



Level: 1st year of computer science
Course: ADS1

series TD/TP N°: 05

Academic year: 2024/2025
Chapter 4 : Loops

Exercise 1: TD/TP

Write an algorithm with its C program that calculates the factorial of a number.

N.B. : $0! = 1$ et $n! = 1 \times 2 \times \dots \times n$

Exercise 2: TP

Write a program to display all the divisors of a number.

Exercise 3: TD

Let the following part of the algorithm be:

```
var nb, c1, c2, p, r : integer
read(nb)
p ← 1
c1 ← nb mod 10
c2 ← nb
while c2 > 10 do
  p ← p * 10
  c2 ← c2 / 10
end while
r ← nb - c1 - c2 * p + c1 * p + c2
write("The result is: ", r)
```

- Run the program for $nb = 286$ and $nb = 14357$
- What does this code do?

Exercise 4: TP

Write a program that displays the mirror image of an integer (displays it in reverse).

Exercise 5: TD/TP

Write an algorithm with its C program that determines if a number is prime or not.

- Using the for loop.
- Using the while loop.
- Generalize this algorithm to display all prime numbers less than or equal to N ($\leq N$).

Exercise 6: TD

Write an algorithm with its C program that calculates the GCD (Greatest Common Divisor).

Given that:

$$PGCD(a, b) = \begin{cases} PGCD(b, (a \% b)), & b \neq 0 \\ a, & b = 0 \end{cases}$$

Exercise 7: TD/TP

Write an algorithm to calculate the n th term of the Fibonacci sequence defined by:

$$u(n) = \begin{cases} 0 & \text{si } n = 0 \\ 1 & \text{si } n = 1 \\ u(n-2) + u(n-1), & \text{si } n > 1 \end{cases}$$

Exercise 8: TD

If you know that the square root of a number "a" is calculated by the following recursive relationship :

$$x_{n+1} = \frac{x_n + \frac{a}{x_n}}{2}$$
$$x_0 = 1$$

Write an algorithm with its C program that calculates the square root of a number « a » with approximation error $\varepsilon = 10^{-6}$. In other words $(x_n)^2 - a \leq \varepsilon$

Exercise 9: TP

If you knew that

$$\exp(x) := \sum_{k=0}^n \frac{x^k}{k!} = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \dots$$

Write a program that calculates $\exp(x)$ (x is a real number and n is an integer).

N.B. : make sure that n is strictly positive.

Exercise 10: (at home)

Write the program to calculate x^n . (x is a real number and n is an integer that can be positive, negative or zero).

Exercise 11: (at home)

Write a program that calculates the Least Common Multiple (LCM) of two numbers.

Exercise 12: (at home)

If you knew that

$$\pi = 4 \sum_{k=0}^n \frac{(-1)^k}{2k+1} = \frac{4}{1} - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \dots$$

Write a program that calculates the approximate value of π .

N.B. : make sure that n is strictly positive.