

Assignment #2	INFO-C 307 / INFO-I 308 Data Representation Review Unit 2 before attempting this assignment. Array Manipulation	H. Hakimzadeh See canvas for due date
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Review unit 2 about array manipulation and complete the labs related to this unit before attempting this assignment.

Create a class called **assign2.java** with the following methods:

1. Create a method named **createIntegers(int arraySize)** that allocates, initializes, and returns an array of random integers in the range of 11, and 71. The method has one parameter called arraySize and its value is currently 10.

```

-----
Create an array and fill it with random numbers between 11 and 71:
Initializing with Random integers between 11 and 71
Returning the integer array
-----

Print Integer Array:
55
64
18
66
64
62
38
54
61
29
-----

```

Look up random number generation functions such as: Random(), nextInt()

2. Create a method named **spreadEagle(string theString)** that takes a string of any size and then allocates, initializes, and returns an array of characters which hold the original characters in theString in spreadEagle format. For example, the following string parameters will return an array of characters representing the following characters.

theString	Returned array of characters	Array size (when its returned)
Hello	H.e.l.l.o	9 (note that there are no dots after the last char)
Chicken wings	C.h.i.c.k.e.n. w.i.n.g.s	24 (note there is no "dot" after a space between chicken and wings, and there is no dot after the last char)
INFO-C 307	I.N.F.O.-.C. 307	16 (note that there are no "dots" between numbers)
574-520-4517	574-.520-.4517	14 (note that we only have dots after the dash symbols)
574.520.4517	574.520.4517	12 (not there was no dots added anywhere)

```

-----
Create Spread Eagle Array of Characters:
Original String: hello
Original Size: 5
Dots needed: 4
Returning the Spread Eagle character array
-----

Print Char Array:
h.e.l.l.o
-----

Original String: Chicken wings
Original Size: 13
Dots needed: 11
Returning the Spread Eagle character array
-----

Print Char Array:
C.h.i.c.k.e.n. w.i.n.g.s
-----

Original String: INFO-C 307
Original Size: 10
Dots needed: 6
Returning the Spread Eagle character array
-----

Print Char Array:
I.N.F.O.-.C. 307
-----

Original String: 574-520-4517
Original Size: 12
Dots needed: 2
Returning the Spread Eagle character array
-----

Print Char Array:
574-.520-.4517
-----

Original String: 574.520.4517
Original Size: 12
Dots needed: 0
Returning the Spread Eagle character array
-----

Print Char Array:
574.520.4517
-----

Original String: 574 520 4517
Original Size: 12
Dots needed: 0
Returning the Spread Eagle character array
-----

Print Char Array:
574 520 4517
-----

```

Look up string manipulation functions such as: .length(), .charAt()

Also look up character array properties such as: .length

3. Create a method named **charFrequency(string theString, theChar)** that takes a string and a single character as parameters. The method iterates the array, counting the number of times theChar is encountered in the string and returns the frequency. Please note that your function should count both uppercase and lowercase characters as the same and report the result accordingly..

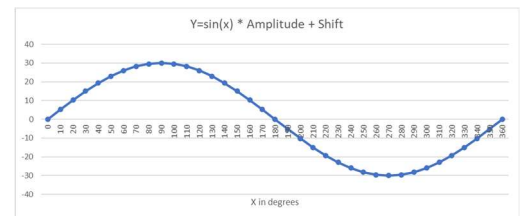
Try the charFrequency() function with following parameters and show the result.

```
charFrequency("This is a test", 'e');
charFrequency("This is a test", 't');
charFrequency("hhakimza@iusb.edu/syllabus.html", '.');
```

```
-----
Original String: This is a test
Original Size: 14
Frequency for letter 'e' is: 1
1
Original String: This is a test
Original Size: 14
Frequency for letter 't' is: 3
3
Original String: hhakimza@iusb.edu/syllabus.html
Original Size: 31
Frequency for letter '.' is: 2
2
-----
```

Look up string manipulation functions such as: toUpperCase(), toLowerCase()
Look up Character manipulation functions such as Character.toUpperCase(), etc.

4. **Optional Hacker's Corner:** Create a method named plotSignWave(). The method should create a 2D array of size 80 rows by 38 columns. In this array we are going to plot the sign wave like the figure shown below. You will find more information about this problem at the end of this document.



What to hand in?

- Submit the entire code, Include documentation for each method.
- Submit a word document with the following:
 - For Problem 1 above,
 - Provide the code for function: **createIntegers(int arraySize)**
 - **Show** how you were able to restrict the random numbers in the array to the range 11 to 71.
 - **Provide screen shot** of running the code.
 - For Problem 2 above,
 - Provide the code for function: **spreadEagle(string theString)**
 - **Provide screen shot** of running the code for each of the examples shown in the assignment sheet.
 - Hello
 - Chicken wings
 - INFO-C 307
 - 574-520-4517
 - 574.520.4517
 - For Problem 3 above,
 - Provide the code for function: **charFrequency(string theString, theChar)**
 - **Provide screen shot** of running the code for each of the examples shown in the assignment sheet.
 - charFrequency("This is a test", 'e');
 - charFrequency("This is a test", 't');
 - charFrequency("hhakimza@iusb.edu/syllabus.html", '.');
 - (Optional Hacker's Corner) For Problem 4 above,
 - **Provide the code for your hacker's corner**
 - **Provide screen shot** of running the code

