University of North Carolina at Charlotte
Department of Electrical and Computer Engineering

Linear Regression Report HW#0

Linear Regression

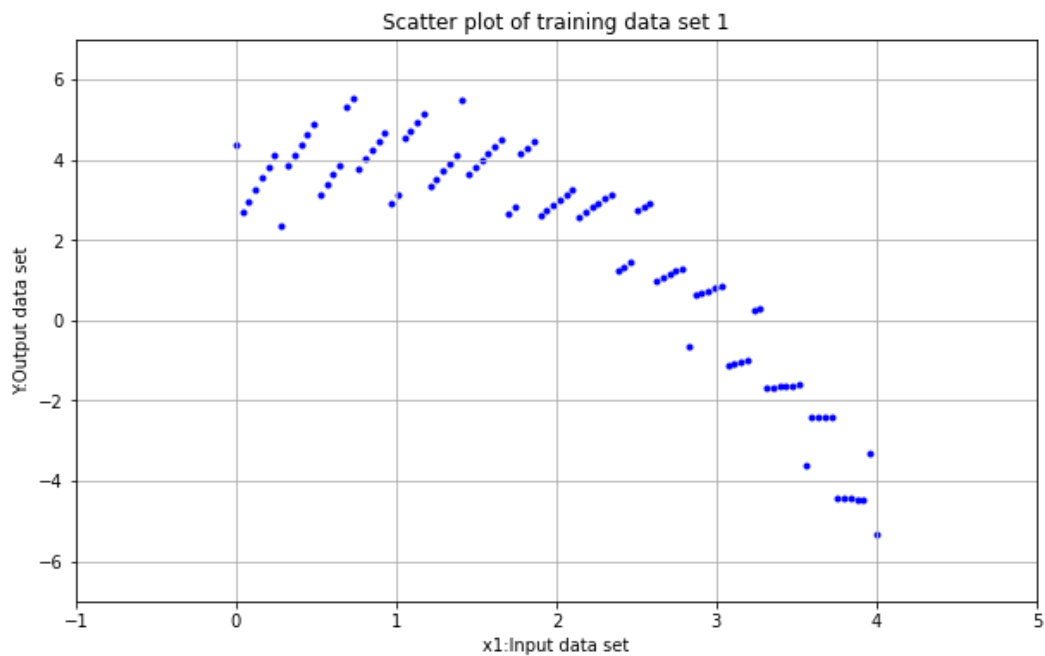# Linear Regression

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Single Variable Linear Regression

Problem #1.1

The following graph is column X1 data (from the D3.csv file) plotted vs Y.

Scatter plot of training data set 1

The following graph is column X2 data (from the D3.csv file) plotted vs Y.

