Algorithms and data structures
Labwork 4 - Recursion

Exercise 1 : In this problem, we would like to implement the algorithm to calculate the digit sum of a given natural number that can be used in detecting errors in message transmission or data storage.

For example:

N = 103509, the digit sum = 1 + 0 + 3 + 5 + 0 + 9 = 18.

N = 9512, the digit sum = 9 + 5 + 1 + 2 = 17

- Write a pseudo-code to solve the above problem using Iteration.

- Write a program from the pseudo-code and solve the Problem using Iteration.

- Calculate the complexity. Justify your answer.

- Write a program to solve the Problem using **Recursion** (with Iteration if necessary).

- Calculate the complexity. Justify your answer.

Exercise 2 :

Write a program in C/C++ to enter a natural number n and find all sphenic numbers from 1 to n using **Recursion**. Calculate the complexity of the proposed algorithm. Note: A sphenic number is a product of p*q*r where p, q, and r are three distinct prime numbers. Example: 30 = 2 * 3* 5; 42 = 2*3*7; 66 = 2*3*11

Exercise 3:

We want to implement a program in C/C++ to calculate approximately the number Pi, a real constant, $\pi = 3.14159265358979323846$. One of the Pi formulas is as follows:

$$\pi = \frac{4}{1} - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + ... + \frac{4}{4n+1} - \frac{4}{4n+3}$$

where n is a natural number.

When n = 10, pi   3.0962410; When n = 100, pi   3.13659310; When n = 1000, pi 3.14109110; When n = 10000, pi   3.14138410;

- Write a function using Recursion with the input n to calculate pi. Another parameters can be used in the function input. Write a main function to test implemented functions.

- Calculate the complexity of your algorithm. Justify the answer.