FIT2004 S2/2016: Lab questions for week 2

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Objectives: This prac is primarily designed to brush up your (i) programming basics and (ii) revise the basic concepts of iteration, recursion etc. you have learnt in FIT1029 and FIT1008.

NOTE: This prac is **NOT** assessed. Write these programs in Python programming language.

1. Write a program to compute the factorial of a number recursively.

2. Write an iterative version of the same.

3. Write a program to print all prime numbers between 1 and N.

4. Explore more efficient ways to print prime numbers between 1 and N. Seek help from your tutors (after you have done your own research).

5. Write a program to compute the *greatest common divisor* (GCD) of two positive numbers.

6. Explore more efficient ways to compute GCD of two positive numbers. Seek help from your tutors (after you have done your own research).

7. Write a program to multiply two 2×2 matrices.

8. A Fibonacci series are numbers in the following sequence:

$$1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, \ldots$$

   Given some $N \geq 0$ as a command line parameter, write a program to compute the Nth number in the sequence.

9. Explore more efficient ways to compute Nth number in the Fibonacci sequence. Seek help from your tutors (after you have done your own research).

If you have managed to cruise through the above preparatory programming questions and still have time left in your lab to attempt more, consider the following task. (If you are unable to finish this in the lab, attempt this as an homework exercise.)

10. Finally, now time for a puzzle that might appeal to those of you who, like me, have some interest in prosody.

    Often *poetic meters* of some **fixed** *beat length* (per line) have some rhythmic pattern composed of `light` and `heavy` syllables from the source language (for example, English or Sanskrit). It is common to treat the `light` syllable to measure as being 1 beat in length, while a `heavy` syllable to measure as 2 beats.

    In such a framework, given a fixed beat length of n, write a program that can compute the *total number of patterns* involving light and/or heavy syllables?

    As an example, a line with a fixed beat length of 5 can be composed of a pattern that is `light-light-heavy-light` (1+1+2+1=5), or `heavy-light-heavy` (2+1+2=5), or any one of the other six possible patterns.

11. What is the time complexity of your algorithm for Q9? What is the most efficient (space and time) algorithm that you can conceive for this problem?

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