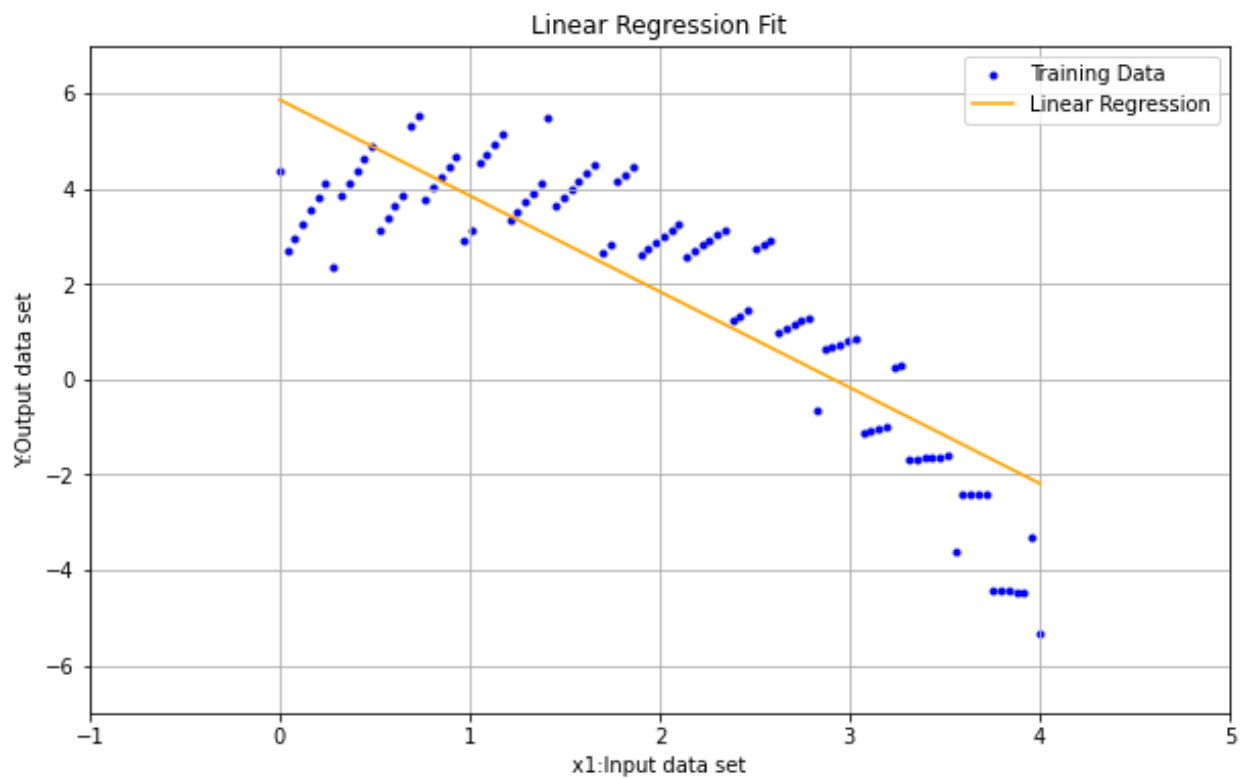Scatter plot of training data set 2

The following graph is column X3 data (from the D3.csv file) plotted vs Y.
