CS454-554 Homework 3: Single- and Multi-Layer Perceptrons for Regression Spring 2022/2023

In this homework, you will implement single- and multi-layer perceptrons for regression. As usual, you are provided with two dataset files and **train.csv** file will be used for training and **test.csv** file will be used for testing. Each row of the files corresponds to one instance with input and desired output. You have 20 instances for training and 80 instances for testing.

You should implement the back-propagation algorithm (without using any machine-learning library) to train the following four networks:
 a) Single-layer perceptron
 b) Multi-layer perceptron with one hidden layer of 10 hidden units,
 c) Multi-layer perceptron with one hidden layer of 20 hidden units,
 d) Multi-layer perceptron with one hidden layer of 50 hidden units.

You will have to do some trial-and-error to adjust the number of epochs and the learning rate. Don't forget to include the bias nodes in the input layer and the hidden layer!

Your output and report should contain:
 a) Four figures for your network's output after convergence, plotted together with the training data (just like you did in Hw#1 on polynomial regression).
 b) A plot of network complexity vs error. The y axis should correspond to the training and the test MSE and the x axis corresponds the number of hidden units, with $x=0$ for the single-layer perceptron

This homework is due **May 10th (Wednesday), 23:00**.

Your submission should include a short report of your findings and your source code.

You can use Python or Matlab. You are **NOT** allowed to use external libraries (e.g., sklearn, tensorflow, pytorch). You can only use libraries like numpy for vector multiplication, vector summation and random number generation.

Upload your submission as one **zip file** that includes a **.pdf** file of your report and a **.py** or a **.m** file for your code. Your executable code should be named NAME_SURNAME_HW3.py/m. If your code does not compile, you will receive 0 points from the coding part of the assignment!