In this lab exercise, you will write a program to demonstrate two concepts:

1. Using pointers as function parameters for arrays.
2. Dynamic memory allocation.

Due Date

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

Saturday, October 17, 2020,

in order to receive full credit for this work.

Programming Exercise

Write a program that contains a **main** function and three additional functions: **populateIntegerArray**, **displayIntegerArray**, and **findMaximumInteger**.

The **main** function must perform the following:

1. Ask the user to input a desired ***size*** for an array. (That is, ask the user to specify ***how many*** data values the array should hold.)
2. Dynamically allocate an array of `int` variables, with the size that the user requested.
3. Call a function named **populateIntegerArray**, which will prompt the user to input an integer value for each element of the array.
4. Call a function named **displayIntegerArray**, which will display on the screen:
   - the hexadecimal address of each array element,
   - the contents of the array element in decimal.
   - the contents of the array element in hexadecimal (this is an *optional* feature).
5. Call a function named **findMaximumInteger**, which will find and return the largest value in the array.
6. Display the value that was returned by the **findMaximumInteger** function.
7. De-allocate the array.

Function Prototypes

The functions indicated above must have the following function prototypes:

```
void populateIntegerArray(int *arrayPtr, int arraySize);

void displayIntegerArray(int *arrayPtr, int arraySize);

int findMaximumInteger(int *arrayPtr, int arraySize);
```

Function: populateIntegerArray

This function has two input parameters:

```
arrayPtr = address of beginning of array
arraySize = number of elements in the array.
```

The function must contain a loop that prompts the user to enter a value each element of the array.

Function: displayIntegerArray

This function has two input parameters:

```
arrayPtr = address of beginning of array
arraySize = number of elements in the array.
```

The function must contain a loop that displays the array contents, formatted as follows:

- Display the hexadecimal address of each array element,
- Display the contents of the array element in decimal.
- Display the contents of the array element in hexadecimal (this is an *optional* feature).

(Observe the **Sample Output** section of this document as an example of the formatting.)

Function: findMaximumValue

This function has two input parameters:

```
arrayPtr = address of beginning of array
arraySize = number of elements in the array.
```

The function must contain a loop that scans the array to identify the maximum value in the array.

The function returns that maximum value to the caller.

Displaying an integer as Hexadecimal (extra credit)

There are several ways to display an integer in hexadecimal format. Do some internet research to find an easy way to do this. See if you can get your display to match the sample output on the next page exactly (except for the pointer value). (**Hint**: try the **cplusplus.com** website.)

If you are curious about the hexadecimal display of negative numbers, search the Internet for the phrase:

Two's Complement

There are many discussions on the Internet regarding the use of **Two's Complement** notation to represent negative integers.

Sample Output

The following are some examples of correct program output, with the *extra credit* enhancement. (The exact value of your pointer will probably be different.)

(**Note**: in these examples, we have indicated which text the user types by showing it in a larger, bold font. In actuality, all text would appear in the same size font, with no bold characters.)

Example 1: array size = 5

```
Enter desired array size: 5
arrayPtr = 01015438
Enter value for array element 0: 27
Enter value for array element 1: 3
Enter value for array element 2: -3
Enter value for array element 3: 2
Enter value for array element 4: -2
01015438:  arrayPtr[0] =          27  (Hex 0000001B)
0101543C:  arrayPtr[1] =           3  (Hex 00000003)
01015440:  arrayPtr[2] =          -3  (Hex FFFFFFFD)
01015444:  arrayPtr[3] =           2  (Hex 00000002)
01015448:  arrayPtr[4] =          -2  (Hex FFFFFFFE)
Maximum integer in array is:  27
DELETING array at arrayPtr = 01015438

C:\CSC237\Lab\Lab09a_Pointers\Lab09a_SOLUTION\Debug\Lab09a_SOLUTION.exe
(process 9752) exited with code 0.
```

Example 2: array size = 20

```
Enter desired array size: 20
arrayPtr = 00AD54D0
Enter value for array element 0: 5
Enter value for array element 1: -5
Enter value for array element 2: 4000
Enter value for array element 3: -4000
Enter value for array element 4: 16
Enter value for array element 5: -16
Enter value for array element 6: 256
Enter value for array element 7: -256
Enter value for array element 8: 255
Enter value for array element 9: -255
Enter value for array element 10: 65535
Enter value for array element 11: -65535
```

Example 2: array size = 20

```
Enter value for array element 12: 65536
Enter value for array element 13: -65536
Enter value for array element 14: 32
Enter value for array element 15: -32
Enter value for array element 16: 2020
Enter value for array element 17: -2020
Enter value for array element 18: 15
Enter value for array element 19: -15
00AD54D0:  arrayPtr[0] =            5  (Hex 00000005)
00AD54D4:  arrayPtr[1] =           -5  (Hex FFFFFFFB)
00AD54D8:  arrayPtr[2] =         4000  (Hex 00000FA0)
00AD54DC:  arrayPtr[3] =        -4000  (Hex FFFFF060)
00AD54E0:  arrayPtr[4] =           16  (Hex 00000010)
00AD54E4:  arrayPtr[5] =          -16  (Hex FFFFFFF0)
00AD54E8:  arrayPtr[6] =          256  (Hex 00000100)
00AD54EC:  arrayPtr[7] =         -256  (Hex FFFFFF00)
00AD54F0:  arrayPtr[8] =          255  (Hex 000000FF)
00AD54F4:  arrayPtr[9] =         -255  (Hex FFFFFF01)
00AD54F8:  arrayPtr[10] =        65535  (Hex 0000FFFF)
00AD54FC:  arrayPtr[11] =       -65535  (Hex FFFF0001)
00AD5500:  arrayPtr[12] =        65536  (Hex 00010000)
00AD5504:  arrayPtr[13] =       -65536  (Hex FFFF0000)
00AD5508:  arrayPtr[14] =           32  (Hex 00000020)
00AD550C:  arrayPtr[15] =          -32  (Hex FFFFFFE0)
00AD5510:  arrayPtr[16] =         2020  (Hex 000007E4)
00AD5514:  arrayPtr[17] =        -2020  (Hex FFFFF81C)
00AD5518:  arrayPtr[18] =           15  (Hex 0000000F)
00AD551C:  arrayPtr[19] =          -15  (Hex FFFFFFF1)
Maximum integer in array is:  65536
DELETING array at arrayPtr = 00AD54D0

C:\CSC237\Lab\Lab09a_Pointers\Lab09a_SOLUTION\Debug\Lab09a_SOLUTION.exe
(process 2560) 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.