CSC-14400: Computer Science I – Lab #4

Dates of Importance:

Tuesday, November 7:	(Optional) Suggested Problems Due for Quiz Extra Credit
Thursday, November 9:	(Required) In-class Exercise
Tuesday, November 14:	(Required) In-class Quiz

Objectives:
This exercise will get you (further) experience with:

- Using the character data type.
- Using the String data type.
- Type casting.
- Iterative execution.
- Building your own Java class.

Suggested Problems
Before attempting to complete this assignment, you should be comfortable with the material from Lab 1 and Chapters 1, 2, 3, 4, 5, and 6 of the Horstmann text book. As a result, you should be comfortable with all of the material from Labs 1-3, all of the preliminary problems from Labs 1-3, and you should be able to complete the following problems before solving the actual lab problem.

1. Evaluate each of the following expressions, and state what t he resulting value would be.

   - Assume that there is an integer variable `World` that currently holds the value 42.
   - Be careful, as some can be a bit misleading.
   - *Make sure you can solve these without the aid of the computer; you need to understand why each of these results in the value it does!*

   (a) `22 / 8`
   (b) `22 % 8`
   (c) `20 % World`
   (d) `World % 20`
   (e) `World % World`
   (f) `1+(1+1 / 1+1)`
   (g) `"8/4/02"`
   (h) `8/4/02`
   (i) `8/ 2*4`
   (j) `"Hello + World"`
   (k) `"Hello " + "World"`
   (l) `"Hello" + "World"`
   (m) `"Hello" + World`
   (n) `"Hello " + World`
   (o) `World + "Hello"`
   (p) `World + World + "Hello" + World + World`

2. Evaluate each of the following expressions, and state what t he resulting value would be.

   - *Make sure you can solve these without the aid of the computer; you need to understand why each of these results in the value it does!*

   (a) `(char) 97`
   (b) `(char) 98`
   (c) `(char) 65`
   (d) `(char) 66`
   (e) `(int) 'a'`
   (f) `(int) 'b'`
   (g) `1 + 'a'`
   (h) `'a' + 1`
   (i) `(char) ('a' + 1)`
   (j) `(char) ('a') + 1`
   (k) `(char) 'a' + 1`
   (l) `(char) 1 + 'a'`
   (m) `((char) 98) + 'b'`
   (n) `'c' - 'a'`

3. *Chapter 3* : p. 121-124: problems E3.3, E3.4, E3.11, E3.15, and E3.16

4. *Chapter 4* : p. 167-169: problems E4.13, E4.14, E4.17

5. Write `printf` calls that meet each of the following requests:

   (a) Print out the contents of an integer variable `a` in 8 spaces, right justified and followed by a newline.

   (b) Print out the contents of an integer variable `b1` in 9 spaces, left justified and followed by an integer variable `b2` in 4 left justified spaces followed by a newline.

   (c) Print out the contents of a double variable `c` in 9 spaces, right justified, with exactly 3 digits after the decimal point, and followed by a newline.

   (d) Using the "grid sheet" found with Lab #1 (see Canvas) or some graph paper (with one printed character per block), show what the following sequence of code prints to the screen:

```
System.out.printf("%6.2f\n", 3.1416);
System.out.printf("%6.2f\n", 3.1473);
System.out.printf("%6.2f\n", 3.1449);
System.out.printf("%6.2f\n", 31416.27183 );
```

   (e) Write a Java program that reads in an integer n and then prints out a table of values and their squares, with one value and square pair on each line. make sure that the columns line up so that their one's digits align, their tens digits align, and so on. You may assume that the user will not enter a value larger than 999 for n. For example, if the user had entered 11, the output might be as follows:

1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100
11	121

NOTE: *You may submit* ***personally hand-written*** *solutions to* ***all*** *of the above problems* ***at the beginning*** *of the class period before the lab. This can earn you up to 2 bonus points on the quiz to be given during the next class meeting after the lab session, but only if you answer* ***all*** *of the problems!*

The Exercise

Write a Java *class* called `StringCrypt` that does *not contain a main method.* This class must, at a minimum, contain the following methods:

- A constructor that takes a single integer argument representing the "salt" amount to use during an encryption scheme. The details of the encryption scheme and the meaning of the "salt" is described below.
- A method called `encrypt` that takes as its input a single (unencrypted String and returns an encrypted version of the String. The encryption scheme should take each character from the input unencrypted String and add the value of the "salt" to it. This should give a new encrypted character "salt" further positions into the alphabet; if this would "overrun" the end of the alphabet, start at the beginning of the alphabet and move overrun positions into the alphabet (***STRONG HINT**: Think modulus (%), realizing there are 26 letters in the alphabet!!!*). Some examples, with a salt of 4:

Unencrypted String	Encrypted String
hello	lipps
zoo	dss
buzzer	fyddiv
skypez	woctid

And the same examples, with a salt of 14:

Unencrypted String	Encrypted String
hello	vszzc
zoo	ncc
buzzer	pinnsf
skypez	gymdsn

- A method called `decrypt` that takes as its input a single (encrypted String). This should perform the reverse of the `encrypt` method. Each character should be converted by finding its "distance" from 'a' (i.e. subtracting 'a' from it) and then adding (26-"salt") to it. If the resulting value "overruns" the alphabet, a similar process to what is done during encryption should be performed.

You will be given several main methods with which to test your class. *Remember NOT to include a main method in your class!*

****PRE**-lab Work**

When you come into class for the lab exercise, you must have a corresponding program that:

1. compiles without any errors **and** ...
2. is a sincere attempt at a solution to the problem. Dr. Blythe's judgment on this will be final, no exceptions.

If you do not meet *both* of the above requirements, you will be given a 0 for this lab and will have to leave class immediately - *no exceptions*!!!

Preparation Notes

- You are *required* to work on this *before* the actual lab. If you do not, you will receive a zero for the lab and will be required to leave class for the day immediately.
- You will be given a minor change to this assignment to complete as part of the in-class exercise. This change will be so minor that if you have done the preparation yourself, it will likely take you less than ten minutes to complete; of course if you don't do your own work in preparing for the lab, the modification may be difficult to complete by the end of class (and completion by the end of class is a *requirement*).
- *WARNING*: For some people this lab will be a 15-30 minute exercise (if that). For others, it may be a 40+ ***hour*** exercise. *Do not wait until the night before this lab is due (when you no longer have 40+ hours) to start this lab and discover you fit in the latter group!!!!*
- *WARNING #2*: This lab often takes time simply to understand what is being asked for, as there is no output to match here. For some people, just getting past this point takes several hours of work. *Budget your time carefully!*