Q5.)

a & c.) For each classifier, you should report the accuracy of the prediction, where accuracy is the percentage of the correctly classified instances. The accuracy needs to be reported for each iteration (or epoch). Note that you do not need to separate the dataset to training and testing. The accuracy can be reported for different iterations.

Ans.) The program was created in a way that the two datasets are trained and tested and able to predict the errors in the dataset by comparing the datasets with the different classifiers.

Perceptron Classifier: (For IRIS Dataset)

Iris Dataset Classes:	Accuracies (in Percentage)	Prediction Failures
Iris-setosa	100.0%	Failed to predict 0 samples
Iris-versicolor	53.333333333333336%	Failed to predict 21 samples
Iris-virginica	93.33333333333333%	Failed to predict 3 samples

(For Wine Dataset)

Wine Dataset Classes:	Accuracies (in Percentage)	Prediction Failures
1	100.0%	Failed to predict 0 samples
2	96.29629629629629%	Failed to predict 2 samples
3	98.14814814814815%	Failed to predict 1 samples

Adaline Classifier: (For IRIS Dataset)

Iris Dataset Classes:	Accuracies (in Percentage)	Prediction Failures
Iris-setosa	100.0%	Failed to predict 0 samples
Iris-versicolor	68.88888888888889%	Failed to predict 14 samples
Iris-virginica	88.88888888888889%	Failed to predict 5 samples

(For Wine Dataset)

Wine Dataset Classes:	Accuracies (in Percentage)	Prediction Failures
1	98.14814814814815%	Failed to predict 1 samples
2	98.14814814814815%	Failed to predict 1 samples
3	96.29629629629629%	Failed to predict 2 samples

SGD Classifier: (For IRIS Dataset)

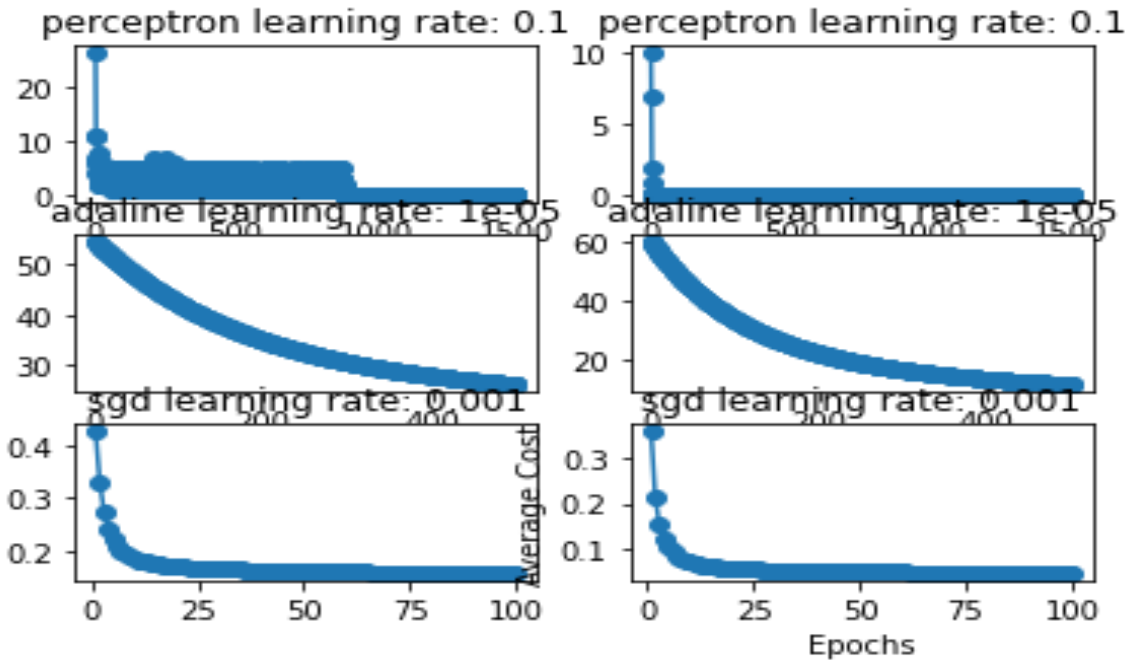
Iris Dataset Classes:	Accuracies (in Percentage)	Prediction Failures
Iris-setosa	100.0%	Failed to predict 0 sample
Iris-versicolor	66.66666666666666%	Failed to predict 15 samples
Iris-virginica	84.44444444444444%	Failed to predict 7 samples

(For Wine Dataset)

Wine Dataset Classes:	Accuracies (in Percentage)	Prediction Failures
1	100.0%	Failed to predict 0 samples
2	96.29629629629629%	Failed to predict 2 samples
3	100.0%	Failed to predict 0 samples

b.) For each classifier, please report the errors or costs in each iteration and plot figures for the errors/costs for all the iterations.

Ans.) Plot Figures for Error Rates in each Epoch:



Error or Cost Rates in each Epoch for different Classifiers

As we can see in the above image, the plots are classified for different classifiers with their cost rates in each epoch for different Datasets.

The left-side Plots are the plots for the IRIS Dataset and the right-side Plots are for the Wine Dataset. We can see that for both the dataset plots, different classifiers has different Cost or Error Rates for each Epoch.

d.) Properly analyze the classifiers behaviour. For example, how do your classifiers converge? what is the effect of feature scaling to your classifiers.

Ans.) In the Plots in the above image we can see that the classifiers converge in the Perceptron according to the Epochs, as each Epoch gradually converges in both the Datasets. The convergence rate in the Adaline is higher as it converges in every Epoch for both the Datasets. The convergence rate in SGD is slightly better than that of the Perceptron as it also converges gradually at each Epoch in both the Datasets.

By using feature scaling It helped me avoid the problem of exploding gradients.

e.) Analysis on any other aspects that are not mentioned above and that you think important. For example, the effect of different learning rates on model convergence.

Ans.) The aspect that helped me is by using feature scaling it helped me avoid the problem of exploding gradients. By taking different learning rates it helped me understand the classifiers models better with their convergence for example as the above Plot Figures. It helped me understand that the convergence depends on the learning rate of the models for each Epoch.

Q7.) Implement a multiclass classifier using One-vs-Rest strategy and the SGD binary classifier. Properly test the classifier using Iris data set and another dataset with more than two class labels. Your second dataset should be from UCI machine learning repository. Include a proper analysis for this multiclass classifier in the report.

Ans.)

Test Accuracy for each model and dataset

	iris	wine
perceptron	1.0	1.0
adaline	1.0	0.9814814814814815
sgd	1.0	1.0

Multiclass-classifier accuracies on different Datasets

From the above image we can see the accuracy scores for the multiclass-classifier using One-vs-Rest strategy for both the datasets. By using the multiclass-classifier we are able to tell clearly that the Accuracy percentage is higher for both the datasets in all the classifiers compared to that of the binary-classifiers.