

COMP 2119A Introduction to Data Structures and Algorithms  
Programming Assignment  
Due Date: 30 November 2016 12:00midnight

Assignment box: A3 (for this assignment, use moodle to submit your work)

Programming Exercise.

Implement the AVL tree. Each node should have the following fields: left, right, parent, and the data (consists of a key which is a positive integer and a string). Initially, the tree is a null tree. Then, the program reads an input file, `input.txt`. Each line in the file refers to one of the following operations:

**0**

(Output the nodes of the tree using an inorder traversal with each node in one line, for each node, list the key and data string separated by “,”. If it is a null tree, print “-1” in the first line. You should have a function `inorder(T)` in your program where `T` points to the root of the tree and print the nodes in the inorder traversal.)

**1 key string**

(1 refers to the insert operation – you should have a function `Insert(data e)` in your program where the function tries to insert the new data item `e` into the AVL tree).

**2 key**

(2 refers to the delete operation – You should have a function `Delete(key k)` in your program where the function tries to delete the data `e` with key `k` from the AVL tree).

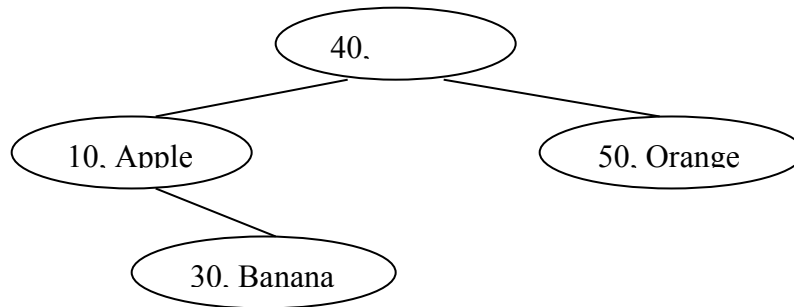
**3 key**

(3 refers to the search operation – You should have a function `Search(key k)` in your program where the function will locate the data `e` with key `k` from the AVL tree and reports the key together with the corresponding string of the data item.)

Here is an example input file.

```
1    10    Apple
1    50    Orange
1    40    Mango
1    30    Banana
0
```

Then, conceptually the following AVL tree should be created:



The following should be the output of the program, stored it in a file called `output.txt`.

10, Apple  
30, Banana  
40, Mango  
50, Orange

Here is another example input file.

```
0
1    10    Apple
1    50    Orange
0
2    10
1    30    Banana
3    50
1    40    Mango
0
```

The corresponding output should be:

```
-1
10, Apple
50, Orange
50, Orange
30, Banana
40, Mango
50, Orange
```

You can assume that there is no error in the input file, that is, for the delete and search operations, the data with the input key must exist in the tree; for the insert operation, there will not be a data item with the same key already in the tree.

Hand in the followings:

- The source code of your program and the executable.

How to hand in?

- Use Moodle to hand in both the source and the executable (state clearly the environment for your executable).

Note: if you do NOT have enough to complete the whole assignment, try to ignore the “Delete” operation, you will get at most 4 (out of 7) marks.