Artificial Intelligence Lab 1 : Python Introduction

import numpy as np

Q1) **Random Number Generation** [25 Marks]

Use the following to generate random integers and uniform random numbers in interval $[0, 1)$.

np.random.randint

np.random.rand

Q2) **Operations with Vectors** [40 Marks]

a) [20 Marks]: Generate a data set of $n = 100$ points of form $(x_i, y_i)_{i=1}^{n}$ in the 2-dimensional plane in the interval $[-1, 1) \times [-1, 1)$. Here (x, y) means points are in 2-dimensions, and the subscript i in (x_i, y_i) means it is the i^{th} data point.

b) [10 Marks]: Given a point (x_{new}, y_{new}) find $k = 5, 10, 15$ nearest point in the data set generated in part a). Distance between point in data set and the new point is given by $\sqrt{(x_i - x_{new})^2 + (y_i - y_{new})^2}$. Can you find a better command in numpy to do this? (Hint: Search in np.linalg). Implement this as a separate function.

c) [10 Marks]: Given a point (x_{new}, y_{new}) find $k = 5, 10, 15$ points in the data set generated in part a) that make a positive angle with the new point. Implement this as a separate function.

Q3) **Plotting** [30 Marks]

a) [15 Marks] Plot the data set in blue and the k points obtained in Q2 a) and Q2 b) in blue.

b) [15 Marks] Generate $n = 100$ random integers and plot their histogram.

Q4)[20 Marks] Generate $n = 100$ random points in the interval $[0, 1)$. Plot the sample mean given by

$$x_k = \frac{x_1 + \ldots + x_k}{k} \tag{1}$$

Using matplotlib plot x_k, and also plot the functions $f_1 = \sqrt{\frac{1}{k}}, f_2 = -\sqrt{\frac{1}{k}}$