Department of Information Systems and Technologies

CTIS 152 – Data Structures and Algorithms

SPRING 2024 - 2025

Lab Guide #2 – Week 2 – 1

OBJECTIVE : Pointer Operations and Pointers as Function Parameters, One dimensional arrays

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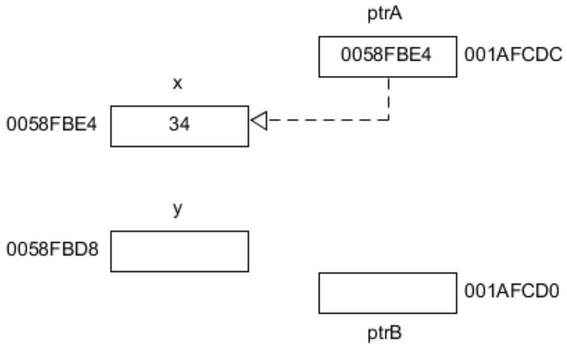
Use **pointer notation** instead of subscript notation!

Q1. a) Suppose that a C program segment contains the following statements.

```
int x = 34, y;
int *ptrA = &x;
int *ptrB;
*ptrA = x + 2;
y = *ptrA + 5;
ptrB = ptrA;
*ptrA = x + y;
```



Write a C program including the above program segment in order to find the final values of:

- &x
- &y
- ptrA
- *ptrA
- x
- ptrB
- *ptrB
- (ptrA + 3)
- (*ptrA + 3)

Project Name: LG2_Q1a
File Name: Q1a.cpp

b) Suppose that a C program contains the following statement:

```
int mat[8] = { 6, 59, 81, 61, 1, 22, 41};
```

According to this statement, examine the values of:

mat
mat+2
*(mat+2)
*mat+4
mat+5
*(mat+7)

Check the results by the program.

Project Name: LG2_Q1b
File Name: Q1b.cpp

Q2. Write a C program that will initialize a one-dimensional integer array of size 5 with the 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.
```

Content of the result.txt file

```
Element Name      Value    Address
-------------     -----    --------
*(nums +   0)         2    00E4F888
*(nums +   1)         4    00E4F88C
*(nums +   2)         8    00E4F890
*(nums +   3)        16    00E4F894
*(nums +   4)        32    00E4F898
```

Project Name: LG2_Q2
File Name: Q2.cpp

Q3. Write a C program that reads the numbers from the user into a one-dim integer array with the size of 10 until -1 is entered. The program first finds the maximum number and calculates their average excluding the maximum number. Then, it writes the results into a text file named **"result.txt"**.

Example Run #1:

```
Enter a number: 25
Enter a number: 36
Enter a number: 47
Enter a number: 85
Enter a number: 96
Enter a number: 24
Enter a number: -1

Result is printed!!
```

result.txt

```
Maximum number is 96
Average is 43.40
```

Example Run #2:

```
Enter a number: 1
Enter a number: 2
Enter a number: 66
Enter a number: 36
Enter a number: 45
Enter a number: 78
Enter a number: 45
Enter a number: 52
Enter a number: 36
Enter a number: 21
10 number is entered. Array size will be exceeded!!

Result is printed!!
```

result.txt

```
Maximum number is 78
Average is 33.78
```

Example Run #3:

```
Enter a number: -1

Program terminated!
```

Project Name: LG2_Q3
File Name: Q3.cpp

Q4. Write a C program that reads an integer list from the text file named **"numbers.txt"** into an array with a size of 15. Then, find the product of numbers that are not divisible by 5.

Write the following functions;

- `readList` that reads a list of numbers from the text file and returns the size of the list.
- `findPro` that calculates the product of the numbers in the list excluding the numbers that are divisible by 5 and returns the result.

Example Run:

```
Product excluding the numbers that are divisible by 5: 483313536
```

numbers.txt

```
25 95 85 5 65 29 23 48 55 15
35 12 37 17 2
```

Project Name: LG2_Q4
File Name: Q4.cpp

Additional Questions

AQ1. There are rates of radio channels in the workdays (Monday to Friday). You will implement a program to do the followings;

- calculates and displays the average rate of the week,
- average rate for the radio channel which has got the average rate amount above the channel average,
- the channel number and the day for the maximum rate.

	M	T	W	R	F
C1	40	51	70	18	120
C2	66	49	88	230	35
C3	26	75	41	30	142
C4	27	110	20	63	51
C5	10	58	45	178	101

```
rates.txt
40 51  70 18  120
66 49  88 230 35
26 75  41 30  142
27 110 20 63  51
10 58  45 178 101
```

Write the following functions;

- **readFromFile** that reads the channel rates from the rates.txt file into a two-dim array.
- **findAvg** that calculates and returns the average rate of the week.
- **findChannelAvg** that calculates and returns the average rate of the specified channel.
- **findMaxRate** that finds and returns the indexes of the channel number and the day of the week with the maximum rate.

Write a C program that will read the channel information from the file **rates.txt** into a two-dimensional integer array. The program will display the average rate of the channels, the channel number and the rate of that channel which has got the rate above the channel average on the screen.

Example Run:

```
The avg rate: 69.76

Channel info which has rate amount is above the avg:
Channel No: 2, Rate: 93.60
Channel No: 5, Rate: 78.40

The Channel 2 has the maximum rate: 230
```

Project Name: LG2_AQ1
File Name: AQ1.cpp

AQ2. Write a C program that reads the IDs of some cities and the number of tourists that have come to these cities in the past 5 years from a text file named "**tourism.txt**".

- The first row of the file contains the years to be stored in a one-dimensional array.
- The first column of the file contains the IDs of the cities to be stored in a one-dimensional array.
- The rest of the file contains the number of tourists to be stored in a two-dimensional array.

tourism.txt

```
       2016   2017   2018   2019   2020
06     22000  56000  43000  70000  12000
42     44000  27000  10000  32000  80000
27     21000  89000  16500  65000  14000
07     130000 33000  30000  20000  62000
35     67000  54000  19000  17000  43000
50     90000  61200  13000  52000  74000
34     23000  76000  72000  56000  49000
77     80000  10000  11600  13000  79000
17     43000  45000  15000  58000  70600
33     65000  54000  18100  41000  10100
26     20000  40000  15200  23000  40000
```

Write the following functions;

- `colMaxVal` that finds and returns the column index of the maximum value in a certain row of a 5-column two dimensional array.
- `rowMinVal` that finds and returns the row index of the minimum value in a certain column of a 5-column two dimensional array.
- `sumRow` that finds the sum of each row of a 5-column two dimensional array, and stores them into a one dimensional array.
- `sumCol` that finds the sum of each column of a 5-column two dimensional array, and stores them into a one dimensional array.

The program should find and display

- for each city:
  - the year that the maximum number of tourists came,
  - the total number of tourists came.
- for each year:
  - the cities that the minimum number of tourists came,
  - the total number of tourists came.

in the given format on the screen, as shown in the example run below .

Example Run:

```
City Id        Year with Max. Tourist        Total Tourists
**********     **********************        **************
 6                      2019                    203000
42                      2020                    193000
27                      2017                    205500
 7                      2016                    275000
35                      2016                    200000
50                      2016                    290200
34                      2017                    276000
77                      2016                    193600
17                      2020                    231600
33                      2016                    188200
26                      2017                    138200

Year           City with Min. Tourist       Total Tourists
****           **********************       **************
2016                      26                    605000
2017                      77                    545200
2018                      42                    263400
2019                      77                    447000
2020                      33                    533700
```

Project Name: LG2_AQ2
File Name: AQ2.cpp