree, when a node is visited put the character string in the file followed by a newline and when a null is visited put a dot, ".", followed by a newline. For example, the tree



   is stored as the file "a b d . . . c e . . f . ." where spaces indicate newlines.

a. Design an algorithm which outputs the preorder file format of a binary tree given a pointer to the root of a binary tree. Assume the binary tree has nodes with fields "data", "left_child", and "right_child".
b. Design an algorithm which takes a preorder file format of a binary tree and produces the binary tree. Hint: an effective approach is to design a recursive function that processes a sequence of lines in a file and returns a binary tree.