

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 *submit* the source code for the solution to this lab exercise to *Moodle* by

Thursday, July 10, 2025

in order to receive full credit for this work. You must also *demonstrate* the solution to the instructor during class, at the earliest opportunity.

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.
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 **populateIntegerArray** 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 **displayIntegerArray** 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.

(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 **findMaximumValue** 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.

Note: this function does *not* display the maximum value on the screen.

Displaying an integer as Hexadecimal

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 this website: <https://cplusplus.com/reference/ios/hex/>)

Sample Output

The following are some examples of correct program output. (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 = 00000210D6EA1230
Enter value for array element 0: 12
Enter value for array element 1: -12
Enter value for array element 2: 65536
Enter value for array element 3: -65536
Enter value for array element 4: 4
00000210D6EA1230: arrayPtr[0] =          12  (Hex 0000000C)
00000210D6EA1234: arrayPtr[1] =         -12  (Hex FFFFFFF4)
00000210D6EA1238: arrayPtr[2] =        65536  (Hex 00010000)
00000210D6EA123C: arrayPtr[3] =       -65536  (Hex FFFF0000)
00000210D6EA1240: arrayPtr[4] =           4  (Hex 00000004)
Maximum integer in array is: 65536
DELETING array at arrayPtr = 00000210D6EA1230
Exit the program.
```

Example 2: array size = 20

```
Enter desired array size: 20
arrayPtr = 000001BA71BC95B0
Enter value for array element 0: 1024
Enter value for array element 1: -1024
Enter value for array element 2: 1
Enter value for array element 3: -1
Enter value for array element 4: 2
Enter value for array element 5: -2
Enter value for array element 6: 7
Enter value for array element 7: -7
Enter value for array element 8: 4096
Enter value for array element 9: -4096
Enter value for array element 10: 100
Enter value for array element 11: -100
Enter value for array element 12: 2000000000
```

Example 2: array size = 20

```

Enter value for array element 13: -2000000000
Enter value for array element 14: 10
Enter value for array element 15: -10
Enter value for array element 16: 5
Enter value for array element 17: -5
Enter value for array element 18: 3
Enter value for array element 19: -3
000001BA71BC95B0: arrayPtr[0] =      1024  (Hex 00000400)
000001BA71BC95B4: arrayPtr[1] =     -1024  (Hex FFFFFFFC00)
000001BA71BC95B8: arrayPtr[2] =         1  (Hex 00000001)
000001BA71BC95BC: arrayPtr[3] =        -1  (Hex FFFFFFFF)
000001BA71BC95C0: arrayPtr[4] =         2  (Hex 00000002)
000001BA71BC95C4: arrayPtr[5] =        -2  (Hex FFFFFFFE)
000001BA71BC95C8: arrayPtr[6] =         7  (Hex 00000007)
000001BA71BC95CC: arrayPtr[7] =        -7  (Hex FFFFFFF9)
000001BA71BC95D0: arrayPtr[8] =      4096  (Hex 00001000)
000001BA71BC95D4: arrayPtr[9] =     -4096  (Hex FFFFF000)
000001BA71BC95D8: arrayPtr[10] =       100  (Hex 00000064)
000001BA71BC95DC: arrayPtr[11] =      -100  (Hex FFFFFFF9C)
000001BA71BC95E0: arrayPtr[12] = 2000000000  (Hex 77359400)
000001BA71BC95E4: arrayPtr[13] = -2000000000  (Hex 88CA6C00)
000001BA71BC95E8: arrayPtr[14] =        10  (Hex 0000000A)
000001BA71BC95EC: arrayPtr[15] =       -10  (Hex FFFFFFF6)
000001BA71BC95F0: arrayPtr[16] =         5  (Hex 00000005)
000001BA71BC95F4: arrayPtr[17] =        -5  (Hex FFFFFFFB)
000001BA71BC95F8: arrayPtr[18] =         3  (Hex 00000003)
000001BA71BC95FC: arrayPtr[19] =        -3  (Hex FFFFFFFD)
Maximum integer in array is: 2000000000
DELETING array at arrayPtr = 000001BA71BC95B0
Exit the program.

```

Submit and Demonstrate the Working Program

- Submit the source code file (***.cpp**) for the working program to *Moodle* assignment for this Lab Exercise.
- Demonstrate the working program to the instructor during class.
- Be sure to save a copy of the source file (***.cpp**) in a safe place for future reference.

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