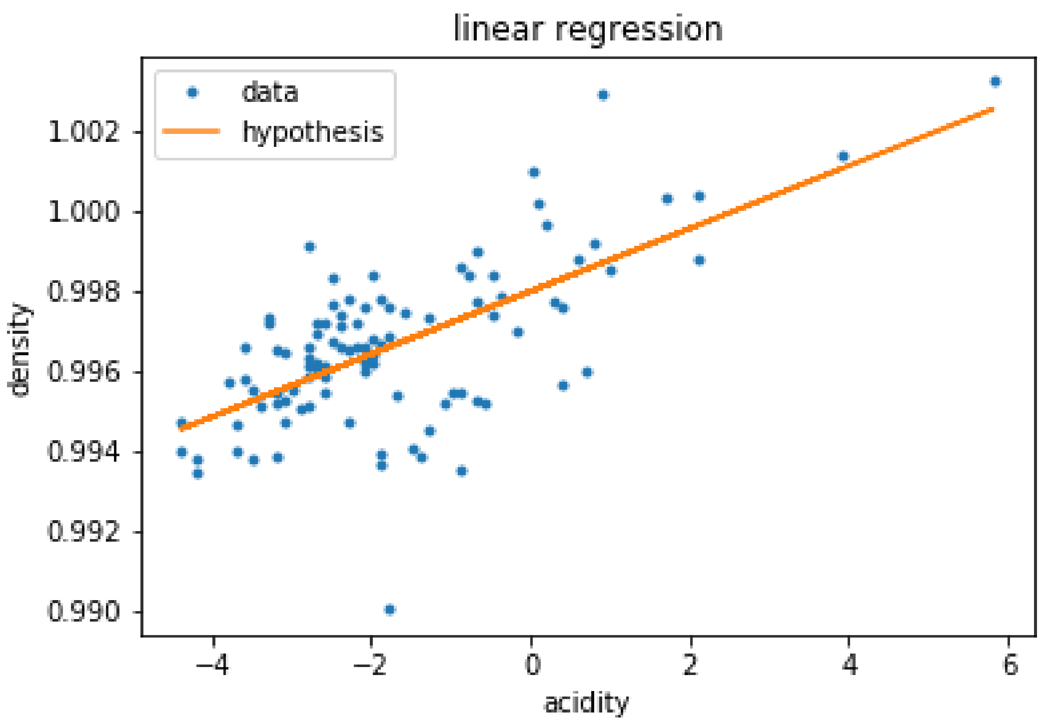
ASSIGNMENT 1

QUESTION1 : LINEAR REGRESSION:

