--> CSc 102 -- Practical 3 <--
50 + 25 = 75 MARKS

Deadlines

You must **complete and submit your solutions** up to and including ***Task 5*** by **5pm** on the day of your practical. Instructions for how to submit your work are given in each section. Work that is not submitted by this deadline *will not be marked*.

All remaining questions must be completed and submitted by **2pm** on the **Monday** after the practical.

You only need to submit the `.java` file for each task on RUConnected.

Task 1: Secret Messages [5 marks]

In Java you can replace **all** occurrences of a string or character with another string using `the <String>.replaceAll() method`. For example each occurrence of "**hello**" in `myString` with a **space**:

```
myString.replaceAll("hello", " ");
```

Write a program called **`Secret.java`** that will ask the user to supply a sentence and a substring. Replace all occurrences of the substring with a space.

For example:

```
Please enter a sentence: Inotamnotcool
Please enter a substring to replace: not
The secret message is: I am cool
```

Task 2: Vertical Printer[5 marks]

Last semester we wrote a vertical printer using Python. Now write a vertical printer in Java (**`Vertical.java`**) that reads in a sentence from the command line and prints it vertically.

For example:

```
java Vertical Hi there
H
i

t
h
e
r
e
```

Task 3: MySubstr [10 marks]

Write a Java method that will extract a substring from a string. Your method must take a string, a starting position and the number of characters that should be returned.

```
public static String mySubstr (String s, int start, int len)
```

Some examples:

```
mySubstr("hello world", 0, 5)       → "hello"
mySubstr("hello world", -1, 5)      → ""
mySubstr("hello world", 6, 5)       → "world"
mySubstr("hello world", 9, 10)      → "ld"
mySubstr("hello world", 20, 10)     → ""
```

Task 4: Letter Frequency [20 marks]

Write a Java program (**`CountLetters.java`**) that reads in input from the keyboard. Your program must continue to read in input until the user types in a line containing only "+++". Your program should then proceed to count how many times each letter occurs in the input and display the result.

For example

```
java CountLetters
Please enter some text:
The quick BroWn FoX jumps oVeR THE laZy dog!!!
+++
```

a -> 1 b -> 1 c -> 1 d -> 1 e -> 3 f -> 1 g -> 1 h -> 2 i -> 1 j -> 1 k -> 1 l -> 1 m -> 1 n -> 1 o -> 4 p -> 1 q -> 1 r -> 2 s -> 1 t -> 2 u -> 2 v -> 1 w -> 1 x -> 1 y -> 1 z -> 1

Task 5: Odd and Even [10 marks]

Write a Java method called `oddEven()` that will find the number of even and odd integers in a given array of integers. For example, given an array [3, 9, 2, 4, 9] after calling your method your program should print:

```
Number of odd numbers: 3
Number of even numbers: 2
```

Code Submission: *In order for your tutor to mark your program, you need to upload it to RUConnected using the submission link. If you do not submit your code on RUConnected your tutor can not mark it and you will get zero for this question.*

Homework follows below

Homework

Task 6: Odd and Even Range [5 marks]

Extend your Task 5 solution to accept a range of numbers by starting at **one** and ending before the user-specified upper range number: For example:

```
Enter your upper range: 10
Number of odd numbers: 5
Number of even numbers: 4
```

Task 7: A different number guessing game [10 marks]

Write a number guessing game that works as follows:

- Your game should create a random number between 0 and 100, both included.
- The user initially gets 10 guesses.
- For each incorrect guess they lose one guess. For each correct guess they get 5 additional guesses.
- The game ends when the user has either guessed three correct numbers or exhausted all guesses.
- The game should provide the following hints:
    - The guess was off by more than 10, 20, 30, etc.
    - The guess was off by less than 10.
    - The guess was off by less than 5.

For example:

Assume the secret number is 53

Guess	Expected feedback
78	The guess is off by more than 20.
62	The guess is off by less than 10.
55	The guess is off by less than 5.
52	The guess is off by less than 5.
47	The guess is off by less than 10.
15	The guess is off by more than 30

Task 8: The Matrix [5 marks]

Extend your vertical printer so that it will produce output in the style of the movie, The Matrix. **`Matrix.java`** reads in a sentence from the command line and prints it vertically. The pattern is repeated for as many words as there are in the sentence, but shifts on one word each time.

For example:

```
java Matrix Computer Science is fun!
C     S     i     f
o     c     s     u
m     i     .     n
p     e     .     !
u     n     .     .
t     c     .     .
e     e     .     .
r     .     .     .

S     i     f     C
c     s     u     o
i     .     n     m
e     .     !     p
n     .     .     u
c     .     .     t
e     .     .     e
.     .     .     r

i     f     C     S
s     u     o     c
.     n     m     i
.     !     p     e
.     .     u     n
.     .     t     c
.     .     e     e
.     .     r     .

f     C     S     i
u     o     c     s
n     m     i     .
!     p     e     .
.     u     n     .
.     t     c     .
.     e     e     .
.     r     .     .
```

Task 9: Square it off [5 marks]

Extend your vertical printer so that it will produce squared output. **`Square.java`** reads in a sentence from the command line and prints it vertically and horizontally, so that they read the same in both directions.

For example:

```
java Square Computer Science is fun!
Computer Science is fun!
o        c       s  u
m        i          n
p        e          !
u        n
t        c
e        e
r

java Square Hello cruel world
Hello cruel world
e     r     o
l     u     r
l     e     l
o     l     d
```

Code Submission: *In order for your tutor to mark your program, you need to upload it to RUConnected using the submission link. If you do not submit your code on RUConnected your tutor can not mark it and you will get zero for this question.*