Advanced Programming 2021 – Year 2
Labwork 1: (5% - or 50 points out of 500 points for labwork this semester)

NOTE: ALL LABS TO BE COMPLETED IN PROJECTS USING ECLIPSE OR EQUIVALENT IDE (NO MORE TEXTPAD, EVER EVER!!!)

IMPORTANT NOTES:

- **NO COPYING PERMITTED AND ZERO MARKS WILL APPLY TO COPIED WORK. FURTHER ACTION MAY BE TAKEN AGAINST STUDENTS THAT HAVE BEEN FOUND TO COPY WORK.**

- **ASSESSMENT WILL INVOLVE ONE-TO-ONE QUESTIONS ABOUT YOUR SUBMITTED WORK. USE COMMENTS IN YOUR CODE TO ENSURE YOU DON'T FORGET WHY YOU WROTE CODE YOU MAY LATER BE ASKED ABOUT.**

- **ALL WORK MUST BE SUBMITTED TO MOODLE BY DATES SPECIFIED (2 LABS SUBMISSIONS OF FIVE LABS THROUGHOUT THE SEMESTER).**

- **MANY OF THE TASKS ASSIGNED BELOW CAN BE COMPLEX AND\OR THE DESCRIPTIONS MAY REQUIRE FURTHER CLARIFICATIONS. PLEASE USE THE AVAILABLE LAB TIMES TO ASK FOR CLARIFICATIONS AND ADVICE\HINTS ON THE TASKS BELOW.**

Part 1 – Recursion and Eclipse projects (15 points)

Create an Eclipse Project called **Lab1Part1**. Create class called **Lab1Part1** within that project. Create a method inside the class called **recursiveSummation(int)** that will find the total of all of the numbers from the number passed as parameter down to 1, e.g., if you pass the value 10 the method uses recursion to add 10+9+8+7+6+5+4+3+2+1 and return the result. Add **javadoc** comments to the above method to describe the function of the method and method parameter (@param). Generate the **javadoc** documents for the project. Finally, Jar the project in a **jarfile** called **Lab1Part1.jar** and test the execution of the **jarfile**.

Required activities and marking guideline:

- Create the Eclipse project Lab1Part1 (2 points)
- Write the recursive method including parameter (6 points)
- Add and generate the Javadoc (3 points)
- Jar and execute the program from the jar (4 points)

Part 2 – Multiple classes communicating in one project (15 points)

Create an Eclipse Project called **Lab1Part2**. Create TWO classes within this project that will communicate with each other through method calls. Call the first class **MathHelper.java** and put a **recursive factorial** method in the MathHelper.java class (this is covered in the lecture notes: call the method **recursiveFactorial(int)**). Put the MathHelper class in a package called *mathematics* (using the keyword package). Make the factorial method **static**. Create a second class called **MathClient.java** and put that class in a package called *client*. From within the main method of the MathClient class call the factorial method from the MathHelper class. Test the **recursiveFactorial** method with AT LEAST THREE different values. Fully Javadoc the methods and classes using the following Javadoc tags: @author, @param, @return. Generate the Javadoc documentation and have a look at the output (start with index.html: open in a browser). Jar the project into a jarfile called **Lab1Part2.jar**. Test that the jarfile runs.

Required activities and marking guideline:

- Implement the two classes in separate packages (4 points)
- Put the **static** factorial method in the MathHelper class (4 points)
- Run the test class MathClient and output results (2 points)
- Write the Javadoc using the THREE tags (3 points)
- Generate the Javadoc (have a browser through it) (1 point)
- Jar the project (and test the jar runs) (1 point)

Part 3 Putting it all together (Jars, Packages, Javadoc IDE) (20 points)

Create an Eclipse Project called **Lab1Part3**. Create a simple JFrame GUI called Lab1Part3 with ONE JTextField in the center and TWO JButton's at the bottom. Use a JLabel to invite the user to enter a number into the textfield, e.g., "Input integer here: ".

Add a second label to the center of the frame with the text "Answer will appear here" (this label will be used to output the numbers). Set the text of one of the buttons to "Summation" and the other button text to "Factorial".

Import the TWO jarfiles from Part 1 (Lab1Part1.jar) and Part 2 (Lab1Part2.jar) above into this project (In Eclipse: Project → Build Path → Configure Build Path. Under Libraries tab, click Add Jars or Add External JARs and point to the jarfiles to import the jarfiles written in part 1 and part 2 above: see this link for full instructions https://stackoverflow.com/questions/3280353/how-to-import-a-jar-in-eclipse).

Once these jars are imported you should be able to use the methods you wrote in the previous parts of this assignment.

Use event handling so that when the Summation button is pushed the integer entered into the input field is passed to the summation method called **recursiveSummation(int)** from Lab1Part1.jar.

Use event handling to enable to Factorial button so that when this is pushed the recursive factorial method is called from Lab1Part2.jar.

In each case output the result using the output label in the frame.

Required activities and marking guideline:

- Create GUI the labels, fields and buttons (within frame) (5 points)
- Add listeners and handlers (and code the responses) (5 points)
- Import the Jarfiles to the project (Lab1Part.jar and Lab1Part2.jar) (4 points)
- Javadoc all of the project and generate the Javadoc (2 points)
- Use BOTH recursive methods from the jars and output results (4 points)