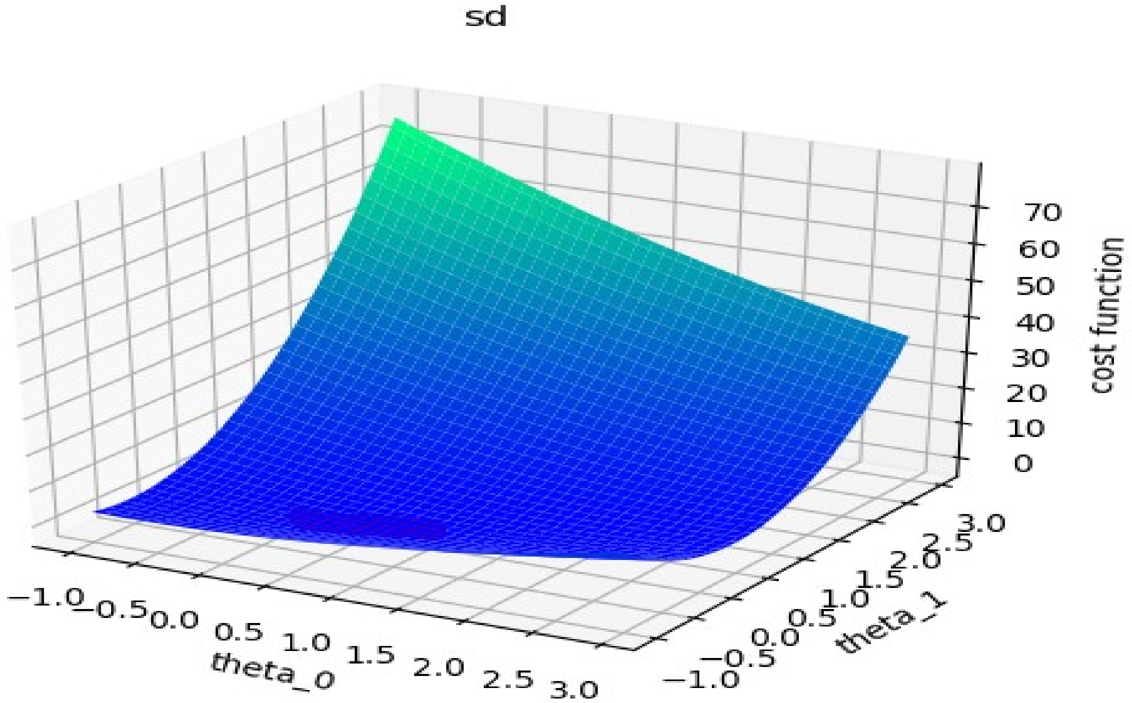
PART-A

STOPPING CRITERIA: COST_FUNCTION[i]-COST_FUNCTION[i+1]<10**-12)
FINAL PARAMETERS: [9.97954209e-01],[7.75857046e-04]
LEARNING RATE: .00025
FINAL COST: 1.1948325601183433e-06

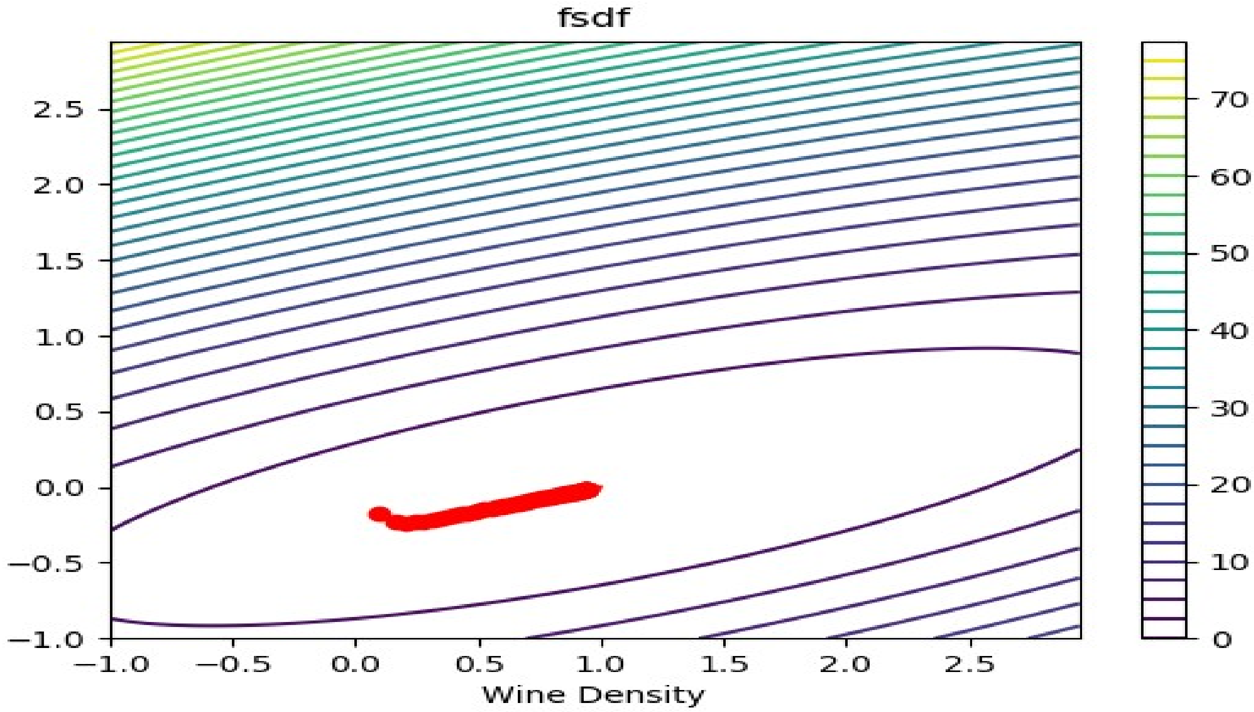
PART-B



PART-C


sd
cost function
70
60
50
40
30
20
10
0
theta_0
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
theta_1
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0

