4. Lab 4

Vectors and matrices

R First, see in the lectures' part of the Laboratory manual (polycopié des TPs), the counterpart chapter of this Lab.

4

1. Consider the following matrix :

$$M = \begin{bmatrix} 6 & 9 & 12 & 15 & 18 & 21 \\ 4 & 4 & 4 & 4 & 4 & 4 \\ 2 & 1 & 0 & -1 & -2 & -3 \\ -6 & -4 & -2 & 0 & 2 & 4 \end{bmatrix}$$

   First, evaluate the following expressions without using Matlab, then check your answers with Matlab.
   (a) `A = M([1,3], [2,4])`
   (b) `B = M(:, [1,4:6])`
   (c) `C = M([2,3], :)`
2. Consider the following system of linear equations :

$$\begin{cases} 5x - 3y + 2z & = 10 \\ -3x + 8y + 4z & = 20 \\ 2x + 4y - 9z & = 9 \end{cases}$$

   (a) Solve this system of linear equations by Gauss-Jordan elimination (Use the substitution method or the combination or elimination method) ?.

(b) Check your results with Matlab's '\' operator ?.

3. Create the following matrices :

$$A = \begin{bmatrix} 12 & 17 & 3 & 4 \end{bmatrix} \qquad B = \begin{bmatrix} 5 & 8 & 3 \\ 1 & 2 & 3 \\ 2 & 4 & 6 \end{bmatrix} \qquad C = \begin{bmatrix} 22 \\ 17 \\ 4 \end{bmatrix}$$

   (a) Assign to the variable `x1` the value of the second column of the matrix `A`.
   (b) Assign the third column of the matrix `B` to the variable `x2`.
   (c) Assign the third line of the matrix `B` to the variable `x3`.
   (d) Assign to the variable `x4` the first three elements of the matrix `A` as its first row, and all the elements of the matrix `B` as its second, third and fourth rows.

4. If the matrix `A` is defined using the Matlab code `A = [1 3 2; 2 1 1; 3 2 3]`, which command will produce the following matrix ?

$$B = \begin{bmatrix} 3 & 2 \\ 2 & 1 \end{bmatrix}$$

5. Create the following matrices :

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 2 & 2 \\ -1 & 2 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix} \qquad C = \begin{bmatrix} 1 & 1 \\ 2 & 1 \\ 1 & 2 \end{bmatrix}$$

   (a) Do the following : `A+B`, `A*B`, `A+C`, `B*A`, `B-A`, `A* C`, `C-B`, `C*A`. what are the results ? What error messages are generated ? For what ?
   (b) What is the difference between `A*B` and `A.*B` ?

6. Solve the following systems of linear equations. Don't forget to check your solutions :

   (a)

$$\begin{cases} -2x + y &= 3 \\ x + y &= 10 \end{cases}$$

   (b)

$$\begin{cases} 5x + 3y - z &= 10 \\ 3x + 2y + z &= 4 \\ 4x - y + 3z &= 12 \end{cases}$$

   (c)

$$\begin{cases} x_1 - 2x_2 - x_3 + 3x_4 &= 10 \\ 2x_1 + 3x_2 + x_4 &= 8 \\ x_1 - 4x_3 - 2x_4 &= 3 \\ -x_2 + 3x_3 + x_4 &= -7 \end{cases}$$

7. Create a vector `t` that ranges from 1 to 10 with a step of 1, and a vector θ that ranges from 0 to π and containing 32 elements. Now calculate the following :

$$x = 2sin(\theta)$$
$$y = \frac{t-1}{t+1}$$
$$z = \frac{\sin(\theta^2)}{\theta^2}$$

■