CSC 325: Algorithms & Advanced Data Structures Fall 2020, MSU

**Homework 8**

(Week 14)

(10 points)

**Due: 12/2 (5 minutes before the class starts)**

* **Problem:**

Write a well-documented C++ program to implement the following operations on a Red-Black tree **with the version** of the algorithm given in the textbook (**a correction**: p 316, line 1 should read as “***while*** *(z ≠ T.root and z.p.color=RED)*”). Assume that all keys in the RBT are unique signed integers.

***RBT\_Output****(RBTree)*: Display the Red-Black tree *RBTree* rotated counter-clockwise 90 degrees (*i.e.*, the same orientation used in *Homework 7* for the binary search trees). You may use ‘B’/‘R’ to indicate the color of a node. Again, if no edge is displayed for a tree, then, the output must **clearly** indicate each node being which node’s which child. Also, if a tree is empty, an appropriate message should be displayed to indicate so.

***RBT\_Search****(RBTree, key)*: If integer *key* is in the Red-Black tree *RBTree*, display a message indicating it is in which child of which node (For example, 3 is in the left child of node 5. If *key* is in the root, indicate so.); otherwise, display a failed-search message with the value of the *key*.

***RBT\_Insert****(RBTree, key)*: If integer *key* is not already in the Red-Black tree *RBTree*, insert a node containing *key* into *RBTree* and display the altered Red-Black tree; otherwise, display an appropriate message and ignore the request.

***RBT\_Delete****(RBTree, key)*: If integer *key* is in the Red-Black tree *RBTree*, delete the node containing *key* and display the altered Red-Black tree; otherwise, display an appropriate message and ignore the request.

When the program starts, it should display a list of all operations above with a “quit” option. Initially, the red-black tree is an empty tree. A user should be able to repeatedly select an operation and enter a needed parameter. The program terminates when a user chooses the “quit” option.

* **What to turn in:**

Submit your file(s) for this assignment on *Blackboard*.