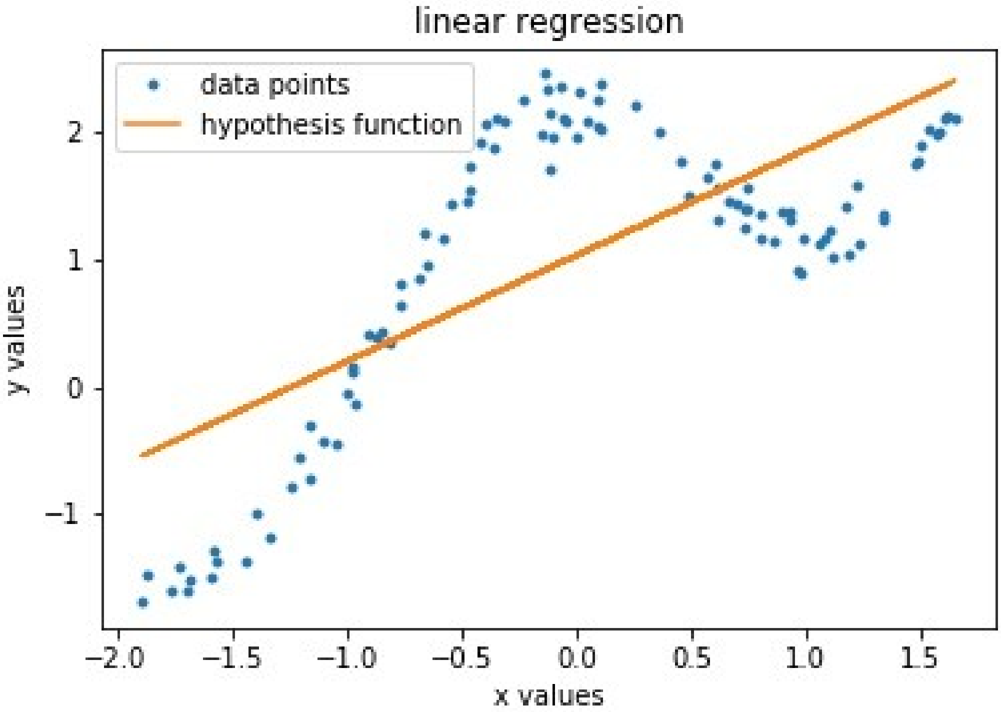
PART-D


fsdf
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
Wine Density
70
60
50
40
30
20
10
0

PART-E: `when the learning rate is too large then the cost function moves around minima but it never reaches minima`

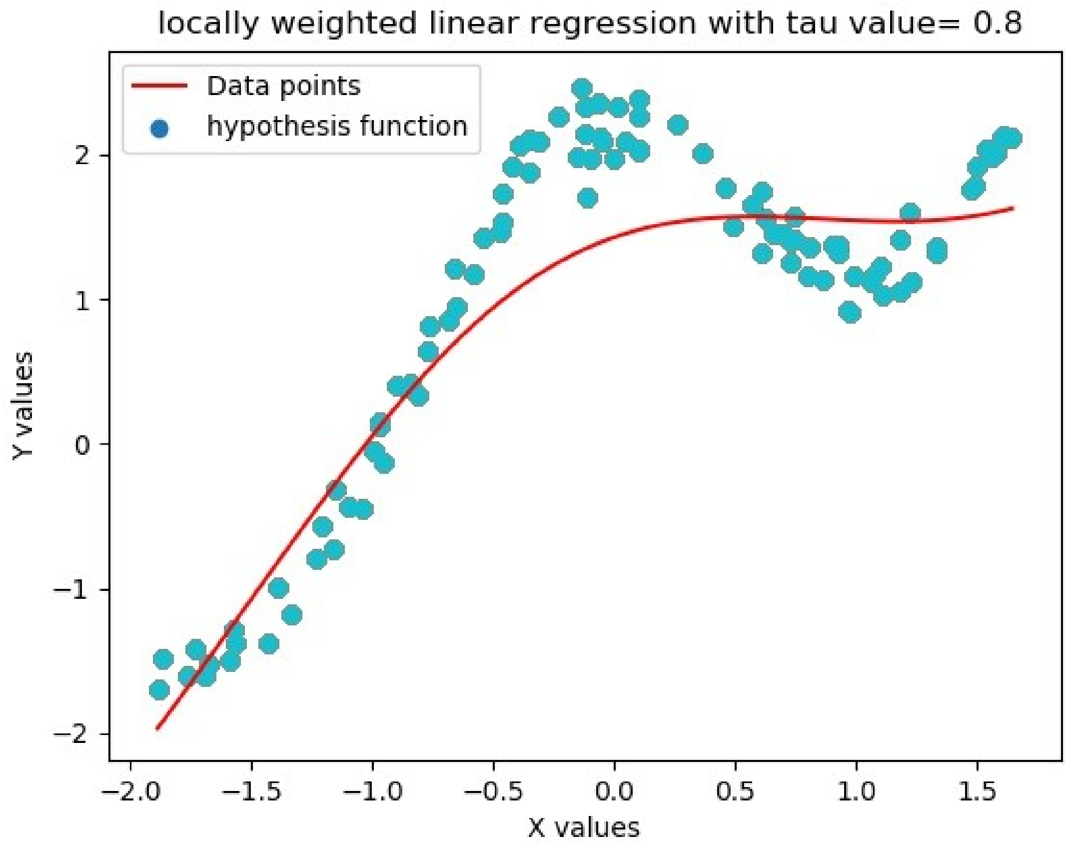
QUESTION2 : LOCALLY WEIGHTED LINEAR REGRESSION

This shows that the linear regression doesn’t fit this kind of data because it can only

