

ENGR 102

Lab and Assignment #6b

Write programs to do each of the following. The programs should be labeled ENGR102_NAME_X.py where NAME is your last name and X is a through e:

For all programs, you should include comments in your code that describe the purpose of individual blocks.

a) The Collatz conjecture:

The Collatz conjecture, also known as the $3n+1$ conjecture (and other names), deals with the following operation to produce a sequence of numbers. Given a number, n , if n is even then the next number is n divided by 2. If n is odd, then the next number is $3n+1$. The Collatz conjecture is that this sequence of numbers always eventually reaches 1. As simple as this seems, it is unproven (and considered extremely hard to prove) by mathematicians.

As an example of a sequence, if you start with the number 6, then the terms of the sequence will be: 6, 3, 10, 5, 16, 8, 4, 2, 1.

Write a program that takes in a positive integer from a user, and computes the Collatz sequence, printing out all the numbers in the sequence, followed by a line stating how many iterations it took to reach the value 1.

b) Averaging measurements:

Assume that someone has collected a set of measurements and wants some statistical data about them. Write a program that asks a user for measurements and prints the average, the maximum, and the minimum measurement. Users should be allowed to enter as many measurements as they want, until entering a negative measurement. The negative measurement should not be processed, but is just used to indicate that the user has finished entering measurements. [Note: do not use a list to store the measurements.]

c) Divisors:

For numbers from 2 to 100, print a series of lines indicating which numbers are divisors of other numbers. For each, print out "X divides Y", where $X \leq Y$, and both X and Y are between 2 and 100. The first few lines will be:

2 divides 2
3 divides 3
2 divides 4
4 divides 4
5 divides 5
etc.

d) Series:

Series are used to quickly estimate functions or values. The following summation can be used to estimate π . Using a for loop, estimate the value of π for the following number of terms, n : 1, 10, 100, 1000, $1e6$, $1e9$. Print the estimated values along with the number of terms as well as the value of π from the math module.

$$\pi \approx 4 \sum_{k=0}^n \frac{(-1)^k}{2k+1}$$

e) Series:

Rather than guess at the number of terms to use to estimate the value of π , one can utilize a tolerance value. Construct a while loop that utilizes the for loop from the previous problem that will estimate π using an increasing number of terms until the difference between successive estimates is less than $1e-6$. Print the estimated value of π along with the number of terms as well as the value of π from the math module.