Department of Information Systems and Technologies

CTIS 152 – Data Structures and Algorithms

Spring 2024 - 2025

Lab Guide #3 – Week 2 – 2

OBJECTIVE : Two-Dimensional Arrays with Pointers and Dynamic Memory Allocation

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Q1. Suppose that a C program contains the following statement:

double array[4][3] = { { 42.90, 60.71, 57.30 }, { 93.21, 82.97, 21.14 }, { 25.91, 92.2, 30.17 }, { 52.87, 75.84, 44.56 } };

According to the statement, examine the values of:

- array
- (array + 1)
- *(array + 1)
- (*(array) + 1)
- *(*(array) + 1)
- *(*(array + 1))
- *(*(array) + 1) + 2
- (*(array + 1) + 2)
- *(*(array + 1) + 2)

Check the results by the program.

Project Name: LG3_Q1
File Name: Q1.cpp

Q2. Write a C program that will initialize a two-dimensional integer array of size 3 by 3 with numbers like 2, 4, 8 ...
When completed, the program should also give an output of these values to the text file result.txt in the format below, including their addresses and pointer iterations.

Example Run:

```
Successful! Please see the result.txt file for the output.
```

result.txt

```
Element Name                Value   Address
--------------------        -----  --------
*(*(arr +   0) +   0)         2   003FF6F0
*(*(arr +   0) +   1)         4   003FF6F4
*(*(arr +   0) +   2)         8   003FF6F8
*(*(arr +   1) +   0)        16   003FF6FC
*(*(arr +   1) +   1)        32   003FF700
*(*(arr +   1) +   2)        64   003FF704
*(*(arr +   2) +   0)       128   003FF708
*(*(arr +   2) +   1)       256   003FF70C
*(*(arr +   2) +   2)       512   003FF710
```

Project Name: LG3_Q2
File Name: Q2.cpp

Q3. Write a C program that gets the number of refuels from the user and creates an integer array **dynamically** to keep the distances traveled after each refuel. It will continue until a non-positive number is given. The program will calculate and display the average fuel consumption per 100 km. Assume that each refueling will be done on an empty tank and each refueling will be 50 liters.

Write the following functions;

- **calculateConsumption** that takes an array and its size as parameters, and returns the fuel consumption per 100 km.
- **inputDistances** that takes a dynamically created array as a parameter and the number of refuels to read and fill the given array.

NOTE: Do not forget a dynamic array will be created for each calculation and the memory must be freed at the end.

Example Run:

```
How many times did you refuel? 2
Enter distances traveled after each refuel (km): 700 900
The average fuel consumption per 100 km: 6.25 liters

How many times did you refuel? 3
Enter distances traveled after each refuel (km): 200 400 600
The average fuel consumption per 100 km: 12.50 liters

How many times did you refuel? -1
```

Project Name: LG3_Q3
File Name: Q3.cpp

Additional Questions

AQ1. Write a C program that gets several numbers from a file named **"numbers.txt"**, then calculates and displays the **Arithmetic** average and **Harmonic** average of these numbers by using the functions below.

Write the following functions;

- **readFromTxt** that gets a file pointer as a parameter and reads the file content into a one-dim array then returns the array and its size.
- **findTwoAvg** that gets a one-dim array and its size as a parameter, then calculates and returns the **Arithmetic** average and **Harmonic** average of these numbers. Use the formulas given below.

$$AA = \frac{x1+x2+\cdots\ldots+xn}{n} \qquad HA = \frac{n}{\frac{1}{x1}+\cdots\ldots\ldots\ldots+\frac{1}{xn}}$$

Example Run:

```
Arithmetic Average is 20.24
Harmonic Average is 5.57
```

numbers.txt

```
9 8 7 12 1 5 6 27 2 43 21 84 5 6 8 90 10
```

Project Name: LG3_AQ1
File Name: AQ1.cpp

AQ2. In Karadeniz region, there are a lot of tea gardens. Because the **RHS Tea Company** and **World Bank** support the farmers;

- The **RHS Tea** company buys the tea plants from the farmers paying **0.90** TL/kg.
- The World Bank pays **%20** of the **RHS Tea** company's payment for each farmer.
- Each farmer makes **3** harvestings and sells the tea plants, but there is a maximum quota (**375** kg.) for each harvesting.

Write the following functions;

- **read** that takes the file pointer and the farmer array as input parameters, reads all the information from the file into the array, and returns the actual number of farmers and the array.
- **calculate** that takes the *farmer array*, *farmer no* to calculate the payments as input parameters. The function calculates and returns the *total tea weight* and the *payments of the World Bank* and *RHS tea company* for the specified farmer.

Write a C program that will read the information from the file "**tea.txt"** into a ***dynamically*** *created two-dimensional integer array* (*The first line of the file consists of the number of farmers*).

Then the program will read the farmer no to calculate the payments and display the information on the screen. (*Do NOT forget to make data validation for the farmer no*)

Example Run #1:

```
There are 10 farmers
Please enter the farmer no: -1
Please enter the farmer no: 0
Please enter the farmer no: 25
Please enter the farmer no: 11
Please enter the farmer no: 2

Your total tea weight: 650 kg
The Support from WorldBank is: 117.00 TL
The Payment from Caykur is   : 585.00 TL
```

Example Run #2:

```
There are 10 farmers
Please enter the farmer no: 10

Your tea weight is 654 kg
Sorry! The maximum QUOTA for each harvesting is: 375

Your tea weight is 741 kg
Sorry! The maximum QUOTA for each harvesting is: 375

Your total tea weight: 964 kg
The Support from WorldBank is: 173.52 TL
The Payment from Caykur is   : 867.60 TL
```

tea.txt

```
10
275 385 750
200 100 350
650 450 205
78  456 125
365 452 147
658 222 145
653 457 223
124 451 68
65  458 121
654 741 214
```

Project Name: LG3_AQ2
File Name: AQ2.cpp