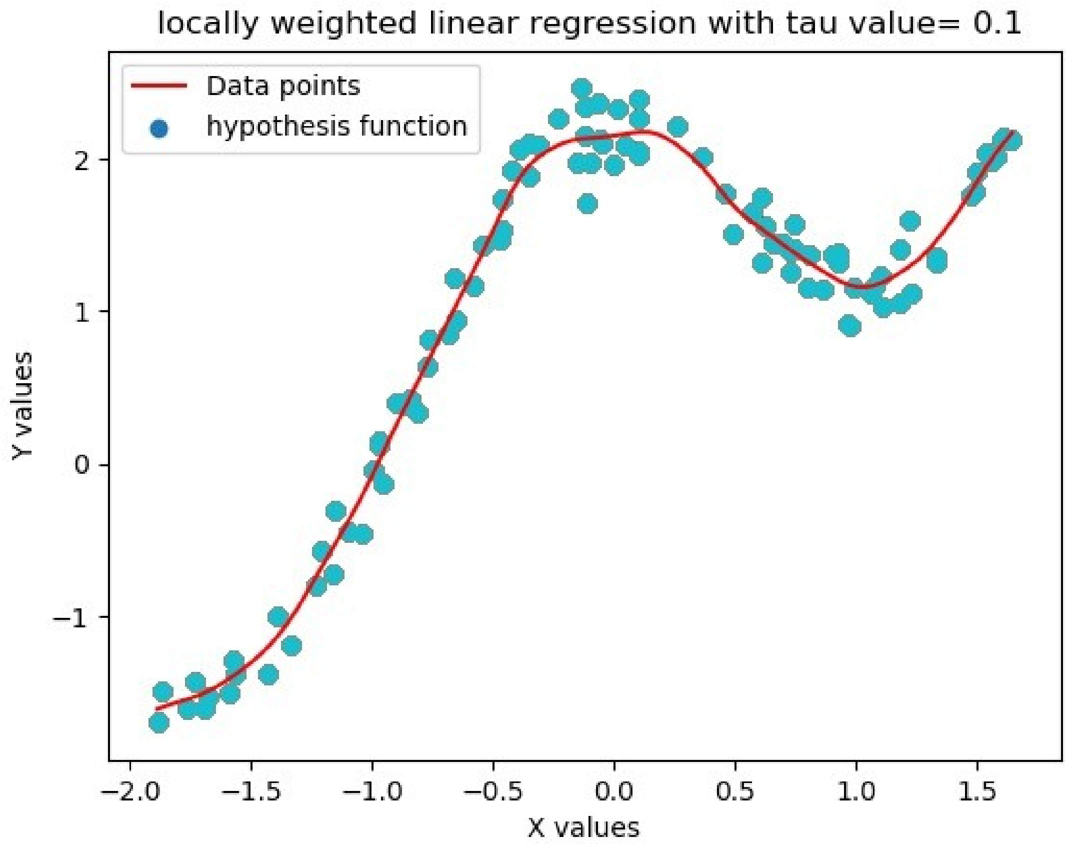


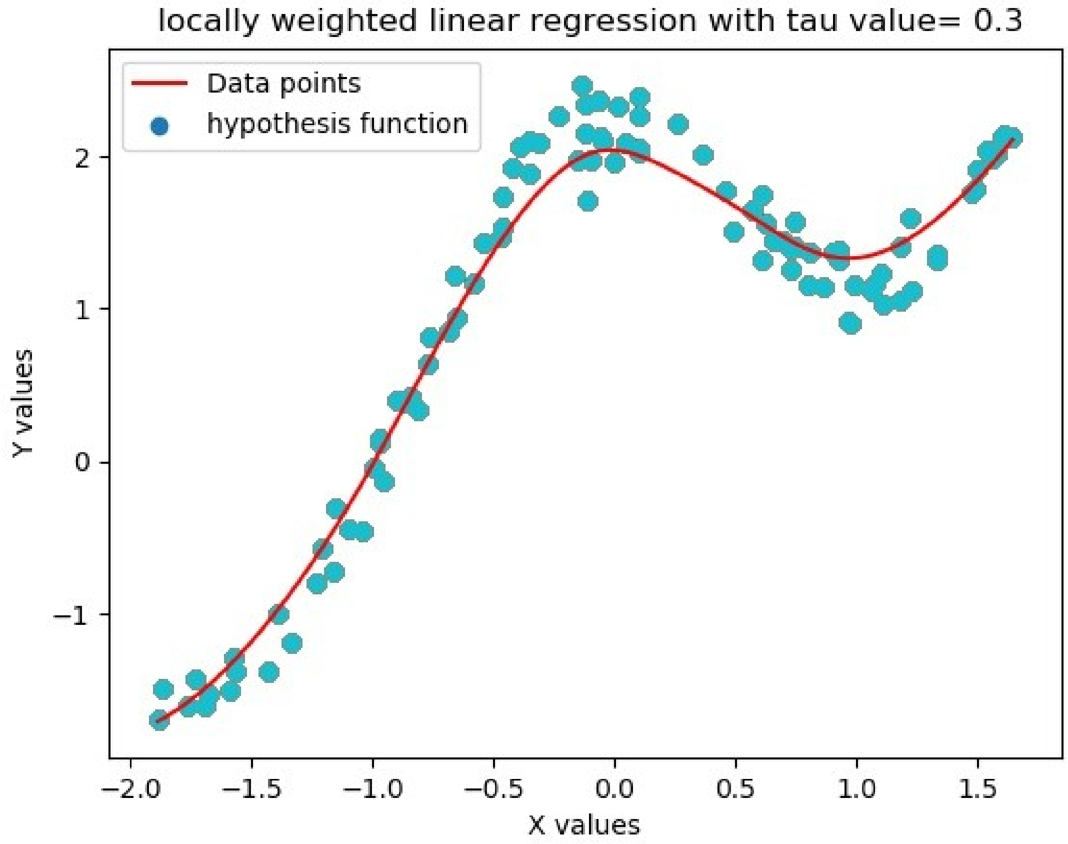
fit straight line to the data.

