

Chapter 6: More advanced exercises

You will find in this tutorial a collection of more advanced exercises. You might also want to have a look at the worksheets on "Collatz conjecture", "Dictionaries and graph theory" and "Strings and the Burrows-Wheeler transform".

Exercise 6.1

How many strings of length n containing only letters a and b but not containing aa are there? Compute the value for each $n = 1, 2, \dots, 10$

Do you know this sequence?

Could you find the corresponding entry in the [OEIS](#)

Exercise 6.2 (Goldbach conjecture)

Verify experimentally the following statement: « For each even integer $n \geq 4$, there exist two prime number $p \geq 2$ and $q \geq 2$ such that $n = p + q$ ».

Up to which value of n are you able to verify this conjecture?

Exercise 6.3

Does there exist two positive integer numbers x and y such that $x^2 - 61y^2 = 1$?

Exercise 6.4

Write a function that given positive integers (p, q, n) return the number of solutions in positive integers (a_1, a_2, \dots, a_n) to the equation

$$\frac{1}{a_1} + \frac{1}{a_2} + \dots + \frac{1}{a_n} = \frac{p}{q}$$

How many solutions are there for $(p, q, n) = (13, 12, 3)$?

A sample of Euler problems

Solve the following Euler problems

- [problem 26](#) (decimal expansions)
- [problem 31](#) (coin sums)

- [problem 45](#) (triangular, pentagonal and hexagonal numbers)
- [problem 46](#) (odd composite number that can not be written as the sum of a prime and twice a square)
- [problem 50](#) (sum of consecutive primes that are primes)