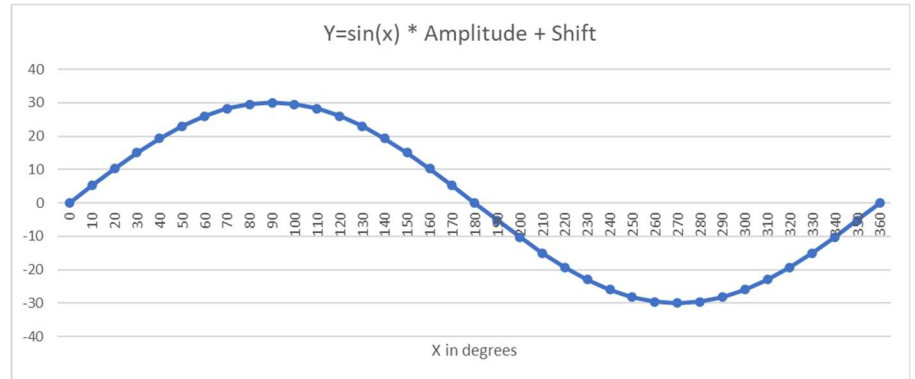
Sample Main() function for testing Problems 1,2, and 3

```
//-----  
public static void main(String[] args) {  
  
    int[] integerArray;  
    char[] charArray;  
  
    System.out.println("-----");  
    System.out.println("Create an array and fill it with random numbers between 11 and 71: ");  
  
    integerArray = createIntegers(10);  
    printIntegerArray(integerArray);  
  
    System.out.println("-----");  
    System.out.println("Create Spread Eagle Array of Characters: ");  
    charArray = spreadEagle("hello");  
    printCharArray(charArray);  
  
    charArray = spreadEagle("Chicken wings");  
    printCharArray(charArray);  
  
    charArray = spreadEagle("INFO-C 307");  
    printCharArray(charArray);  
  
    charArray = spreadEagle("574-520-4517");  
    printCharArray(charArray);  
  
    charArray = spreadEagle("574.520.4517");  
    printCharArray(charArray);  
  
    charArray = spreadEagle("574 520 4517");  
    printCharArray(charArray);  
  
    System.out.println("-----");  
    System.out.println("Display Character Frequency: ");  
  
    System.out.println(charFrequency("This is a test", 'e'));  
    System.out.println(charFrequency("This is a test", 't'));  
    System.out.println(charFrequency("hhakimza@iusb.edu/syllabus.html", '.'));  
    System.out.println("-----");  
  
}
```

Additional information about the Hacker's Corner

Here is the sort of data that we need to create this chart. You can try this in your spreadsheet first to get a feel for it.

	Amplitude=	30
	Shift:	0
X	X in Radians	$Y=\sin(x) * \text{Amplitude} + \text{Shift}$
0	0	0
10	0.174532925	5.20944533
20	0.34906585	10.2606043
30	0.523598776	15
40	0.698131701	19.28362829
50	0.872664626	22.98133329
60	1.047197551	25.98076211
70	1.221730476	28.19077862
80	1.396263402	29.54423259
90	1.570796327	30
100	1.745329252	29.54423259
110	1.919862177	28.19077862
120	2.094395102	25.98076211
130	2.268928028	22.98133329
140	2.443460953	19.28362829
150	2.617993878	15
160	2.792526803	10.2606043
170	2.967059728	5.20944533
180	3.141592654	3.67545E-15
190	3.316125579	-5.20944533
200	3.490658504	-10.2606043
210	3.665191429	-15
220	3.839724354	-19.28362829
230	4.01425728	-22.98133329
240	4.188790205	-25.98076211
250	4.36332313	-28.19077862
260	4.537856055	-29.54423259
270	4.71238898	-30
280	4.886921906	-29.54423259
290	5.061454831	-28.19077862
300	5.235987756	-25.98076211
310	5.410520681	-22.98133329
320	5.585053606	-19.28362829
330	5.759586532	-15
340	5.934119457	-10.2606043
350	6.108652382	-5.20944533
360	6.283185307	-7.35089E-15



Try modifying the **Amplitude** and the **Shift** parameters in the spreadsheet and observe the result in the graph. The amplitude will adjust the height of the wave and the shift parameter will shift the entire wave up or down on our graph. (You may want to do the shift up the graph by 30 to make sure your resulting data is in the positive territory.)

To learn more about shifting functions in a graph, watch this video:

<https://www.khanacademy.org/math/algebra2/x2ec2f6f830c9fb89:transformations/x2ec2f6f830c9fb89:shift/v/shifting-functions-intro>

Now that you have a better understanding of the overall problem, to implement it in java you need to do the following:

- 1) Create a 2D array of characters with the right dimensions.
- 2) Initialize the 2D array with "blanks".
- 3) Create a for loop that goes from 0 to 360 (in increments of 10). These will constitute our "X" values
- 4) Convert the X to Radian, because we use the X in radians in our `sin()` function later. The `toRadians()` is a build in function in java. See: `Math.toRadians(X)`;
- 5) Then apply the formula $Y = \sin(x) * \text{Amplitude} + \text{Shift}$
Note: that the Amplitude and Shift are basically constants that adjust the height of the wave and shift the entire graph up or down. (So, you may need to use these two constants to properly position your graph in the 2D array.)
- 6) Finally, plot an (X,Y) coordinate in the array with an "x" or a "." To denote a point on the graph.

