

**CS 531: Computer Systems and  
Fundamentals of Systems Programming  
Instructor: Hal Greenwald  
Homework 3 with Rubric**

Homework # 3 builds upon Homework # 2. Recall that in HW#2, our program reads the contents of datafile "CS531\_Inet.txt". Each line in "CS531\_Inet.txt" contains an IPv4 address and alias pair as shown below:

```
111.22.3.44 platte
131.250.95.21 jet
172.66.7.88 wabash
111.22.5.66 green
131.250.47.63 baker
```

As with HW#2, for this assignment, you will create your own test data files using the sample format. Grading will involve using different data files with the same format.

In HW#2, you were asked to construct a linked list of *address\_t* structures, each of which contained the four integers of an IPv4 address along with a fifth component in which to store an associated alias of up to 10 characters. In this project, you will replace the linked list with a **Binary Search Tree** (BST).

Again, you will create a structure type called **address\_t** similar to that used in HW#2, with the following modifications needed to convert the linked list to a BST.

```
struct address_t
{
    int octet[4];
    char alias[11];
    struct address_t *leftChild, *rightChild, *parent;
    int height, depth;
}
struct address_t *head = NULL;
```

As CS531\_Inet.txt is being read in, the data will be stored in the BST composed of *address\_t* structures containing the address/alias pairs read in from the file.

Once the BST has been created, the user will receive the following menu options (the same menu as in HW2).

- 1) Add address
- 2) Look up address
- 3) Update address
- 4) Delete address
- 5) Display list
- 6) Display aliases for location
- 7) Save to file
- 8) Quit

### **Program Structure and Design**

- displayList(), displayAliasesForLocation(), and saveFile() shall be based on **Inorder Traversal**.
- displayList() will display the alias, address, height, depth, and parent's alias for each node.
- deleteAddress(), lookUpAddress(), and displayAliasesForLocation() will display an error message if the alias (or location) entered is not listed. Following the error message, the menu will be redisplayed.
- A separate UDF will be defined for each menu option.
- No duplicate aliases or address are allowed. If attempted, display an appropriate error message followed by the menu.
- For this exercise, all aliases will be entered in lower case.

### **Rubric (10 points)**

- Is the source code well documented and formatted using clearly readable indentation and white space (while viewed within **vi**)? **1 point**
- Is the BST and associated recursion properly implemented? **2 points**
- displayList() must display the correct alias, address, height, depth, and parent's alias for each node in order to receive credit. **2 points**
- Does each menu option map to its own UDF, and is each UDF properly implemented? **5 points**
- 1 global variable may be used. Each additional global variable will cost **1 point**
- **Note:** Your program must compile using gcc/unix in order to receive credit.

Based on the sample data discussed above, an example run of the program may look like:

- 1) Add address
- 2) Look up address
- 3) Update address
- 4) Delete address
- 5) Display list
- 6) Display aliases for location
- 7) Save to file
- 8) Quit

Enter menu option: 5

<b>baker</b>	<b>131.250.47.63</b>	<b>height:0</b>	<b>depth:3</b>	<b>parent:green</b>
<b>green</b>	<b>111.22.5.66</b>	<b>height:1</b>	<b>depth:2</b>	<b>parent:jet</b>
<b>jet</b>	<b>131.250.95.21</b>	<b>height:2</b>	<b>depth:1</b>	<b>parent:platte</b>
<b>platte</b>	<b>111.22.3.44</b>	<b>height:3</b>	<b>depth:0</b>	<b>parent: NONE</b>
<b>wabash</b>	<b>172.66.7.88</b>	<b>height:0</b>	<b>depth:1</b>	<b>parent:platte</b>

(note that option 5 displays the list in alphabetical order, due to the inorder traversal)

Enter menu option: 6

Enter Locality: **131.250**

**Location: 131.250**  
**baker**  
**jet**

Enter menu option: 2

Enter alias: **platte**

**platte: 111.22.3.44**

Enter menu option: 1

**Enter IPv4 address: 131.250.42.18**

**Enter alias: barbara**

Enter menu option: 5

baker	131.250.47.63	height:1	depth:3	parent:green
barbara	131.250.42.18	height:0	depth:4	parent:baker
green	111.22.5.66	height:2	depth:2	parent:jet
jet	131.250.95.21	height:3	depth:1	parent:platte
platte	111.22.3.44	height:4	depth:0	parent: NONE
wabash	172.66.7.88	height:0	depth:1	parent:platte

Enter menu option: 6

Enter Locality: 131.250

Location: 131.250

baker  
barbara  
jet

Enter menu option: 8

**Goodbye!**