Department of Information Systems and Technologies

CTIS 152 – Data Structures and Algorithms

Fall 2024 - 2025

Lab Guide #5 – Week 4– 2

OBJECTIVE: Structures - Nested Structures

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PRE. The Q2 question we used in **Lab 4** rewrite the program so that it will read information of cars from the file **"cars.txt"**, store them into an array of structure and display the number of cars and their information.
(Use **dynamic memory allocation for the array.** The first line of the file consists the number of cars.)

Example Run:

```
There are 3 cars.


The car information is:
**********
Brand: dodge
Horse Power: 707
Color: black
Body Type: coupe
**********
Brand: gmc
Horse Power: 275
Color: white
Body Type: suv
**********
Brand: chevrolet
Horse Power: 450
Color: yellow
Body Type: pickup
**********
```

cars.txt

```
3
dodge 707 black coupe
gmc 275 white suv
chevrolet 450 yellow pickup
```

Project Name: LG5_pre
File Name: pre.cpp

Q1. Amazon offers special discounts for some products. Discounted products' information (product name, price, discount rate) is kept in the "**amazon.txt"** file.

Write a C program that will read all the product information from the file into a **dynamically** created structure array, and display the product information including the discounted price and the saved amount. The program will also display the number of products.

(Use **dynamic memory allocation** for the structure array. The first line of the file consists of the number of products.)

Example Run:

```
There are 6 products in the market

 PRODUCT NAME      PRICE      DISCOUNT  DISC. PRICE   SAVED AMOUNT
 ************      *********  ********  ***********   ************
 e-reader           119.99 $       %17      99.59 $        20.40 $
 WifiCamera          39.99 $       %33      26.79 $        13.20 $
 SolarLight          16.99 $       %67       5.61 $        11.38 $
 LedBulb             25.99 $       %62       9.88 $        16.11 $
 CarOrginazer        39.99 $       %74      10.40 $        29.59 $
 FlashLight          19.99 $       %40      11.99 $         8.00 $
```

amazon.txt

```
6
e-reader 119.99 17
WifiCamera 39.99 33
SolarLight 16.99 67
LedBulb 25.99 62
CarOrginazer 39.99 74
FlashLight 19.99 40
```

Project Name: LG5_Q1
File Name: Q1.cpp

Q2. Write a C program that will read all the information from the file into a **dynamically** created **structure array**. The structure will keep also the grade and scholar amount which will be assigned to 0 while reading the file. Then calculate the grade and display the student information including the grade and the scholar percentage. The program will also display the number of students.

> Bilkent University opens a new graduate program and accepted students. Students can be a candidate for scholarship depending on some criteria. Accepted students' information (Student name, cgpa, ales grade, yds grade) is **kept** in the "**graduateStudent.txt"** file.

The grade is going to be calculated by the sum of **30% of cgpa**, **45% of ales grade** and **25% of yds grade**.

To decide the scholar percentage below table can be used.

Grade	Scholar Percentage %
>90	100
>80	75
>65	50
<=65	0

graduateStudent

```
6
PhilAnselmo 89 99 87
AngelaGossow 35 70 14
FloorJansen 47 69 88
JamesHetfield 40 85 92
DavidVincent 31 59 92
MaxBlack 65 98 89
```

(Use **dynamic memory allocation** for the structure array. The first line of the file consists the number of students in the graduate program.)

Project Name: LG5_Q2
File Name: Q2.cpp

Example Run:

```
There are 6 students in the Graduate program

STUDENT NAME        CGPA    ALES     YDS         GRADE      SCHOLAR PERCENTAGE
************        ****    ****     ***         *****      ******************
PhilAnselmo         89.00   99.00   87.00        93.00             100 %
AngelaGossow        35.00   70.00   14.00        45.50               0 %
FloorJansen         47.00   69.00   88.00        67.15              50 %
JamesHetfield       40.00   85.00   92.00        73.25              50 %
DavidVincent        31.00   59.00   92.00        58.85               0 %
MaxBlack            65.00   98.00   89.00        85.85              75 %
```

Q3. Volleyball teams' information (**name, points, match details** consisting the number of **matches played, wins** and **losses**) are kept in the text file "**volleyball.txt"** into a nested structure array. Maximum number of teams is **20**.

Write the following functions;

- **`readFromFile`** that reads the teams' information from the file into an array of structures and returns the number of teams.
- **`displayAll`** that displays the information of all teams as in the example run.
- **`findWinner`** that finds and returns the index of the team which has the maximum points.

Write a C program that reads and displays the team's information. The program will also display the information of the winner team.

