CSCE 350: Data Structures and Algorithms

Homework – 4

- Write a C++ program to implement a Binary Search Tree and perform some operations on the Binary Search Tree.

Instructions:

Part-A: (80 points) Your program must perform the following tasks:

1. Be able to store user provided values(integers) as nodes within the Binary Search Tree(BST)
2. Perform insert, search and delete operations on the BST
    - Insertion: Allow the user to provide integer values using the console
        - The first value provided by the user becomes the root node
        - The user can insert any number of nodes into the BST
        - Be able to handle duplicate nodes.
    - Search: Allow the user to search for a node within the binary search tree
        - If the search key is found, return all the nodes visited (path traversed) to reach the search key.
        - If search key is not found, return the path traversed to find the search key and indicate search was unsuccessful.
    - Deletion: Allow the user to delete nodes from the binary search tree
        - Delete node with no children
        - Delete node with 1 child
        - Delete node with 2 children
3. Find and display the BST node with the smallest value
4. Find and display the BST node with the largest value
5. At the end of each operation, display the nodes of the current BST [See Test cases]
6. File Name: BinarySearchTree_YourLastName_YourFirstName.cpp
7. You may compile your C++ program using the following command:

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```
g++ -Wall -std=c++11 <filename>
```

Part-B: (20 points) In a text file, provide answers for the following questions:

1. How did you organize your code to implement all the required tasks? Describe in detail the task of each segment/function in your program?
2. What challenges did you encounter while completing this program? How did you resolve these challenges?
3. Any compilation instructions, if applicable

Test Cases:

Inserting nodes into the BST in the following order: 5, 3, 1, 4, 7, 8

BST nodes are: 1, 3, 4, 5, 7, 8

Test Case01:

Delete node 4

Node 4 has been deleted

BST nodes are: 1, 3, 5, 7, 8

Test Case02:

Insert node 2

Node 2 has been inserted

BST nodes are: 1, 2, 3, 5, 7, 8

Test Case04:

Insert node 7

Node 7 is a duplicate node. Cannot insert Node 7 again

BST nodes are: 1, 2, 3, 5, 7, 8

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Test Case05:

Insert node 6

Node 6 has been inserted

BST nodes are: 1, 2, 3, 5, 6, 7, 8

Test Case06:

Delete node 7

Node 7 has been deleted

BST nodes are: 1, 2, 3, 5, 6, 8

Test Case07:

BST node with the smallest value

Node 1

BST nodes are: 1, 2, 3, 5, 6, 8

Test Case08:

Search for node 9

5 → 8 → 6 → search key not found

BST nodes are: 1, 2, 3, 5, 6, 8

Submission:

- Make sure to test your code on the departmental Linux machines prior to submission.
- Any program submission that does not compile will automatically receive a grade of zero.
- Your solution will contain 2 files:
  - 1 C++ source file and
  - 1 text file
- Upload your solution on Blackboard