ASSIGNMENT 2

COMP-202A, Fall 2013, All Sections

Due: October 20^{th}, 2013 (23:59)

Please read the entire PDF before starting.

You must do this assignment individually and, unless otherwise specified, you must follow all the general instructions and regulations for assignments. Graders have the discretion to deduct up to 10% of the value of this assignment for deviations from the general instructions and regulations. These regulations are posted on the course website. Be sure to read them before starting.

Part 1:	0 points
Part 2, Question 1:	35 points
Part 2, Question 2:	40 points
Part 2, Question 3:	25 points
	100 points total

It is very important that you follow the directions as closely as possible. The directions, while perhaps tedious, are designed to make it as easy as possible for the TAs to mark the assignments by letting them run your assignment through automated tests. While these tests will not determine your entire grade, it will speed up the process significantly, which will allow the TAs to provide better feedback and not waste time on administrative details. Plus, if the TA is in a good mood while he or she is grading, then that increases the chance of them giving out partial marks :)

Part 1 (0 points): Warm-up

Do **NOT** *submit this part, as it will not be graded. However, doing these exercises might help you to do the second part of the assignment, which will be graded. If you have difficulties with the questions of Part 1, then we suggest that you consult the TAs during their office hours; they can help you and work with you through the warm-up questions.*

Warm-up Question 1 (0 points)

Create a file called `Counting.java`, and in this file, declare a class called `Counting`. This class should ask the user when the computer should stop counting.

```
What should I count to?
10 <---- User types this
I am counting to 10: 1 2 3 4 5 6 7 8 9 10
```

Warm-up Question 2 (0 points)

For this question you have to generalize the last question. The user will give you the number they want the computer to count up to and the step by which it will do so.

```
What should I count to?
25 <----
What step size should I use?
3 <----
```

```
I am counting to 25 with a step of 3:
1 4 7 10 13 16 19 21 24
```

In order to achieve this you will have to do some computation on the number of iterations in your loop, *e.g.* `math.floor(25.0/3.0)`. This should be put in a method to simply the comprehensibility of your code.

Warm-up Question 3 (0 points)

This program should ask the user how big she wants the square to appear. Using two loops, you should be able to describe the outline of a square like the following. In order to simplify your code, please put this process within a method.

```
How big do you want your square to be?
10 <---- User types this
##########
#        #
#        #
#        #
#        #
#        #
#        #
#        #
#        #
##########
```

Hint: In order to display this sort of structure think of the following pseudo code,

```
For j = 0 to N:
    For i = 0 to N:
        if( i == ? or j == ? or i == ? or i == ?):
            print "#"
        else:
            print " "
```

N.B. It is normal that it does not output a perfect square as the width and the length of the characters are not the equal.

How would you extend your program to output a rectangle with width and length as specified by the user?

Warm-up Question 4 (0 points)

In this question the program should ask the user to enter two letters. The program then looks at the inputs and tell the user which one of the two she entered comes last alphabetically. This method should **NOT** be case sensitive.

For example, the letter 'b' should be treated the same way as the letter 'B', meaning that 'A' and 'a' are both before 'B' and 'b'.

Make sure you handle the following case, 'Az' or 'zA'.

Hint: It is NOT sufficient to write `c1 < c2` if `c1` and `c2` are `char`s as this would be case sensitive.

Hint: To read a char from the user, you can use the method `next()` in `Scanner` to first read a `String`. Then use the method `charAt` with input `0` that is defined on a `String`.

Hint: Look at the official documentation (on the Internet) of the String class to find out more about String methods (including charAt and comparing Strings).

Part 2

The questions in this part of the assignment will be graded.

Question 1: Generalized Order (35 points)

In the first assignment you were asked to find if 4 digits were consecutive. In this question you are asked to generalize that question to any `String`, *i.e.* alphabetic or numerical.

Write a method `isConsecutive` in a class `Question1`[1] that takes as input a `String s` and returns a `boolean` value of `true` if the text is consecutive (see examples below) and `false` otherwise. In addition, unlike in assignment 1, you will allow the letters and numbers to "loop" so that a String like `89012` or `xyZabc` will count as consecutive. On the other hand `09283dgdDDf` does not count as being consecutive. Corner case such as `AbCBa` or `1abC` should return `false`. On the other hand `DcbaZ` should return `true`. For this question, feel free to use `if` statements (and it is highly encouraged).

Hint: You are not required to hand in a main method for this question. However, to test your required method, you will need to write one. In this method you can do whatever you want. You MAY ask the user to enter a value which you will then use as input to your method, but you may find it easier to hard-code this value for testing purposes. For example, your main method might look like,

```
public static void main(String[] args)
{
    String consecutive = "aBc";
    //check that this prints true
    System.out.println(isConsecutive(consecutive));
    //check that this prints false
    System.out.println(isConsecutive("aeg"));
}
```

You will want to test your code more thoroughly than the above two cases.

[1] If you fail to do this our test cases will not work and the TAs **will** remove marks

Question 2: Displaying Circle (40 points)

You are asked to draw the outline of a circle projected over a grid at a given position (x,y) and radius. Please put your code in the class named `Question2` and this code has to be put in a method called `public static void DrawMeACircle(int posX, int posY, int radius)` [2]. This method will output an ellipse on a grid using `" "` and `"#"`. The size of the grid is at your discretion, but we are expecting a grid that is at least 20 by 20.

```
public static void main(String[] args)
{
    int x = 14;
    int y = 8;
    int radius = 5;

    //Calling the method
    DrawMeACircle(x, y, radius);
}
```

```
Output:
Here is a 20 x 20 grid with a circle of radius 5 at (14,8).
```

```
          #####
         #     #
        #       #
       #         #
       #         #
       #         #
       #         #
       #         #
        #       #
         #     #
          #####
```

```
------  End Program -----
```

In order to solve this problem you will need the equation of a circle,

$$(x-a)^2 + (y-b)^2 = r^2 \tag{1}$$

In equation 1, (a,b) is the circle center coordinates, r is the radius, and (x,y) is the set of all points that satisfy equation 1. Make sure that the x-axis is horizontal and the y-axis is vertical. Moreover it is normal that the circle is not perfectly round as the width and length of characters are not equal.