Example Run:

```
Team Name        Pts    Matches   Wins  Losses
-----------------------------------------------
ModenaVolley      43       22       15       7
FunvicNatal        7       22        2      20
TalteckVK         43       22       14       8
VolleyLube        40       22       12      10
Galatasaray       16       22        6      16
BerlinRecycling   34       22       12      10
SporToto          50       22       16       6
Fenerbahce        58       22       20       2
GKSKatowice       44       22       15       7
LevskiSofia       26       22        9      13
GentofteVolley    16       22        6      16
RegatasLima       19       22        5      17

The Winner team:
Fenerbahce        58       22       20       2
```

volleyball.txt

```
ModenaVolley 43 22 15 7
FunvicNatal 7 22 2 20
TalteckVK 43 22 14 8
VolleyLube 40 22 12 10
Galatasaray 16 22 6 16
BerlinRecycling 34 22 12 10
SporToto 50 22 16 6
Fenerbahce 58 22 20 2
GKSKatowice 44 22 15 7
LevskiSofia 26 22 9 13
GentofteVolley 16 22 6 16
RegatasLima 19 22 5 17
```

Project Name: LG05_Q3
File Name: Q3.cpp

Additional Questions

AQ1. Write a C program that reads several characters from the "**input.txt"**. into a **dynamically** created **two-dimensional array.** The first line of the file **input.txt** contains the dimensions of the two-dimensional character array, the following lines contain the elements of the array, separated by spaces. After reading all elements, display the array content to the screen as in the example run. The program reads a column number and displays the characters on the specified column.

Write the following functions;

- **readFile** that gets a file pointer and a two-dim character array, to read each word line by line and store them into a two-dim character array.
- **displayWords** that gets the two-dimensional character array, the number of rows and columns and displays all the elements in the array.
- **displayWordSpecCol** that gets a two-dimensional array as a parameter, the number of rows and the specified column number from the user and displays the word in that column.

Example Run #1:

```
Array elements:
N A T U R E L
O N R R E S E
T C U G P C G
I H S E O A E
C O T N R P N
E R Y T T E D

Enter the column number: 6
ESCAPE
```

input.txt

```
6 7
N A T U R E L
O N R R E S E
T C U G P C G
I H S E O A E
C O T N R P N
E R Y T T E D
```

Example Run #2:

```
Array elements:
N A T U R E L
O N R R E S E
T C U G P C G
I H S E O A E
C O T N R P N
E R Y T T E D

Enter the column number: 2
ANCHOR
```

Project Name: LG5_AQ1
File Name: AQ1.cpp

AQ2.
A hospital keeps the *name*, *id*, *department code(C: Covid – O: Other), type of the worker (D: Doctor – N: Nurse)* and *extra worked hour* information of the employees who worked extra in the **"healthEmployee.txt"** file.

Write a C program that will read all the information of the employees from the file into a **dynamically** created **structure array**. Program will calculate extra fee and display the information of the employees according to their department. It displays a menu with the following options;

```
Menu:
1. Calculate Extra Fee
2. Display by Department
3. Exit
```

Finally output the appropriate result according to the selected menu option to the screen as in the example run.

Since, in the text file the department code stored in uppercase letters, before checking the enter input, it should be converted to the uppercase letter.

Write the following functions;

- **`menu`** that displays the menu items and takes the choice from user. Then it will return the validated choice.
- **`readFile`** that reads employee information into a **dynamically** created **structure array.** Fill the extra fee as 0.
- **`calculateExtraFee`** that takes the structure array and its size as parameters. Then it will calculate all employees' extra fee according to the below rules;
    - if the employee's type is 'D'(doctor) s/he will get 100$ for an hour, otherwise s/he will get 55$
    - if the department is 'C'(Covid), then s/he will get 2.5% raise to his/her extra fee
- **`displayDepartment`** that takes the structure array, its size and a character for department type as parameters. Then it displays the employee information according to the given department type.
- **`convertToUpperCase`** that takes a character as a parameter. Then the function converts and return it as a uppercase letter.

Project Name: LG5_AQ2
File Name: AQ2.cpp

```
Menu:
1. Calculate Extra Fee
2. Display by Department
3. Exit

Enter your choice: 1
Extra Fees are calculated.

Menu:
1. Calculate Extra Fee
2. Display by Department
3. Exit

Enter your choice: 2
Enter Employee Department (C: Covid- O: Other): C
Name       Id    Dept    Type    Extra Hour    Extra Fee
---------------------------------------------------------------------
JonSnow    1122   C       D       12          1230.00
JaneDoe    2562   C       D       7           717.50
JakeGrey   5588   C       N       22          1240.25
MaxBlack   9966   C       N       16          902.00

Menu:
1. Calculate Extra Fee
2. Display by Department
3. Exit

Enter your choice: 2
Enter Employee Department (C: Covid- O: Other): O
Name       Id    Dept    Type    Extra Hour    Extra Fee
---------------------------------------------------------------------
MonicaBing 2255   O       N       8           440.00
RossGeller 6655   O       D       10          1000.00

Menu:
1. Calculate Extra Fee
2. Display by Department
3. Exit

Enter your choice: 3
```