This lab exercise involves writing a program to read data into a two-dimensional array and perform calculations on that data.

The program must output (in column format) the contents of the array, after reading the data from the input file. Next, the program must calculate the sum of all items in each row, and of all items in each column. Lastly, the program must output the sum of ALL rows and the sum of ALL columns. (Refer to the **Sample Output** section of this document for examples of correct output.)

Feel free to use the sample program discussed in the lecture as a starting point. That sample program can be found on *Moodle*: **Ch07_sample_code_TwoDimensionalArray**.

Due Date

You must *demonstrate* the solution to this lab exercise to the instructor during class by

Saturday, October 3, 2020,

in order to receive full credit for this work.

REMINDER

The most important detail to remember about any computer work you do is to DOUBLE CHECK that your work is saved on a backup device, such as a flash drive.

In case you do not have a flash drive with you: another technique for saving your work is to compose an EMail message to yourself, and attach the source file as an attachment to that EMail. Do this *before* you shut down or reboot the PC.

Always remember: make small, incremental changes. Test each small change as you go.

Design the ArrayCalculations Program

The program must contain a loop to read one number at a time from the input file, and place that number into the array. This requires careful attention to the data, and where it is being stored:

- The program has no way of knowing ahead of time how many numbers are in the input file. For this reason, the program needs to handle circumstances where there is too much or too little data in the file.

In addition to the functions in the sample program, your program must contain **at least** the following functions:

- **sumRow**: calculates the sum of all elements in a row specified by the caller.
- **sumColumn**: calculates the sum of all elements in a column specified by the user.

Inputs from the user:

```
The name of the input data file.
```

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Sample Output

In the sample output shown below, text that the user types is shown in **BOLD** font. When the program actually runs, all text is shown in the same font.)

Sample Input / Output: Example 1

```
Enter name of input file: numbers1.txt
(line 196)  Wrap-around to beginning of array: row=0, col=0
12 numbers inserted into array from file numbers1.txt

Contents of array:
         5.0         7.0         9.0         2.0
         4.0         2.0         7.0         3.0
         3.0         5.0         1.0         7.0

Sum of row 0 is 23.0
Sum of row 1 is 16.0
Sum of row 2 is 16.0
Sum of column 0 is 12.0
Sum of column 1 is 14.0
Sum of column 2 is 17.0
Sum of column 3 is 12.0
SumOfAllRows = 55.0
SumOfAllColumns = 55.0

C:\CSC237\Lab\Lab07a_Arrays\ArrayCalculations\Debug\ArrayCalculations.exe (process
12252) exited with code 0.
```

Sample Input / Output: Example 2

```
Enter name of input file: numbers2.txt
(line 196)  Wrap-around to beginning of array: row=0, col=0
12 numbers inserted into array from file numbers2.txt

Contents of array:
         3.5         5.7         1.9         5.2
         7.4         3.2         9.7         0.3
         4.3         8.5         1.1         3.7

Sum of row 0 is 16.3
Sum of row 1 is 20.6
Sum of row 2 is 17.6
Sum of column 0 is 15.2
Sum of column 1 is 17.4
Sum of column 2 is 12.7
Sum of column 3 is 9.2
SumOfAllRows = 54.5
SumOfAllColumns = 54.5

C:\CSC237\Lab\Lab07a_Arrays\ArrayCalculations\Debug\ArrayCalculations.exe (process
14996) exited with code 0.
```

Sample Input / Output: Example 3

```
Enter name of input file: numbers3.txt
(line 196)  Wrap-around to beginning of array: row=0, col=0
Data value 2.3 was NOT inserted into array
because previous insert resulted in insertStatus=2.
Data value 9.2 was NOT inserted into array
because previous insert resulted in insertStatus=2.

Some data lost: inputCount=14, insertCount=12
12 numbers inserted into array from file numbers3.txt

Contents of array:
         3.5         5.7         1.9         5.2
         7.4         3.2         9.7         0.3
         4.3         8.5         1.1         3.7

Sum of row 0 is 16.3
Sum of row 1 is 20.6
Sum of row 2 is 17.6
Sum of column 0 is 15.2
Sum of column 1 is 17.4
Sum of column 2 is 12.7
Sum of column 3 is 9.2
SumOfAllRows = 54.5
SumOfAllColumns = 54.5

C:\CSC237\Lab\Lab07a_Arrays\ArrayCalculations\Debug\ArrayCalculations.exe (process
17240) exited with code 0.
```

Sample Input / Output: Example 4

```
Enter name of input file: numbers4.txt
5 numbers inserted into array from file numbers4.txt

Contents of array:
         3.5         5.7         1.9         5.2
         7.4         0.0         0.0         0.0
         0.0         0.0         0.0         0.0

Sum of row 0 is 16.3
Sum of row 1 is 7.4
Sum of row 2 is 0.0
Sum of column 0 is 10.9
Sum of column 1 is 5.7
Sum of column 2 is 1.9
Sum of column 3 is 5.2
SumOfAllRows = 23.7
SumOfAllColumns = 23.7

C:\CSC237\Lab\Lab07a_Arrays\ArrayCalculations\Debug\ArrayCalculations.exe (process
19024) exited with code 0.
```

Demonstrate the Working Program to the Instructor

Demonstrate the working program to the instructor.

Be sure to save a copy of the source file in a safe place for future reference.