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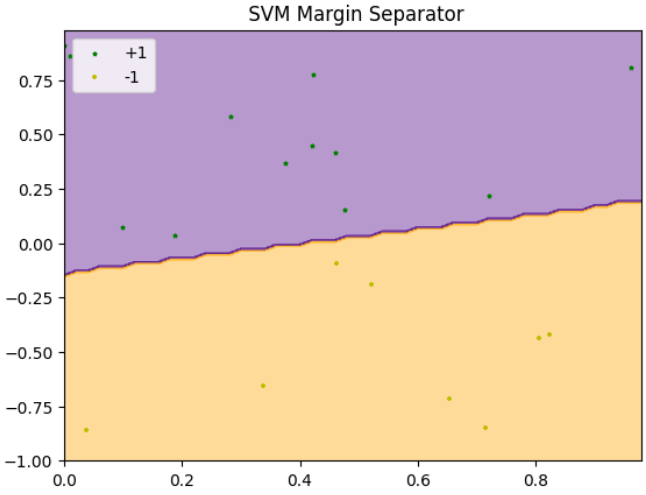
ENPM808A: Introduction to Machine Learning

Homework 4

Problem 2

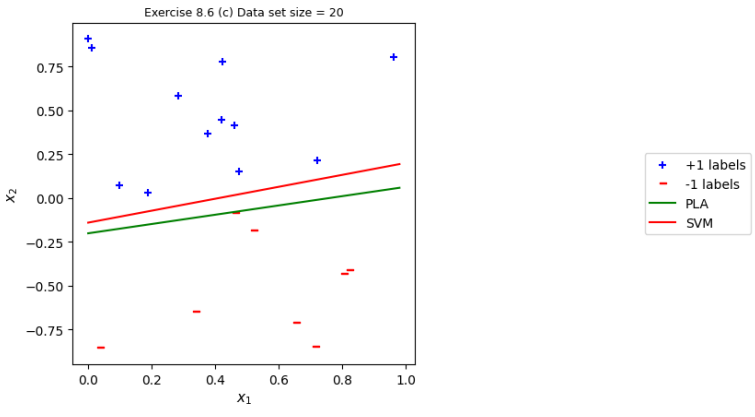
a) The Margin Separator



b) One ordering of data points that will result in a hyperplane with bad E_out when PLA runs is **one positive point on the left** and **one negative on the right lower corner of the plot**, so their perpendicular bisector separating plane is a bad separator. We need to put them at the points' end so the PLA algorithm will have no chance to adjust the separating line using other points. In this case, it took 23 iterations to make PLA converge. But the convergence of the PLA does not intend that the PLA works properly.

c)

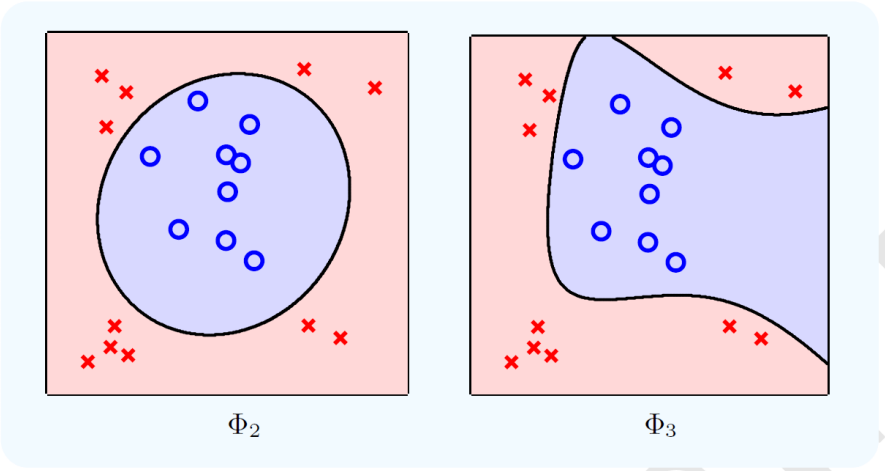
```
Number of positive points: 12
Number of negatives points: 8
Final correctness: 20
Total iteration: 33
Final w: [ 1.        -1.31863186  4.9749975]
Out-of-Sample Error: 0.04
```



Problem 4

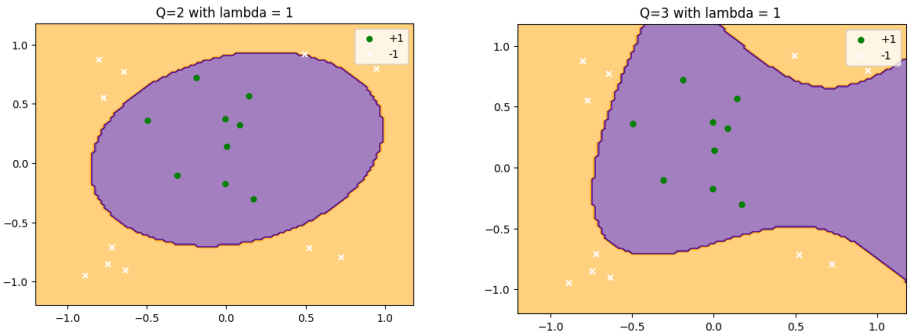
Answer: [Check the attached code to verify]

a)



b) The fit with Q=3 looks like it has been overfitted. It's more complicated and seems to fit the on the far right too much.