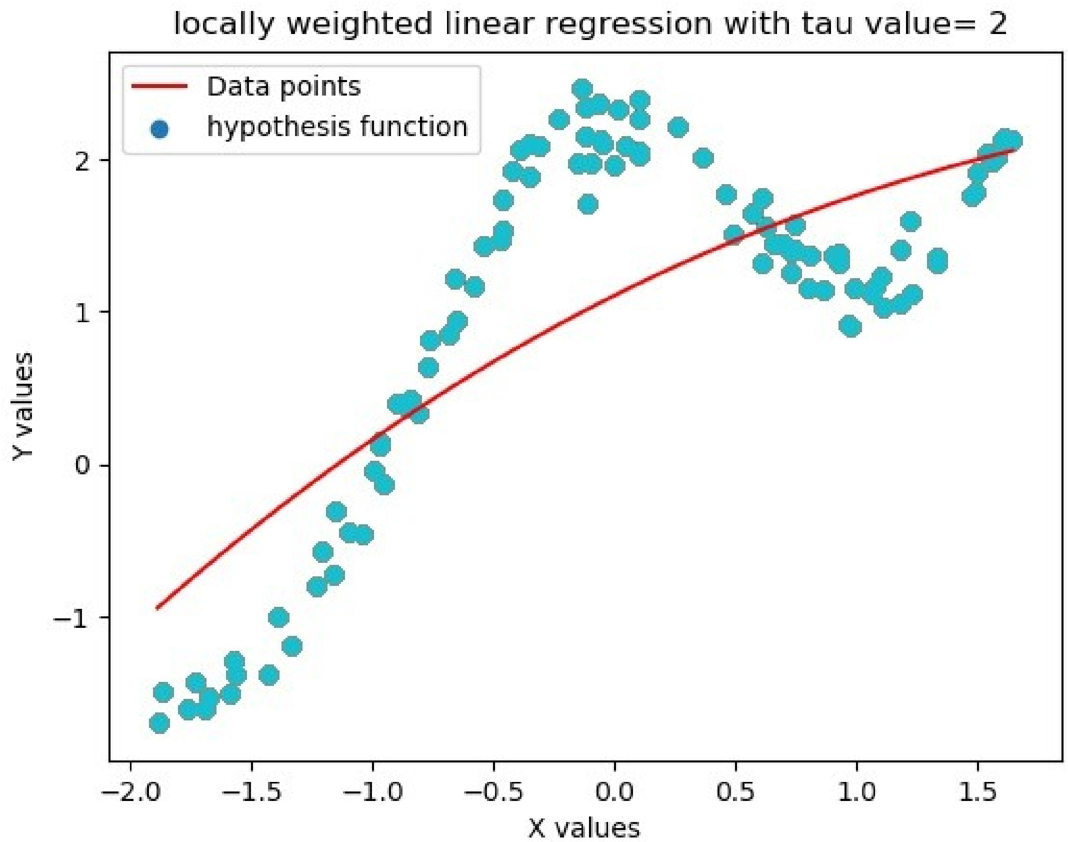
PART-B

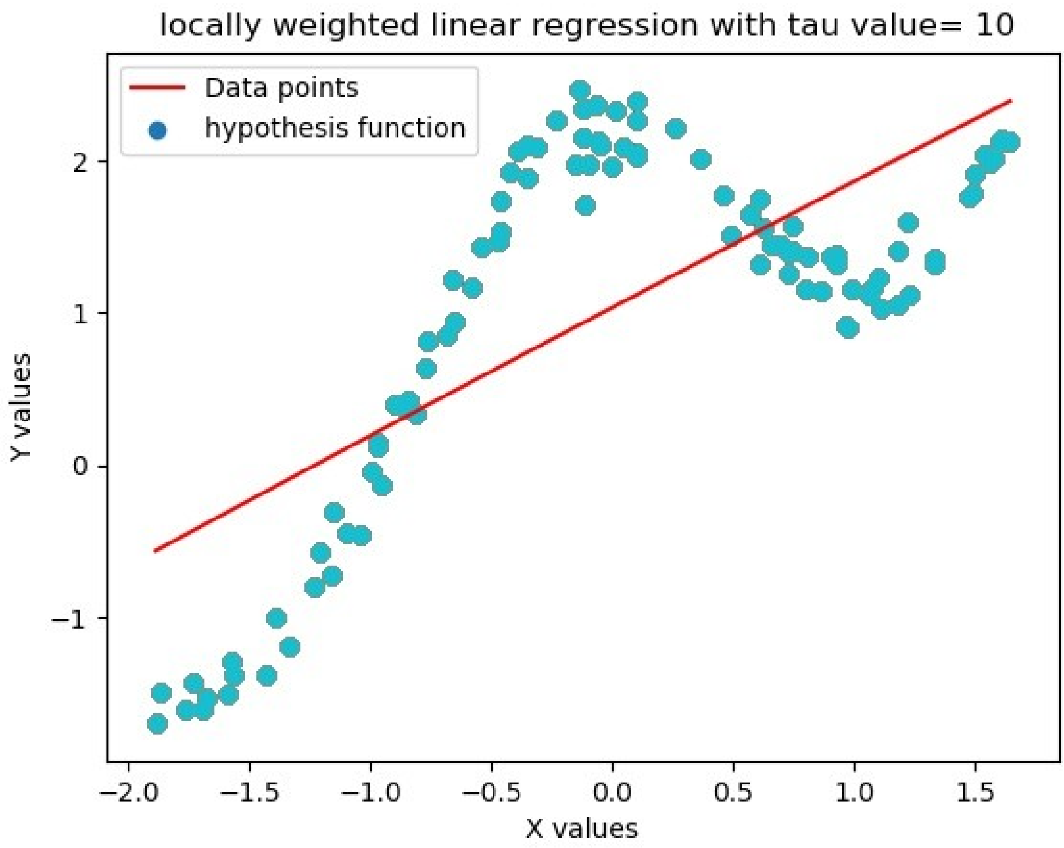

locally weighted linear regression with tau value= 0.8
Data points
hypothesis function
Y values
X values
2
1
0
−1
−2
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5

PART-C


locally weighted linear regression with tau value= 0.1
Data points
hypothesis function
Y values
X values
2
1
0
−1
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5


locally weighted linear regression with tau value= 0.3
Data points
hypothesis function
Y values
X values
2
1
0
−1
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5


locally weighted linear regression with tau value= 2
Data points
hypothesis function
Y values
X values
2
1
0
−1
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5



