Lab 5 Arrays:

You will write a test plan and a Java program does the following for a one-dimensional array and a two-dimensional array. Create a menu system to allow the user to select a 1 or 2 dim array.

1. Declares an array of 10 ints
2. Declares an int to hold the index of the largest array element
3. Declares an int to hold the index of the smallest array element
4. Declares an int to hold the sum of the array elements
5. Declares a double to hold the value of the average of the array elements
6. Defines a method that assigns a random value from 100 to 999 to each array element
7. Defines a method that displays all the elements in the array
8. Defines a method that sorts the array using the insertion technique (the textbook provides sample code for this)
9. Defines a method that identifies and returns the index of the highest value in the array
10. Defines a method that identifies and returns the index of the lowest value in the array
11. Defines a method that calculates the sum of the array elements
12. Defines a method that calculates the average of the array elements
13. Defines a method that displays the results calculated by the methods described in items 5 through 8.

Remember that Java passes arrays **by reference**, so you don't need to return an array. Whatever changes a method makes to an array passed in as a parameter happen to the original array in the method that invokes it.

Please avoid the integer division problem that causes quotients to lose their decimal places.

The main method will:

1. Declare the variables for the index and value of the largest array element, the index and value of the smallest array element, the sum of the elements and the average of the elements
2. Declare the array and pass it to the method that assigns random values to it
3. Pass the array into the method that displays its elements, so we can view their original order
4. Pass it into the method that determines the index of the largest element
5. Pass it into the method that determines the index of the smallest element
6. Pass it into the method that calculates the sum of the elements
7. Pass it into the method that calculates the average of the elements
8. Invoke the method that displays the index and value of the largest array element, the index and value of the smallest array element, the sum of the elements and the average of the elements
9. Pass the array into the sort method
10. Pass the array into the method that displays its elements again, so we can view their sorted order

Your program already has a method for calculating the sum of the array elements. Question: will you re-calculate the sum in the method that obtains the average? No, in the spirit of writing re-usable code, you'll use invoke your previously written sum method.

(Note that the values are for illustration only. Your array will have different randomly assigned values.)

```
**********************************
           Array Program

   1. One-dimensional Array
   2. Two-dimensional Array
   3. Exit
Enter your selection:
1
```

```
**********************************
     One-Dimensional Processing
**********************************
Auto-generated Array Elements: (unsorted)
102 297 353 878 445 150 226 610 333 705

The index of the highest value is 3. Its value is 878.
The index of the lowest value is 0. Its value is 102.
The sum of the 10 array elements is 4099.
The average of the 10 array elements is 409.9.

Auto-generated Array Elements: (sorted)
102 150 226 297 333 353 445 610 705 878
```

```
**********************************
           Array Program

   1. One-dimensional Array
   2. Two-dimensional Array
   3. Exit
Enter your selection:
2
```

```
************************************
     Two-Dimensional Processing
************************************
Auto-generated 10x10 Array Elements: (unsorted)
101   102   103   104   105   106   107   108   109   110
102   103   104   105   106   107   108   109   110   111
103   104   105   106   107   108   109   110   111   112
104   105   106   107   108   109   110   111   112   113
105   106   107   108   109   110   111   112   113   114
106   107   108   109   110   111   112   113   114   115
107   108   109   110   111   112   113   114   115   116
108   109   110   111   112   113   114   115   116   117
109   110   111   112   113   114   115   116   117   118
110   111   112   113   114   115   116   117   118   119

The index of the highest value is 9,9. Its value is 119.
The index of the lowest value is 0,0. Its value is 101.
The sum of the 10x10 array elements is 11000.
The average of the 10x10 array elements is 110.0.

Auto-generated 10x10 Array Elements: (sorted)
101   102   102   103   103   103   104   104   104   104
105   105   105   105   105   106   106   106   106   106
106   107   107   107   107   107   107   107   108   108
108   108   108   108   108   108   109   109   109   109
109   109   109   109   109   110   110   110   110   110
110   110   110   110   110   111   111   111   111   111
111   111   111   111   112   112   112   112   112   112
112   112   113   113   113   113   113   113   113   114
114   114   114   114   114   115   115   115   115   115
116   116   116   116   117   117   117   118   118   119

************************************
           Array Program

   1. One-dimensional Array
   2. Two-dimensional Array
   3. Exit
Enter your selection:
3

--- Program Ended Normally ---
```

Make sure your output makes sense. For example, do you see what is wrong with this output?

The sum of the 10 array elements is 344.
The average of the 10 array elements is 123.4.