**Lab Assignment #3 – Using Recursion**

Due Date: Sunday, 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:

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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:**

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| --- | --- |
| **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.

Use 7-zip to compress files (https://www.7-zip.org/download.html).

**Demonstration Video Recording**

Please record a short video (max 4-5 minutes) to explain/demonstrate your assignment solution. You may **use the Windows 10 Game bar** to do the recording:

1. Press the Windows key + G at the same time to open the Game Bar dialog.

2. Check the "Yes, this is a game" checkbox to load the Game Bar.

3. Click on the Start Recording button (or Win + Alt + R) to begin capturing the video.

4. Stop the recording by clicking on the red recording bar that will be on the top right of the program window.

(If it disappears on you, press Win + G again to bring the Game Bar back.)

You'll find your recorded video (MP4 file), under the Videos folder in a subfolder called Captures.

Submit the video together with your solution.