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## TP3: MATLAB Scripts and Functions

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### Exercise 1. (*Conditional Statements*)

1. Write a MATLAB script that requests two values  $x$  and  $y$  from the user, displays them, swaps their contents, and then displays the updated values.
2. Write a MATLAB script that asks the user to enter a number and then displays its sign (positive, negative, or zero).

### Exercise 2. (*Repeating Instructions: Loops*)

1. Write a program that asks the user to enter two integers  $a$  and  $N$ , and then displays the value of the sum

$$\sum_{i=1}^N i^a.$$

2. Write a MATLAB program that takes as input a real number  $x \in ]0, 20[$ , displays an error message if  $x \notin ]0, 20[$ , and otherwise computes and outputs the smallest integer  $n$  such that the partial sum  $S_n$  satisfies  $S_n > x$ , where

$$S_n = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}.$$

3. Write a program that computes and displays the 10<sup>th</sup> term of the Fibonacci sequence defined by

$$F_{n+2} = F_{n+1} + F_n,$$

where  $F_0 = 0$  and  $F_1 = 1$ .

### Exercise 3. (*MATLAB Functions*)

1. Write a function `pair` that determines whether an integer  $x$  is even.
2. Write the function `somme` that computes the sum of two matrices  $A$  and  $B$ .
3. Write the function `produit` that computes the product of two matrices  $A$  and  $B$ .

**Exercise 4. (MATLAB Functions)**

Consider the following MATLAB function, which contains two nested loops:

```
function M = calcul(M)
[n, m] = size(M);
for i = 1:n
    v = M(i, :);
    for j = 1:m
        M(i, j) = v(m - j + 1);
    end
end
end
```

1. Determine the value of  $B$  after executing the following instructions:

```
>> A = [1 2 3 4; 5 6 7 8; 9 10 11 12];
>> B = calcul(A)
```

2. Explain what the function `calcul` does.
3. Rewrite the function `calcul` to produce the same result using only a single loop.

**Exercise 5. (MATLAB Functions)**

1. Write a MATLAB function `produit` that takes as input two square matrices of the same dimension  $A$  and  $B$ , computes the matrix product  $A \times B$  **without using** the built-in operator `*`, and stores the result in matrix  $C$ . The function should then display  $C$ .
2. Write a MATLAB script that allows the user to enter two square matrices  $A$  and  $B$  of the same dimensions. The script must check whether their sizes are compatible. If not, it should display an error message and terminate with no output. If the dimensions are compatible, the script should compute the matrix expression

$$AB + BA$$

by calling the function `produit`, and again **without using** operations of the form  $A*B$  or  $A+B$ ; all computations must be performed using element-by-element assignments.

**Exercise 6. (MATLAB Functions)**

1. Write a MATLAB function **fact** that takes a positive integer  $N$  as input and returns  $N!$  as output, knowing that

$$N! = 1 \times 2 \times 3 \times \cdots \times N.$$

2. Write a MATLAB script that reads two numbers  $N$  and  $P$  and computes the quantity

$$\frac{N!}{P!(N-P)!}$$

using the function **fact**. The script should then display the result.