Date handed out: 03 November 2023, Friday
Date submission due: 17 Novemebr 2023, Friday 23:00

Fishdom: App for aquaculture management

This assignment aims to help you practice linked list data structure and basic linked list operations. Your main task in this assignment is to write a C program to create a simple application that will allow you to help researchers to trace marine life, mainly fish.

When you start the application, it will read fish data from an external text file (fishingArchive.txt), create a linked list, and then populate this list with the data stored in that file. This application will then provide some operations for you to manage the fishing archive. When you exit from the application, the application will overwrite the external file with the latest version of the list to include the latest fishing in your application. Therefore, the Fishdom application needs to support the following operations.

- **Reading your fish data from an external file and initializing your fishing lists:** The application will start by reading the fish data from an external text file called fishingArchive.txt. The fishingArchive.txt file will include the details of the fish that you have, including species, weight of the fish in grams, vertical length in CM, diagonal length in CM, cross length in CM, height in CM, fish length in CM, fishing date, and city separated by a semicolon. An example file (fishingArchive.txt) is shown below that contains a couple of rows:

  Bream;242; 23.2; 25.4;30;11.52;4.02; 22/02/2022;city1
  Whitefish;270;23.6;26;28.7;8.3804;4.2476;22/02/2022;city2
  Whitefish;270;24.1;26.5;29.3;8.1454;4.2485;15/09/2022;city3
  Roach;40;12.9;14.1;16.2;4.1472;2.268; 15/09/2022;city4
  Parkki;300;24;26;29;11.368;4.234; 15/09/2022;city5

To represent the data in your file. First, create a linked list to store the fish species (species list). The data in the file is ordered one species after the other, for example, Bream, Whitefish (all the fish from the whitefish species, here we have 2), Roach, Parkki ... etc. Second, you need to create another linked list (fish data list) where each node stores information about a particular fish data within the species. An illustration can be found in figure 1 for the data snap presented below.

Please note that you cannot make any assumptions about the number of species you have in your list and there is no upper limit for the number of fish we get in each fishing journey. In your internal representation, you will need to decide about the structure of your linked list based on the text file given above.

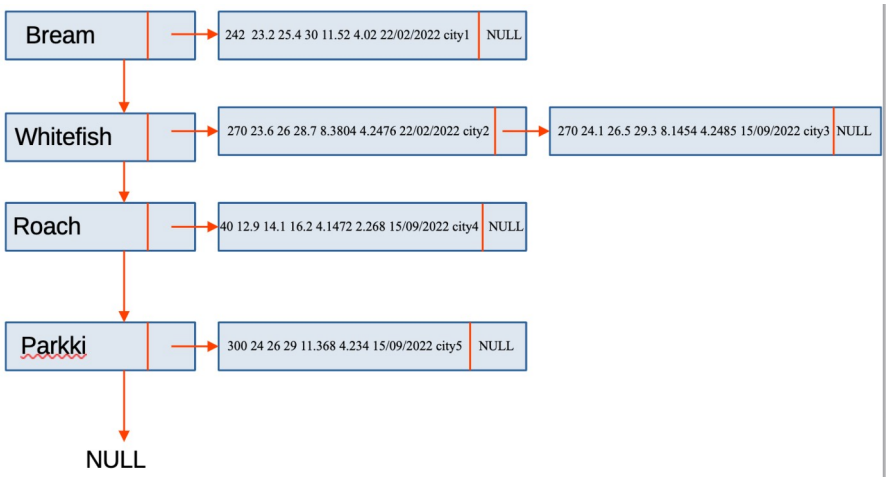

Figure 1: Illustration for data representation (read arrows are pointers)

Once you read the processed data from a file, you will need to implement some basic operations of linked lists, such as the insertion and deletion of nodes. Once you create the required data structure with its basic operations, then you will need to provide some statistics about the fishing data to the users and also allow them to interact with your application as given below.

Programming Requirement:

- **Adding a new fish data:** After the initialization of the application with the external file, you may want to add a new fish to your archive. The fish may belong to a previously recorded species or it may be a new species. In this case, the application will ask you to enter the species, and then the fish details including weight of the fish in grams, vertical length in CM, diagonal length in CM, cross length in CM, height in CM, fish length in CM, fishing date, city. Remember fish should be added to a specific species. If the species does not exist, call add new species list.

- **Deleting a fish:** This application will allow you to delete fish from any species that has a weight less than a threshold. Here, your application will request the threshold weight from the user.

