MIDDLE EAST TECHNICAL UNIVERSITY, NORTHERN CYPRUS CAMPUS
CNG213 Data Structures – Programming Assignment 3

Date handed out: **15 December 2023, Friday**
Date submission due: **29 December 2023, Friday 23:00**

Fishdom Analysis

This assignment aims to help you practice binary search tree ADT, in particular AVL Tree. You will write a program that can be used to analyze the collected fish data. You will use this application to index the fish.

Requirements:
In this assignment, you are given a list of fishes in an external text file called "fishes.txt". In this text file, you can find several fishes.

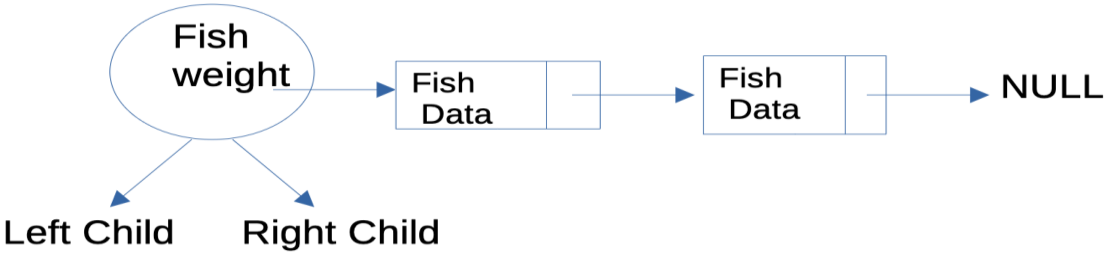
This file includes the following information:

Name: the name of the fish
Weight: weight of the fish in grams
Length: length of the fish in cm
Date: the fishing date
City: the fishing city

And sample data is as follows where each part is separated by a "," character:

```
Name,Weight,Date,City
Beam,242,23.2,02/02/2022,city1
Whitefish,270,23.6,22/02/2022,city2
Roach,40,12.9,15/09/2022,city3
Parkki,300,26.0,15/09/2022,city4
Whitefish,270,24.1,15/09/2022;city3
Parkki,300,26.5,18/09/2022,city5
```

Your task here is to process this file and generate an AVL tree based on the **weight**. If there is more than one fish with the same **weight**, they should then be stored together in the same node as shown below.



Based on this data representation, you need to write a program that provides the following functionalities to the user:

1. **Display the full index:** This will display the full AVL tree constructed. For traversal, you need to display the fishes sorted in ascending order based on their weight.
2. **The fish with the maximum weight:** This will display the details (Name, Weight, Length, Date, City) of the fish(es) that has the maximum weight.
3. **The fish with the maximum length:** This will display the details (Name, Weight, Length, Date, City) of the fish(es) that has the maximum lenght.

Programming Requirements:

You will start by taking the file name as a command line argument and then you will need to implement at least the following functions:

- **`readData()`:** This function will mainly process the external file. As an input, it will take the file name and it will return an AVL tree.
- **`insertFish()`:** This function will take an AVL tree and the details of the fish, and then it will insert the fish into the AVL tree. The fish will be interested in the tree based on its weight. You cannot make assumptions about the number of fish that have the same weight. Therefore, if the node with the given weight exists then you will add your fish details to that node.
- **`displayIndex()`:** This function will mainly take an AVL tree and display the data in the tree in ascending order according to the weight of the fish.
- **`heaviestFish()`:** This function will mainly take an AVL tree, and will find and display the details of the fishes which has the maximum weight. In the comment part of this function, discuss the complexity of this function based on your current representation of data. You also need to discuss if there is a way you could improve this.
- **`longestFish()`:** This function will mainly take an AVL tree and will find and display the fish which has the maximum length. In the comment part of this function, discuss the complexity of this function based on your current representation of data. You also need to discuss if there is a way you could improve this.

Please note that in this assignment, you can make use of the functions in the **string.h** library and similar external libraries. You cannot assume about the number of fish in this external file.

Submission Requirements:
In this assignment, you need to have a header file (avltree.h) that includes the major functionality of the AVL Tree ADT. If you will use other ADTs, you need to create a separate header file for each of them. You also need to have a C source file (FishdomAnalysis.c) that includes the main function and other functions. You need to put all these files into the "cng213a3" folder and then submit the compressed version of the folder to ODTU-CLASS. If you do not follow this structure, you will lose %10 of the overall grade.

Programming Style Tips!
Please follow the modular programming approach. In C programming, we use functions referred to as modules to perform specific tasks that are determined/guided by the solution. Remember the following tips!
• Modules can be written and tested separately!
• Modules can be reused!
• Large projects can be developed in parallel by using modules!
• Modules can reduce the length of the program!
• Modules can also make your code more readable!

Important Notes:

- Remember to have a good programming style (Appropriate comments, variable names, formulation of selection statements and loops, reusability, extensibility, etc.). Each of the items above will include 10% for good programming style.
- Read rules regarding assignments from the Syllabus carefully.
- If your code does not compile due to syntax errors, you will automatically get zero.
- If your code includes global variables, you will automatically get zero.

Grading:
Your program will be graded as follows:

Grading Point Mark	**(out of 100)**
AVL Tree Data Structure	5
Processing data file (**readData()**)	15
Inserting/Updating a node in the tree (**insertFish()**)	25
Displaying the index (**displayIndex()**)	10
Displaying the details of the fishes which have the maximum weight (**heaviestFish()**(complexity discussion – 2pts)	15
Displaying the details of the fishes which have the maximum lenght (**longestFish()**)(complexity discussion – 2pts)	15
The main function	15

Sample run:
You can find the sample run of the program for the entries in the above text file.

```
********Welcome to Fishdom Analysis********
*******************************************
Menu
1. Display the full index of fishdom
2. Display the heaviest fishes
3. Display the longest fishes
4. Exit
*******************************************
Enter your option: 1
```

```
Roach,40,12.9,15/09/2022,city3
Beam,242,23.2,02/02/2022,city1
Whitefish,270,23.6,22/02/2022,city2
Whitefish,270,24.1,15/09/2022;city3
Parkki,300,26.0,16/09/2022,city4
Parkki,300,26.5,18/09/2022,city5

*******************************************
Menu
1. Display the full index of fishdom
2. Display the heaviest fishes
3. Display the longest fishes
4. Exit
*******************************************
Enter your option: 2

Parkki,300,26.0,16/09/2022,city4
Parkki,300,26.5,18/09/2022,city5

*******************************************
Menu
1. Display the full index of fishdom
2. Display the heaviest fishes
3. Display the longest fishes
4. Exit
*******************************************
Enter your option: 3

Parkki,300,26.5,18/09/2022,city5

*******************************************
Menu
1. Display the full index of fishdom
2. Display the heaviest fishes
3. Display the longest fishes
4. Exit
*******************************************
Enter your option: 4

Bye!
```