EE-527: Machine Learning Laboratory Due Date: 16 Jan 2022

Assignment 1: Python Basics

- 1. Print 'Hello World!'.
- 2. User input two numbers a and b. Perform the following algebraic operations c = a+b, d= a-b, e= a*b, f=a/b and g=a%b and print their results.
- 3. Print the factorial of a positive number 'a' given as a user input.
- 4. Write a function to print all prime numbers in an interval [a,b]. Interval is to be obtained as a user input.
- 5. User input two numbers a and b. Print their lowest common multiple (LCM).
- 6. Create a list of length n = 15. Sort in descending order and print the sorted list as well as the sorted indices. Use bubble sort algorithm.
- 7. Repeat the previous program for sorting in ascending order. Use numpy array instead of list.
- 8. Print a matrix $M \in \mathbb{R}^{m \times n}$ having random values in the given range [-2, 5]. m and n are to be given as a userinput.
- 9. Program to multiply two random matrices $M1 \in \mathbb{R}^{m \times n}$, $M2 \in \mathbb{R}^{n \times p}$ (Don't use built-in functions). Compare the result obtained with the built-in function.
- 10. File operations :write
 - O Generate a set of n=100 random points $\mathbf{X} = \{\mathbf{x}_i\}, i = 1, ..., n, \mathbf{x}_i \in \mathbf{R}^{10}$
 - O Write the points to a csv (https://en.wikipedia.org/wiki/Comma-separated values) file
- 11. File operations:read
 - O Read the csv (https://en.wikipedia.org/wiki/Comma-separated_values) file generated in the previous program to a matrix. Each column of the matrix should represent a vector
 - o Compute the following: $\mathbf{C} = \frac{1}{n} \sum_{i=1}^{n} (\mathbf{x}_i \mu)(\mathbf{x}_i \mu)^T$, where $\mu = \frac{1}{n} \sum_{i=1}^{n} \mathbf{x}_i$, $i = 1, ..., n, \mathbf{x}_i = [x_{i1}, ..., x_{i10}]^T$ is a column vector
- 12. Define a class for a complex number a+jb. Define member functions to do basic operations conjugate, absolute value, addition, subtraction, multiplication, division and angle. Define two complex numbers c1, c2 and print the results of the following operations c1+c2, c1-c2, c1+c2, c1+c2, c1+c2, c1+c2.
- 13. Plot the function y = 3x + 2 with $x \in [-10, 10]$.

14. Scatter plot

O Generate a set of n=100 points, $\mathbf{X}=\{\mathbf{x}_i\}, i=1,\dots n, \mathbf{x}_i \in \mathbf{R}^2$ within an ellipse $\frac{(x-\mu_x)^2}{a^2}+\frac{(y-\mu_y)^2}{b^2}$ centered at $[\mu_x, \mu_y]=[5, -5]$ and has a major axis 2a=10 and minor axis 2b=5

O Scatter plot all the points.