# E-402-STFO Problems for Module 1

Updated November 23, 2024

This module has 10 problems, each problem gives you 10 points. Thus if you solve 10 problems correctly you are at 100 points and get full marks.

Each problem has a separate turn in on Kattis. Each has some sample input and output which you are shown, and some secret data which you are not shown. If you get all the secret data correct, you get 10 for that problem, otherwise 0.

Kattis supports most programming languages, see the languages page on the site for a full list. Your programs need to read input from stdin and print answers on stdout. You can only import standard libraries in this module.

`m1p01` Given a positive integer $n$ calculate the sum of all positive multiples of 3 and 5 less than $n$ ($n \leq 10^{18}$).

`m1p02` Given a positive integer $n$ find the largest prime factor of $n$ ($2 \leq n \leq 10^9$).

`m1p03` Given a positive integer $n$ find the sum of all primes less than $n$ ($n \leq 10^7$).

`m1p04` Given a positive integer $n$ find a Pythagorean triple $(a, b, c)$ such that $a + b + c = n$. Separate the output numbers by spaces. A Pythagorean triple $(a, b, c)$ is a triple of positive integers such that $a^2 + b^2 = c^2$. If there are multiple answers, choose any one of them. If there is no answer print `0 0 0` instead ($n \leq 10^4$).

`m1p05` Given a positive integer $n$ find the number of divisors $1 + 2 + \cdots + n$ has ($n \leq 10^{15}$).

`m1p06` Find which starting number under a given positive integer $n$ produces the longest Collatz chain. This means we start at $n$ and when we are at an even value we divide it by two, and for odd values we multiply it by 3 and add 1. Each of these procedures are 1 step. We consider the chains to end at 1 ($n \leq 10^6$).

`m1p07` Given a positive integer $n$ find the prime factors of $n$ ($1 < n \leq 10^{24}$).

`m1p08` Given a positive integer $n$ print the number of values $< n$ that are palindromes in both base 2 and 10 ($n \leq 10^{12}$).

`m1p09` Find the last 10 digits of $1^1 + 2^2 + 3^3 + ... + n^n$ for an integer $n$ ($10 \leq n \leq 10^7$).

`m1p10` $41 = 2+3+5+7+11+13$ is the longest streak of consecutive primes that adds to a prime below a hundred. Which prime below a given positive integer $n$ can be written as the sum of the most consecutive primes? ($100 \leq n \leq 5 \cdot 10^6$).