Part B Report

Name: John Doe (replace with your own name and delete this instruction!)

Assignment 6: Perceptron Classification and Training

CSE 415 Introduction to Artificial Intelligence, Winter 2023, University of Washington

Please answer each question using text in Blue, so your answers stand out from the questions.   
Note: If not otherwise specified, use the default parameters present in the code to answer the questions.

B1. How many epochs were required to train your perceptron on the 3-class Iris data having 4 features (the given training file, with 30 examples)? How many of the test data examples (out of 120) were mis-classified? Determine the percentage error rate and write that here.

B2. Capture the plot that is produced by the program showing the training data and the weight vectors when projected onto the 2-D subspace spanned by sepal length and petal length (which is the starter-code default in run\_3\_class\_4\_feature\_iris\_data.py. Paste it here, reduced to fit in the remaining space on this page.

B3. In the file run\_3\_class\_4\_feature\_iris\_data.py, now modify the code so you can see the data projected onto the subspace spanned by features 2 and 3 (petal length and petal width). Describe the how the data seems to be distributed in this view. Describe how the weight vectors seem to be pointing. Finally, describe the relationship between the weight vectors and the distribution of the data.

B4. In the file run\_3\_class\_4\_feature\_iris\_data.py, instead of using all zero weight, let

W = [[1, 1, 1, 1, 1], [-1, -1, -1, -1, -1], [0, 0, 0, 0, 0]]. Now, for learning rates starting from 1e-3 to 1e+3 (all powers of 10), investigate how many epochs it takes for the model to converge. (You may similarly investigate the model for other initializations of W if you wish). Also, find the number of errors on the test set for each ternary perceptron. What kinds of trends do you observe?

B5. Using the file run\_synth\_data\_ternary.py, capture the plot of the ternary perceptron for the synthetic dataset and paste it here. (Let the maximum number of epochs be 50 and learning rate 0.5, and the weights be all zeros).

B6. Using the file run\_synth\_data\_1\_vs\_all.py, capture the plots of all the One-Vs-All classifiers for the synthetic data and paste them here. (Let the maximum number of epochs be 50 and learning rate 0.5).

B7. Using the file run\_synth\_data\_1\_vs\_1.py, capture the plots of all the One-Vs-One classifiers for the synthetic dataset and paste them here. (Let the max number of epochs be 50, and learning rate 0.5)

B8. Using the One-Vs-All classifier, classify the point [6.78, -0.12] as either in class 0, 1, or 2. Briefly explain how you got that class using the individual classifiers. Repeat the same process for One-Vs-One.