Hint: You have to use two loops in order to scan the coordinates. When you are evaluating a specific coordinate, you will have to figure out if it should be blank or filled in *i.e.* ' ' vs '#'.

[2] If you fail to do so marks will be removed

Hint: (x_i, y_j) is part of the outline of a circle if and only if it respects equation 1. In other words, which coordinates (x, y) make equation 1 true?

Hint: The discrete world we have to work with makes it hard to express the strict equality in equation 1. Can you relax that equality in order to draw better circles?

Question 3: Displaying Ellipse (25 points)

In this question you are asked to generalise the last question to draw an ellipse. Please make sure you understand question 2 before working on this one as they are very similar. You have to project the outline of an ellipse on the grid.

Your code has to be put in a class called `Question3` and it will define the following method `public static void DrawMeAnEllipse(int posX, int posY, int radiusA, int radiusB)`. [3] Again this method will output an ellipse on a grid using `" "` and `"#"`. The size of the grid is at your discretion, but we are expecting a grid that is at least 20 by 20.

```
public static void main(String[] args)
{
    int x = 10;
    int y = 8;
    int radiusA = 5;
    int radiusB = 1;

    //Calling the method
    DrawMeAnEllipse(x, y, radiusA, radiusB);
}

Output:
Here is your 20 x 20 grid with an ellipse defined by (5,1) radii at (14,8).
```

```
  #########
####     ####
  #########
```

```
---- End Program ----
```

In order to solve this problem you will need the equation of an ellipse,

$$\left(\frac{x-h}{a}\right)^2 + \left(\frac{y-l}{b}\right)^2 = 1 \tag{2}$$

[3] If you fail to do so marks will be removed

In equation 2 (h,l) is the ellipse's center coordinates, a and b are the radii, and (x,y) is the set of all points that satisfy equation 2. It is interesting to point out that if both radii are equal we get a circle. Moreover because of the grid structure will the output will be squeezed.

What To Submit

You should submit your assignment on MyCourses. In order to do this, you will need to make a `zip` of the file. You can do this on windows by following the instructions at this link: `http://condor.depaul.edu/slytinen/instructions/zip.html`. On a mac or linux, you can find instructions at `http://osxdaily.com/2012/01/10/how-to-zip-files-in-mac-os-x/`

You should submit a zip file called `Assignment2.zip` with the following files inside of it.

`Question1.java`	with	`public static boolean IsConsecutive(String s)`
`Question2.java`	with	`public static void DrawMeACircle(int x, int y, int radius)`
`Question3.java`	with	`public static void DrawMeAnEllipse(int x, int y, int radiusA, int radiusB)`

`Confession.txt` (optional) In this file, you can tell the TA about any issues you ran into doing this assignment. If you point out an error that you know occurs in your problem, it may lead the TA to give you more partial credit. On the other hand, it also may lead the TA to notice something that otherwise he or she would not.

Hacker question - Steganography

This question is **not** marked, it is **optional**. It is oriented towards people looking for a harder challenge, and you will only win the satisfaction of taking on the challenge and COMP202's fame.

You are to explore the basic idea of steganography which consists of hiding information within something trivial, also know as the art of hiding messages. The input of the program is a picture, you will have to drop two channels of color, *e.g.* blue and green and replace them with random values from 0 to 255. The kept colour will have to map down by a factor x. From testing, we found that anything between 1.5 to 3.0 works well. If you use a lower value, your hidden image will be visible in the encoded version, and something bigger will make it hard to see details in your image. The logic follows something like this,

```
newImage.redValue(i,j) = oldImage.redValue(i,j) / 2.2f;
```

From there you have to save the encoded picture. When you want to decode your encoded picture you have to set to zero the two channels you decided to drop and multiply the last by the same factor.

For example,

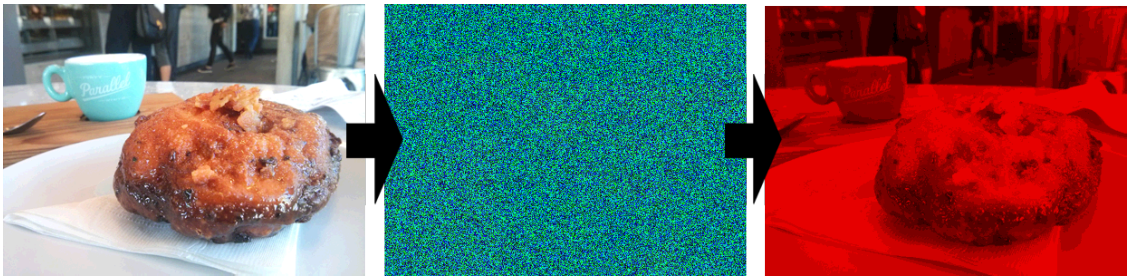

Figure 1: Left: the input is a simple BMP image. Middle: this image is then encoded. Right: the final result has some information lost

I would recommend to look at the `java.awt.image.BufferedImage` class and read about images in Java, `http://docs.oracle. com/javase/tutorial/2d/images/`. This is not an easy task you will have to be patient in order to succeed. This work invokes multiple pieces of Java to work together. Good luck.

For more information on this problem, such as code samples, please consult the website's assignment page. This is obviously not a perfect method, can you think of better approach to hide an image within an actual image?