- **Printing fishing statistics**: This application will allow you to print the number of fish for a particular species. For example, if the user gave Whitefish as input, 2 should be presented on the screen.

- **Searching for fish**: This application will allow you to search for fish data by using the following details: city or month number.

- **Add a new species list**: This function add a new species, and then add fish details to this newly added species (see sample code). This means that a new node will be added to the species list and another new node will be created to store fish details (fish data) of that species.

- **Save updated list**: When the user choose exit, the external file (fishingArchive.txt) should be overwritten with the latest version of the list, which means you should be able to see the newly added data the next time you start the application.

When you write this application, you need to consider the data structure(s) that will be necessary. Therefore, it is recommended that you implement your basic linked list operations first (add/delete/search/print, etc). By using these basic operations on linked lists, you can implement other required operations. You also need to define and use a structure for fishing date. To achieve these steps, you need to have the following functions. Please strictly follow the requirements of the functions given below! In addition to these functions, you can write some helper/auxiliary functions.

Function	Explanation	Take	Return
initializeFishing	To create and initialize the lists of fish that you have in fishingArchive.txt file.	File name	A list of species with the list of fish data
addFishData	To insert new fish data into your list of fish within specific species by taking the required details.	~~A list of fish~~ List of species	-
deleteFish	To delete a fish from the list of fish using its weight threshold.	A list of species, threshold	-
printStatistic	To show the number of fishes within a species.	A list of species	-
searchFishData	To search fish data by city name or month number. More than one fish data can be listed based on search keys.	A list species	-
AddSpeciesList	To add a new species, and add fish data list with the details provided.	A list of species	-
saveUpdatedList	Overwrite the external files with the latest versions of the lists.	A list of species	-

Grading:

Your program will be graded as follows:

Grading Point	Mark (out of 100)
Structures to represent a list of species and fish data	5
Main function to control and coordinate the commands	15
initializeFishing	15
addFishData	10
deleteFish	7.5
printStatistic	7.5
searchFishData	15
addSpeciesList	15
saveUpdatedList	10

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.

Sample Run: (Inputs are shown in bold)

```
The fishingArchive.txt file has been loaded successfully!

-----MENU--------------------------------------
1. Add Fish Data
2. Delete Fish Data
3. Print Fish Statistics
4. Search Fish Data
5. Add Species List
6. Exit

Enter your option: 1
Species: Bream
Weight of the fish in grams: 720
Vertical length in CM: 32
Diagonal length in CM: 35
Cross length in CM: 40.6
Height in CM: 16.3618
Fish Length in CM: 6.09
Fishing date: 11/12/2023
City: City1
The data has been added, successfully!
```

```
-----MENU-----------------------------------------
1. Add Fish Data
2. Delete Fish Data
3. Print Fish Statistics
4. Search Fish Data
5. Add Species List
6. Exit

Enter your option: 3
Provide the species:  Whitefish
The number of available fish data is 2

-----MENU-----------------------------------------
1. Add Fish Data
2. Delete Fish Data
3. Print Fish Statistics
4. Search Fish Data
5. Add Species List
6. Exit

Enter your option: 2
Provide fish weight threshold in grams:  50
1 fish data was deleted from your list!

-----MENU-----------------------------------------
1. Add Fish Data
2. Delete Fish Data
3. Print Fish Statistics
4. Search Fish Data
5. Add Species List
6. Exit

Enter your option: 4
Enter your search option (C for city/M for month): M
Enter the month number: 13
You entered the wrong number!!
Enter the month number: 9

Whitefish;270;24.1;26.5;29.3;8.1454;4.2485;15/09/2022;city3
Roach;40;12.9;14.1;16.2;4.1472;2.268; 15/09/2022;city4
Parkki;300;24;26;29;11.368;4.234; 15/09/2022;city5

-----MENU-----------------------------------------
1. Add Fish Data
2. Delete Fish Data
3. Print Fish Statistics
4. Search Fish Data
5. Add Species List
6. Exit

Enter your option: 5

The new species is: Smelt
Provide the following info:
5
```

Weight of the fish in grams: **720**
Vertical length in CM: **32**
Diagonal length in CM: **35**
Cross length in CM: **40.6**
Height in CM: **16.3618**
Fish Length in CM: **6.09**
Fishing date: **11/12/2023**
City: **City1**
Do you want to add more fish (Y/N): **N**

-----MENU----------
1. Add Fish Data
2. Delete Fish Data
3. Print Fish Statistics
4. Search Fish Data
5. Add Species List
6. Exit

Enter your option: **6**

The FishingArchive.txt file has been updated successfully!!