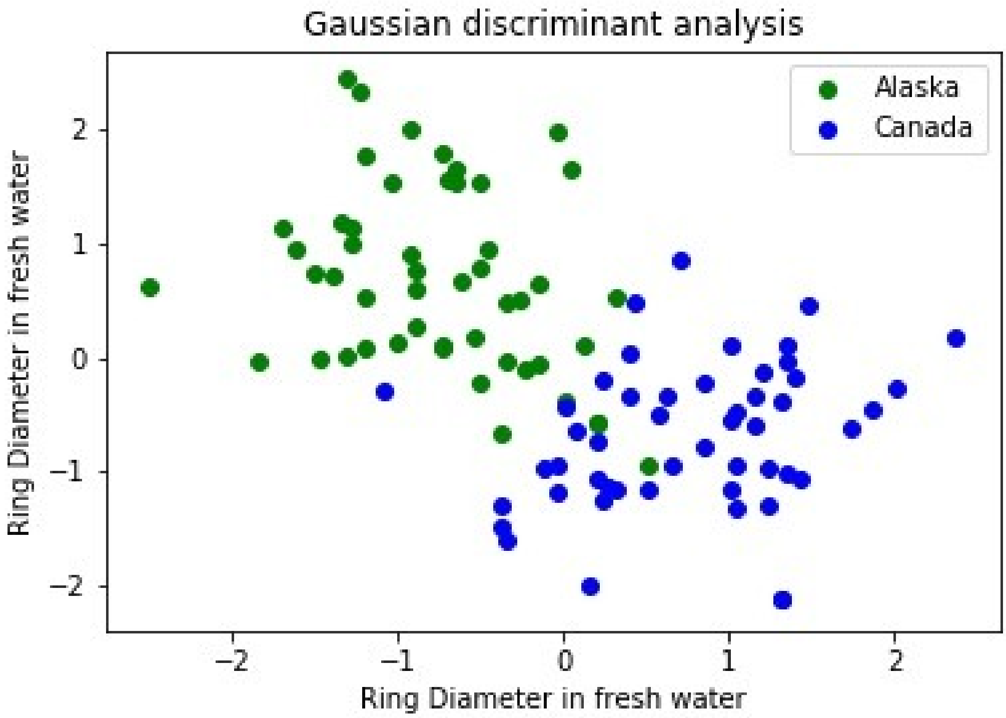
When tau is very small then the weights become near to zero and it overfits the data.
When tau is very large then the weigthts become near to one and it becomes just like linear regression.
Tau=0.3 gives the best hypothesis functiion

QUESTION3
PART-A:
`the final values of parameters are [ 0.22329537  1.96261552 -1.9648612 ]`
part-b:

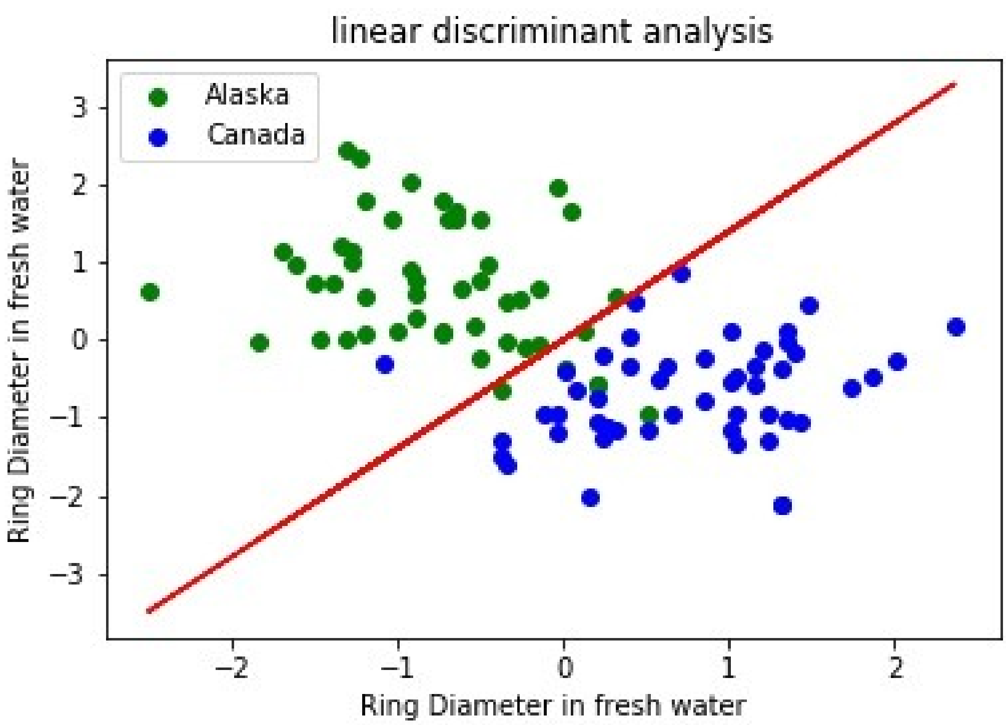
QUESTION-4:
linear discriminat analysis

```
mean of first class is:[-0.75529433  0.68509431]

mean of second class is:[ 0.75529433 -0.68509431]

covariance matrix is:[[ 0.42953048 -0.02247228]
                      [-0.02247228  0.53064579]]
```

part-b



part-c



boundary equation:
AX+B=0
A=pinv(COVARIANCE MATRIX).dot(mean0-mean1)
B=(-1/2)*(np.transpose(mean0+mean1).dot(pinv(covariance_matrix).dot(mean0-mean1)))

