

LABORATORY 2

This assignment is due for **Week 2**.

Write a C application with a menu based console interface which solves the problems below. Each requirement must be resolved using at least one function. All functions need to be specified.

1.
 - a. Generate all the prime numbers smaller than a given natural number n .
 - b. Given a vector of numbers, find the longest increasing contiguous subsequence.
2.
 - a. Generate the first n prime numbers (n is a given natural number).
 - b. Given a vector of numbers, find the longest contiguous subsequence such that any two consecutive elements are relatively prime.
3.
 - a. Print the Pascal triangle of dimension n of all combinations $C(m,k)$ of m objects taken by k , $k = 0, 1, \dots, m$, for line m , where $m = 1, 2, \dots, n$.
 - b. Given a vector of numbers, find the longest contiguous subsequence of prime numbers.
4.
 - a. Compute the approximated value of square root of a positive real number. Use a given precision.
 - b. Given a vector of numbers, find the longest contiguous subsequence such that the difference of any two consecutive elements is a prime number.
5.
 - a. Print the exponent of a prime number p from the decomposition in prime factors of a given number n (n is a non-null natural number).
 - b. Given a vector of numbers, find the longest contiguous subsequence such that any two consecutive elements are relatively prime.
6.
 - a. Read a sequence of natural numbers (sequence ended by 0) and determine the number of 0 digits of the product of the read numbers.
 - b. Given a vector of numbers, find the longest contiguous subsequence such that the sum of any two consecutive elements is a prime number.
7.
 - a. Read sequences of positive integer numbers (reading of each sequence ends by 0, reading of all the sequences ends by -1) and determine the maximum element of each sequence and the maxim element of the global sequence.
 - b. Given a vector of numbers, find the longest contiguous subsequence such that all elements are in a given interval.
8.
 - a. Determine the value x^n , where x is a real number and n is a natural number, by using multiplication and squared operations.

- b. Given a vector of numbers, find the longest contiguous subsequence such that any two consecutive elements have contrary signs.
9. a. Decompose a given natural number in its prime factors.
b. Given a vector of numbers, find the longest contiguous subsequence such that any consecutive elements contain the same digits.
10. a. Decompose a given even natural number, greater than 2, as a sum of two prime numbers (Goldbach's conjecture).
b. Given a vector of numbers, find the longest contiguous subsequence such that any consecutive elements have at least 2 distinct digits in common.
11. a. Determine the first n pairs of twin numbers, where n is a given natural and non-null number. Two prime numbers p and q are called twin if $q - p = 2$.
b. Given a vector of numbers, find the longest decreasing contiguous subsequence.
12. a. Determine all the numbers smaller than a given natural and non-null number n and that are relatively prime to n .
b. Given a vector of numbers, find the longest contiguous subsequence with the maximum sum.
13. a. Determine the first 10 natural numbers (x_1, x_2, \dots, x_{10}) greater than 2 with the following property: all the natural numbers smaller than x_i and that are relatively prime with x_i , are prime, $i = 1, 2, \dots, n$.
b. Given a vector of numbers, find the longest contiguous subsequence such that any consecutive elements contain the same digits.