c) After adding regularization



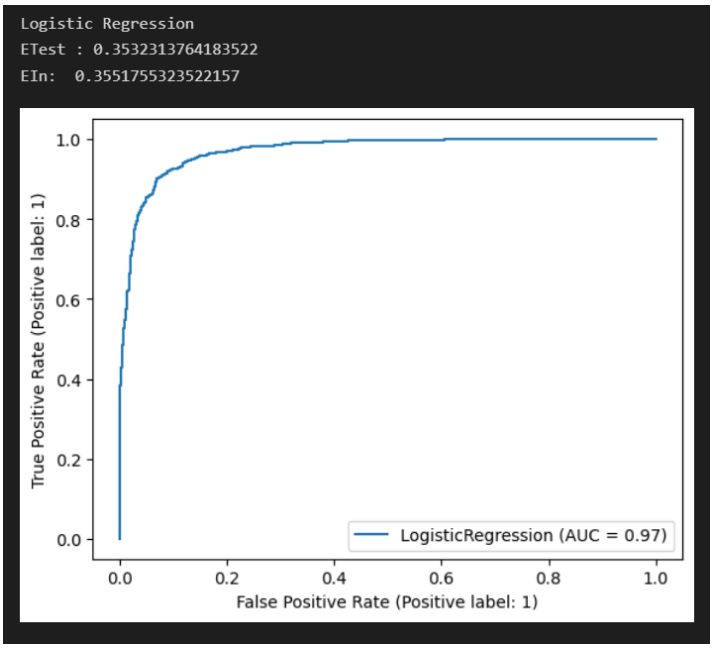
Problem 5

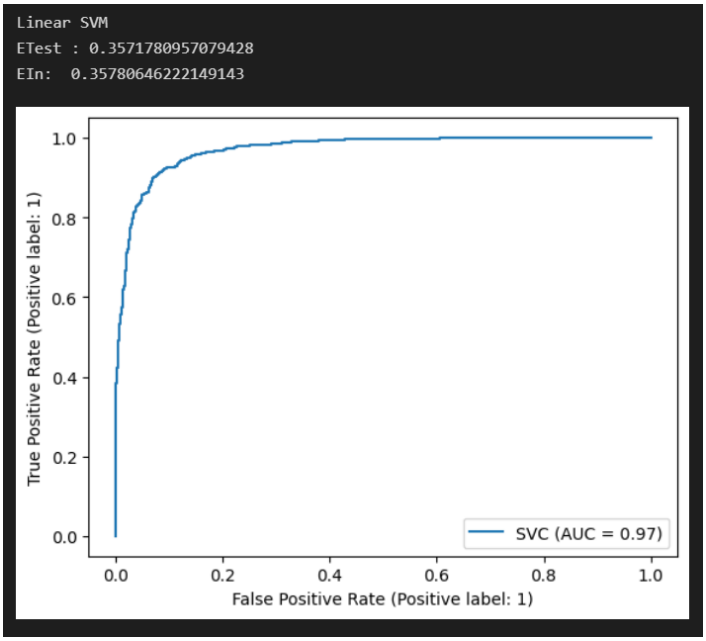
[Check the attached code for the ML pipeline followed]

Steps:

Load the data → Preprocess the data → Process the data → Fit the model for the train data → Test on the test Data → Calculate the errors and verify the accuracy of the model

I chose logistic regression as the linear model here.





```
Neural Network
ETest : 0.34336457819437594
EIn:  0.3528734687165995
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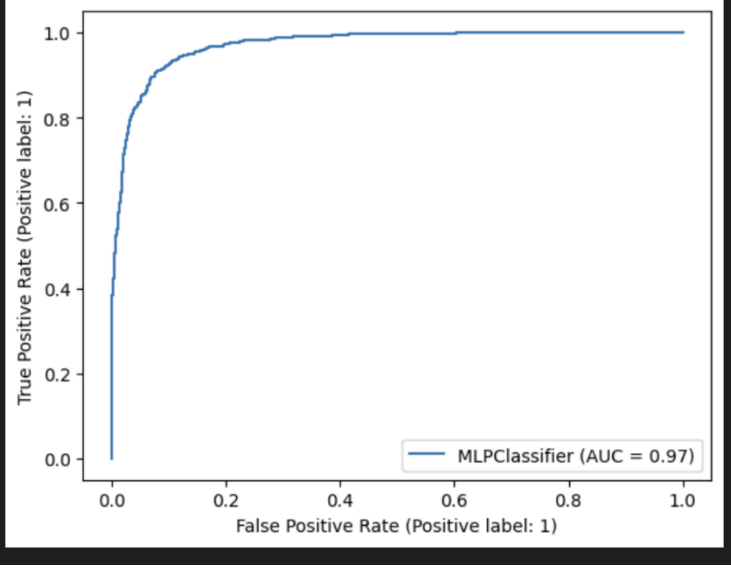

__Thank You__