Proposed problems

Write an algorithm that calculates the following amounts:

$$S_1=\sum_{i=1}^{m}(i+i^2)$$

$$S_2=\sum_{i=1}^{m}\sum_{j=i}^{n}(j+i)$$

$$S_3=\sum_{i=1}^{m}\sum_{j=i}^{n}(i/j)$$

What is the complexity of each algorithm.

Calculate the integral defined on the interval [a,b] by the trapeze method (linear interpolation polynomial) and the Simpson method (second degree interpolation polynomial). Study correctness (i.e. partially correct (invariant, repetitive cycle) + finitude function) and study the complexity of the two numerical integration algorithms (i.e. dominant operations).

Goldbach's conjecture states that any even number strictly greater than 2 is the sum of two prime numbers. Propose an algorithm that for an even number n, strictly greater than 2 determines two prime numbers that have the property that their sum is equal to n. Describe the algorithm in pseudocode and implement it in Python.

Bachet's conjecture states that any natural number can be represented as the sum of squares of four natural numbers. Propose an algorithm that for a natural number n determines four natural numbers a, b, c, d with the property that $n = a^2 + b^2 + c^2 + d^2$. Describe the algorithm in pseudocode and implement it in Python.

Gauss's arithmetic-geometric mean sequence (indirect recursion): Let be two strings $(a_n)_{n \in \mathbf{N}}$, $(b_n)_{n \in \mathbf{N}}$ recurrently defined as: $a_0=a$; $b_0=b$; $(a,b>0)a_n=(a_{n-1}+b_{n-1})/2$, $b_n=sqrt(a_{n-1}\cdot b_{n-1})$. Write a program in Python to calculate a_n şi b_n , for $n \in \mathbf{N}$, read from the keyboard.

It is considered a list of dates of birth specified by triplets of the form (day, month, year). Propose (and implement in Python) an algorithm that orders birth dates ascendingly. Set the order of complexity of the algorithm.

Propose a random password generator (strings of letters and numbers) with a length between 8 and 12