Logic and Maths for Computing Laboratory Task 1

You are recommended to write the programs in the language Python. Note that in several of the exercises you will do over the next weeks, the integers you are dealing with get quite big. You might need to use **long** integers, otherwise you will be a bit restricted.

1) Write an iterative program which computes the Fibonacci series.

$F_n = F_{n-1} + F_{n-2}$, with $F_0 = 1$, $F_1 = 1$

2) Write a recursive program which takes an integer *n* and returns the *n*th Fibonacci number. Investigate whether this algorithm is faster or slower than the first algorithm you wrote. Why?

3) Investigate the periodicity of the last two digits of the Fibonacci series. Does the series eventually repeat itself?

Hint: To investigate this, even long integers will be too small. However you can get around the problem by using modulo arithmetic (i.e. if you work in modulo 100, you are only keeping the last two digits in store). We will be looking at modulo arithmetic in more detail later in the course…..

4) Consider these "modified" versions of the Fibonacci series:

$F_n = 2F_{m-1} + F_{m-2}$, with $F_0 = 1$, $F_1 = 1$
$F_p = F_{p-1} + 2F_{p-2}$, with $F_0 = 1$, $F_1 = 1$

Modify both your iterative and recursive Fibonacci series programs to compute these new series. Verify that both series contain only odd numbers and prove why this is the case.

5) For each of the series we have looked at, consider the ratio between successive terms:

F_n/F_{n-1} F_m/F_{m-1} and F_p/F_{p-1}

What happens as n, m and p become large? Does it matter if you choose different starting values? (for example $F_0=1$, $F_1 = 2$) Experiment with a few different starting values and see what happens.

To pass the lab you need to write and hand in a report which describes what you did and what conclusions you have been able to make. Try to relate to the theoretical material on the course. Include a copy of your code.