**Lab Assignment #3 – Using Recursion**

Due Date: Friday, Week 6

Purpose: The purpose of this Lab assignment is to:

1. Design recursive algorithms
2. Implement recursive methods in Java or Python

References: Read the course’s text chapter 5 and the lecture slides. This material provides the necessary information that you need to complete the exercises.

Be sure to read the following general instructions carefully:

- This assignment must be completed individually by all the students.

* You will have to provide a **demonstration video for your solution** and upload the video together with the solution on **eCentennial** through the assignment link. See the **video recording instructions** at the end of this document.

**Exercise 1**

**If your first name starts with a letter from A-J inclusively:**

Create a **recursive algorithm** to compute the **product of two positive integers**, *m* and *n*, using only addition and subtraction. Implement the Java or Python code. **Hint:** You need subtraction to count down from *m* or *n* and addition to do the arithmetic needed to get the right answer. Check *linearSum* method from Week 5 examples.

**If your first name starts with a letter from K-Z inclusively:**

Write a recursive method to produce the following pattern:

\*

\*\*

\*\*\*

\*\*\*\*

\*\*\*

\*\*

\*

Test the method by asking the user to enter the number of asterisks of the maximum line (for example, the user should enter 4 in this case).

(3 marks)

**Exercise 2**

**If your first name starts with a letter from A-J inclusively:**

Write a short **recursive Java method** that determines if a string s is a palindrome, that is, it is equal to its reverse. Examples of palindromes include 'racecar' and 'mom'. Test the method by asking the user to provide string entries to be checked. **Hint:** Check the equality of the first and last characters and recur (but be careful to return the correct value for both odd and even-length strings).

**If your first name starts with a letter from K-Z inclusively:**

Write **a recursive method** to that returns the number of vowels in a string. Test the method by asking the user to enter a string. **Hint**: create a special method for checking if a character is a vowel.

(3 marks)

**Exercise 3**

**If your first name starts with a letter from A-J inclusively:**

Write **a recursive method** that takes a string as argument and determines if the string has more vowels than consonants. Test the method by asking the user to enter a string. **Hint**: Write your recursive method to first count vowels and consonants.

**If your first name starts with a letter from K-Z inclusively:**

Implement a **recursive method** that takes *(path, filename)* as arguments and returns all entries of the file system rooted at the given *path* having the given *file name*. Test the method with a real path, filename from your file system. **Hint**: Review use of the *java.io.File* class and the week 5 examples.

(4 marks)

**Evaluation:**

|  |  |
| --- | --- |
| **Functionality:**   * Correct implementation of requirements for implementing and testing recursive methods * Code demonstration and brief explanation in a short video | 70%  10% |
| **Object-Oriented design**:   * Correct design of classes and methods similarly to chapter 5 examples. * Correct use of generics * Correct use of naming guidelines for project, classes, variables, methods. | 15%  5% |
| **Total** | 100% |

**Naming and Submission Rules:**

You must **name your Eclipse project** according to the following rule:

**YourFullname\_COMP254Labnumber**. Example: **JohnSmith\_COMP254Lab3**

You must name package names **com.exercisenumber.yourfirstname.yourlastname**, for example: **com.exercise1.john.smith**

Provide your **student number and full name as a comment** at the top of main method for each exercise.

**Archive your project in a zip file** named according to the following rule:

**YourFullname\_COMP254Labnumber.zip**

Example: **JohnSmith\_COMP254Lab3.zip**

Upload the zip file on eCentennial using the Assignment link.