CS 721: Advanced Algorithms & Analysis

Programming assignment, Fall 2018, Total 100 points

Assigned on: Wednesday, 10/31/2018
Due on: Thursday, 11/29/2018

1. (20 points) In a programming language of your choice, develop an interactive program to dynamically manage a binary search tree of integer key values. The tree is initially empty. Your program should repeatedly prompt its user for options where each option will corresponds to certain functionality as describe below:

   (a) `Option 1`: This option is for inserting a new node. When the user chooses this option, the program should ask for the key value v of the new node to be inserted and insert this node to the existing tree. Your program should display depth of this newly inserted node, where depth is measured from the root node, i.e., depth of root node is 0 and so on.

   (b) `Option 2`: This option is for deleting a node. When the user chooses this option, the program should ask for the key value v of the node to be deleted and delete this node from the existing tree. If this key value v is not present in the tree, it should print out `deletion unsuccessful`. If for some reason there are multiple occurrences of this key value v present in the tree, your program should delete the first occurrence of the key value v. Your program should display depth of this deleted node, where depth is measured from the root node, i.e., depth of root node is 0 and so on.

   (c) `Option 3`: This option is for searching the occurrence of a key value in the existing tree. When the user chooses this option, the program should ask for the key value v to be searched within the existing tree. If this key value v is not present in the tree, it should print out `key not found`. Otherwise, it should print out `key found`. When the key is present, you program should display depth of the node with key value v, where depth is measured from the root node, i.e., depth of root node is 0 and so on.

   (d) `Option 4`: This option is for minimum key value in the existing tree. When the user chooses this option, the program should printout the minimum key value and the depth of the node whose key value is minimum. For empty tree, it should printout that the `tree is empty`.

   (e) `Option 5`: This option is for maximum key value in the existing tree. When the user chooses this option, the program should printout the maximum key value and the depth of the node whose key value is maximum. For empty tree, it should printout that the `tree is empty`.

   (f) `Option 6`: This option is for finding successor of a node in a binary search tree. When the user chooses this option, the program should ask for the key value v of the node for which successor is to be found. Your program should printout the key value of the successor node and its depth.

   (g) `Option 7`: This option is for finding predecessor of a node in a binary search tree. When the user chooses this option, the program should ask for the key value v of the node for which predecessor is to be found. Your program should printout the key value of the predecessor node and its depth.

   (h) `Option 8`: When user chooses this option, your program should print out, preorder, inorder and postorder traversal of the existing binary search tree in separate lines.

(i) `Option 9`: When this option is chosen your program should delete all nodes of the existing binary search tree so that it becomes an empty tree.

(j) tt Option 0: When this option is chosen your program should exit from the interactive session.

Submision:

- Please provide a README file that will describe how to compile/run your code. Submit your source code file(s) and README file as a single zip file and name it Programming_MyWSU.zip (replace MyWSU by your MyWSU ID).
- **This programming assignment is due at 11:59 pm on the due date.**