Université Grenoble Alpes
MAP350 – L3 MI

TP1 : Introduction to Python

Exercise 1

Write in the simplest way the following vectors and matrices.

$$v1 = \begin{pmatrix} 5 & 6 & 7 & 8 & 9 & 10 \end{pmatrix} \quad v2 = \begin{pmatrix} 0 & 0 & 0 & 5 & 6 & 7 & 8 & 9 & 10 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$v3 = \begin{pmatrix} 0 & 1 & 2 & 3 & 4 & 9 & 7 & 5 & 3 & 1 \end{pmatrix}$$

$$M1 = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix} \quad M2 = \begin{pmatrix} 1 & 3 & 5 & 7 & 9 \\ 8 & 6 & 4 & 2 & 0 \\ 8 & 6 & 4 & 2 & 0 \end{pmatrix} \quad M3 = \begin{pmatrix} 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 2 & 3 & 4 & 5 \end{pmatrix}$$

Exercise 2

Write in the simplest way the following matrix.

$$M4 = \begin{pmatrix} 2. & 1. & 0. & 0. & 0. & 0. & 0. & 0. \\ 1. & 4. & 1. & 0. & 0. & 0. & 0. & 0. \\ 0. & 1. & 4. & 1. & 0. & 0. & 0. & 0. \\ 0. & 0. & 1. & 4. & 1. & 0. & 0. & 0. \\ 0. & 0. & 0. & 1. & 4. & 1. & 0. & 0. \\ 0. & 0. & 0. & 0. & 1. & 4. & 1. & 0. \\ 0. & 0. & 0. & 0. & 0. & 1. & 4. & 1. \\ 0. & 0. & 0. & 0. & 0. & 0. & 1. & 2. \end{pmatrix}$$

Exercise 3

Triangle of Pascal. Write a program in Python computing each line " n" of the triangle of Pascal for $0 \leq n \leq N_{\max}$ as below.

```
Enter N_max : 7
n = 0 :  [ 1.]
n = 1 :  [ 1.  1.]
n = 2 :  [ 1.  2.  1.]
n = 3 :  [ 1.  3.  3.  1.]
n = 4 :  [ 1.  4.  6.  4.  1.]
n = 5 :  [  1.   5.  10.  10.   5.   1.]
n = 6 :  [  1.   6.  15.  20.  15.   6.   1.]
n = 7 :  [  1.   7.  21.  35.  35.  21.   7.   1.]
```

Exercise 4

Sieve of Eratosthenes. Write a program in Python allowing to determine all the prime numbers lower than $N_{\max}$, with an algorithm using the "sieve of Eratosthenes".

```
Enter N_max : 154
[  2   3   5   7  11  13  17  19  23  29  31  37  41  43
```

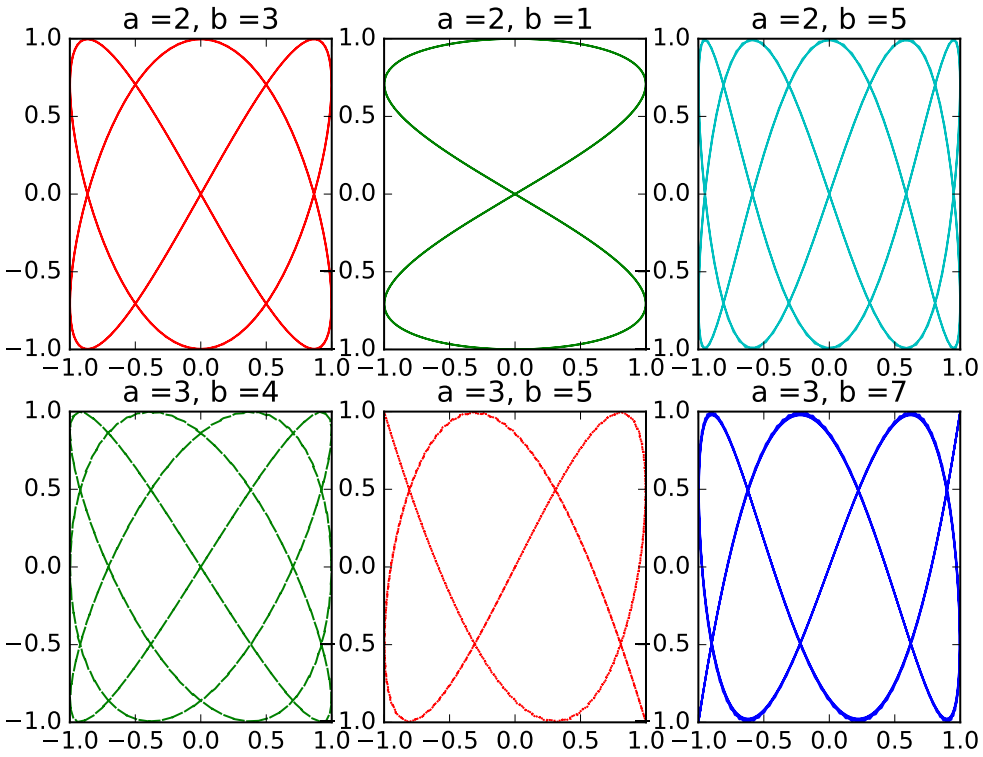
```
   47  53  59  61 67  71  73  79  83  89  97 101 103 107
   109 113 127 131 137 139 149 151]
```

Exercise 5

Write a Python program to draw the Lissajous curves $t \in [0, 2\ \pi] \mapsto (\sin(a\,t), \sin(b\,t))$, *as shown in the figure below. For this purpose, create the file* `exoLissajousTools.py` *given below and create a second Python file* `exoLissajousDrawing.py` *using the function "sinatsinbt".*

```python
# File exof41LissajousTools.py
import numpy as np

def sinatsinbt(t,a,b):
    x = np.sin(a*t)
    y = np.sin(b*t)
    return x,y
```



Le compte rendu de ce TP consistera en un fichier pdf dont le nom sera `TP1_NOM1_NOM2.pdf`
Ce fichier pdf contiendra en entête les noms NOM1 et NOM2, puis
— le script Python demandé pour chacun des exercices
— la sortie graphique demandée dans le dernier exercice.