PART-D
GAUSSIAN DISCRIMINANT ANALYSIS

mean of first class is:[-0.75529433 0.68509431]

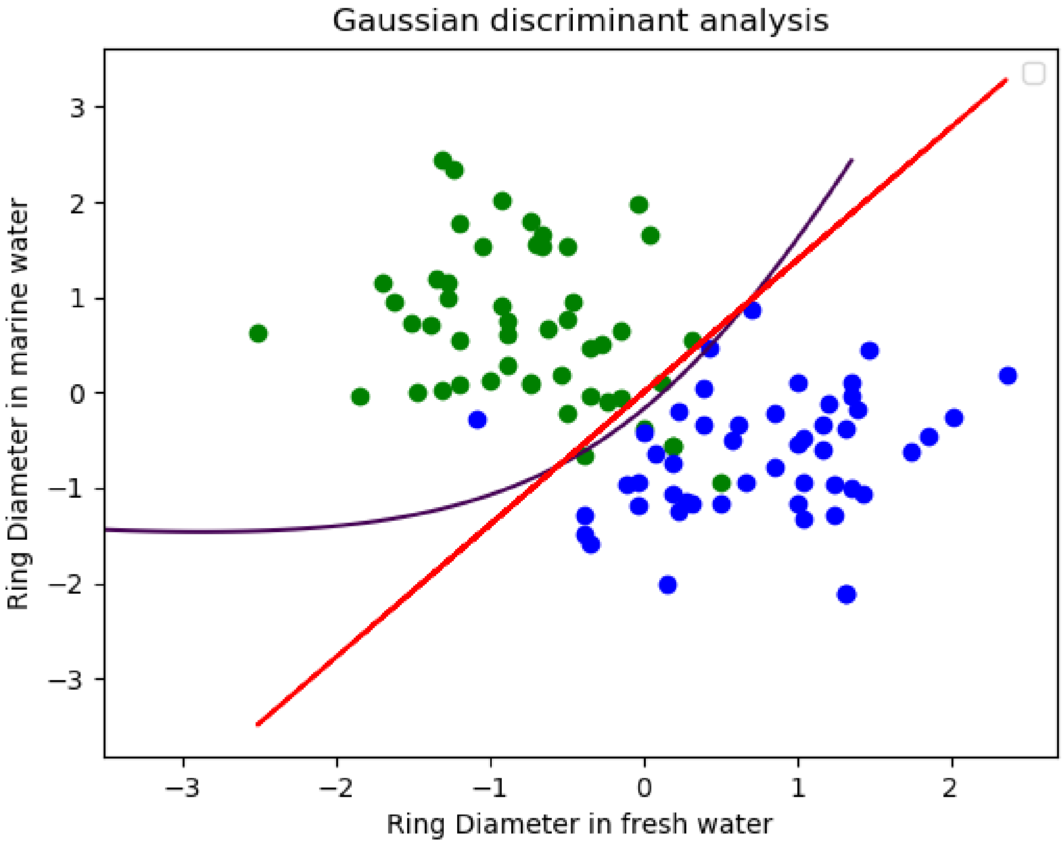
mean of second class is:[0.75529433 -0.68509431]

covariance matrix of first class is:[[0.38937733 -0.15802567]
[-0.15802567 0.6609563]]

covariance matrix of second class is:[[0.48721548 0.11216388]
[0.11216388 0.4219943]]

PART-E
X(TRANS)AX+BX+C=0
A=inv0-inv1
B=-2*(np.transpose(mean0).dot(inv0)-np.transpose(mean1).dot(inv1))
C=np.transpose(mean0).dot(inv0).dot(mean0)-
np.transpose(mean1).dot(inv1).dot(mean1)-2*np.log((0.5/0.5)*(det1/det0))

PA
Th
lin n
cl



Gaussian discriminant analysis
Ring Diameter in marine water
Ring Diameter in fresh water
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2