Lab 3

Number Theory

1 Prime Number Checker

Implement a function that determines whether a given positive integer is a prime number or not using Sieve of Eratosthenes

2 Prime Factorization

Create a function that computes the prime factors of a given integer.

3 GCD and LCM Computation

Implement functions to calculate the GCD and LCM of two positive integers.

a) Using the Euclidean algorithm for GCD computation and the relationship between GCD and LCM to find the LCM.
b) Using prime factorization.

4 Chinese Remainder Theorem

Implement Chinese remainder theorem that takes as input m_1, m_2, m_3, …., m_n that are pairwise relatively prime and (a_1, a_2, …., a_n) and calculates x such that

$x = a_1 \pmod{m_1}$

$x = a_2 \pmod{m_2}$

…

$x = a_n \pmod{m_n}$

5 Submission

- You must work **individually** and use **Java programming language** in your implementation.
- You should deliver all the coding files.
- Make sure you provide a clear and detailed report. It should contain:
  1. Problem statement.
  2. Used data structures.
  3. Sample runs and different test cases.
  4. Assumptions and details you find necessary to be clarified.

Good Luck,,,