Software Development 1, Lab 3

This is individual assessed coursework. You are allowed to discuss this assessment with other students, but you should not copy their code, and you should not share your own code with other students. Note that we will carry out plagiarism checks on all submissions.

This lab script consists of **three tasks**, which require you to apply your knowledge of iteration (see lecture in Week 3) in addition to other topics covered in previous lectures. You should attempt to **complete all tasks before getting your solutions marked**.

The deadline for completing this lab is the end of the lab session in Week 5. Before this deadline, you should show your code (whether you have completed all the tasks or not) to either a lab helper or your lecturer, and also upload your code (as instructed at the end of this document) to Vision. Uploading your code to Vision is mandatory; you will not receive any marks if you do not do this.

Task 1

You should use the Eclipse IDE for this lab – see lecture slides from Week 3:

- First, create a new Java project (File -> New -> Java Project) and call it **`SD1_Lab3`**
- Next, create a new Class (File -> New -> Class) and call it **`Factorials`**

Write a program that calculates and displays the factorial of a number entered by the user. The factorial of a number *n* is the product of all positive integers that are less than or equal to *n*. For example, the factorial of 4 is 1 x 2 x 3 x 4 = 24. In particular:

- Your program should use a `for` loop to calculate the factorial of the input value.
- Your program should use a `long` rather than an `int` to store the result. This is because an `int` can only store numbers up to 2^{31}, and factorials can be very large numbers. Even `long` variables can only store numbers up to 2^{63}, which means in practice that your program will only be able to provide factorials up to *n*=20.

You will get **4 marks** for a correct, well-formatted, program.

Task 2

Make a new class called **`Factorials2`**, copy and paste the code from Task 1, and extend it so that your program only accepts a number from the user that is between 1 and 20. If they enter a number outside this range, it should keep asking for a new input until they provide one between 1 and 20.

To do this, you should add a `do…while` loop.

You might find it useful to consult the examples in the Iteration lecture.

When run, your program should do something like this (user input shown in bold):

```
Please enter a number between 1 and 20: 100
That number is out of range!
Please enter a number between 1 and 20: 0
That number is out of range!
Please enter a number between 1 and 20: 20
The factorial of 20 is 2432902008176640000
```

You will get **3 marks** for a correct, well-formatted, program.

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Task 3

Make a new class called **`Factorials3`** and extend your code from Task 2. This time, rather than just printing out the factorial for the number entered by the user, it should print out the factorials for all numbers up to the number entered by the user.

For example, your program, when run, should do something like this (user input shown in bold):

```
Please enter a number between 1 and 20: 100
That number is out of range!
Please enter a number between 1 and 20: 5
The factorial of 1 is 1
The factorial of 2 is 2
The factorial of 3 is 6
The factorial of 4 is 24
The factorial of 5 is 120
```

You will get **3 marks** for a correct, well-formatted, program.

Next, show your solutions to a lab helper or your lecturer. Once they have marked your work, **upload your .java file for each task to Vision** using the appropriate submission link found in the Lab 3 folder under the "Assessment" tab. If you have not been able to finish all the tasks, please show us what you have been able to do, and then upload the solutions to Vision.

All of your solutions to Lab 3 must be uploaded to Vision by midnight on Friday 12th October. Late submissions will be marked according to the university's late submissions policy, i.e. a 30% deduction if submitted within 5 working days of the deadline (e.g. within the following lab), and no mark after that. If you have mitigating circumstances (e.g. illness), please submit the form available at: https://www.hw.ac.uk/students/studies/examinations/mitigating-circumstances.htm