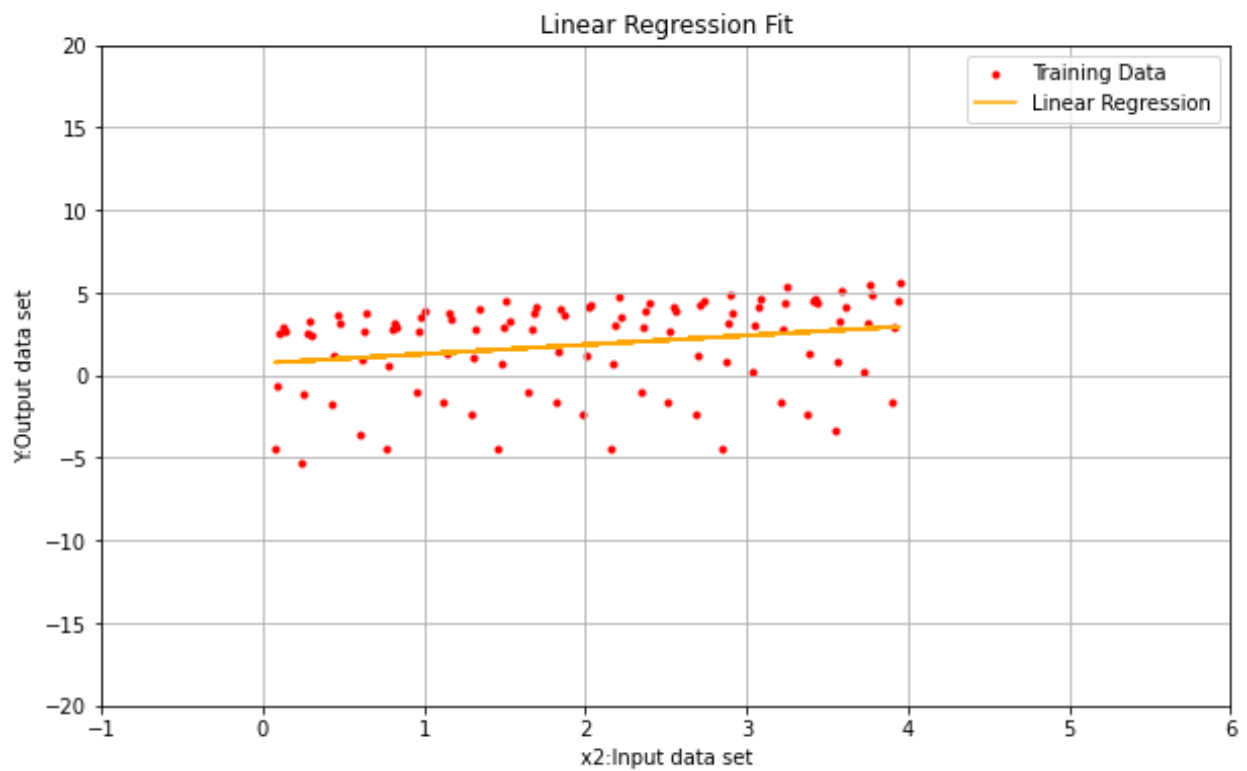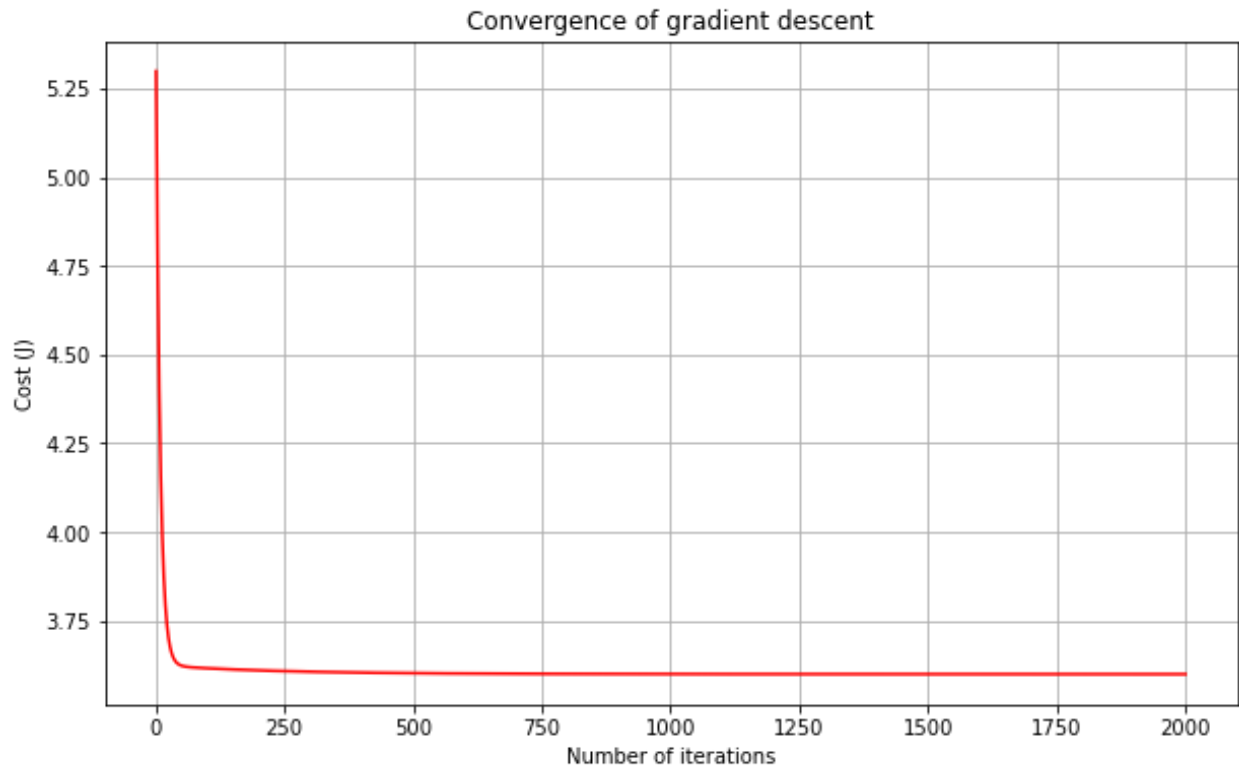
Scatter plot of training data set 3
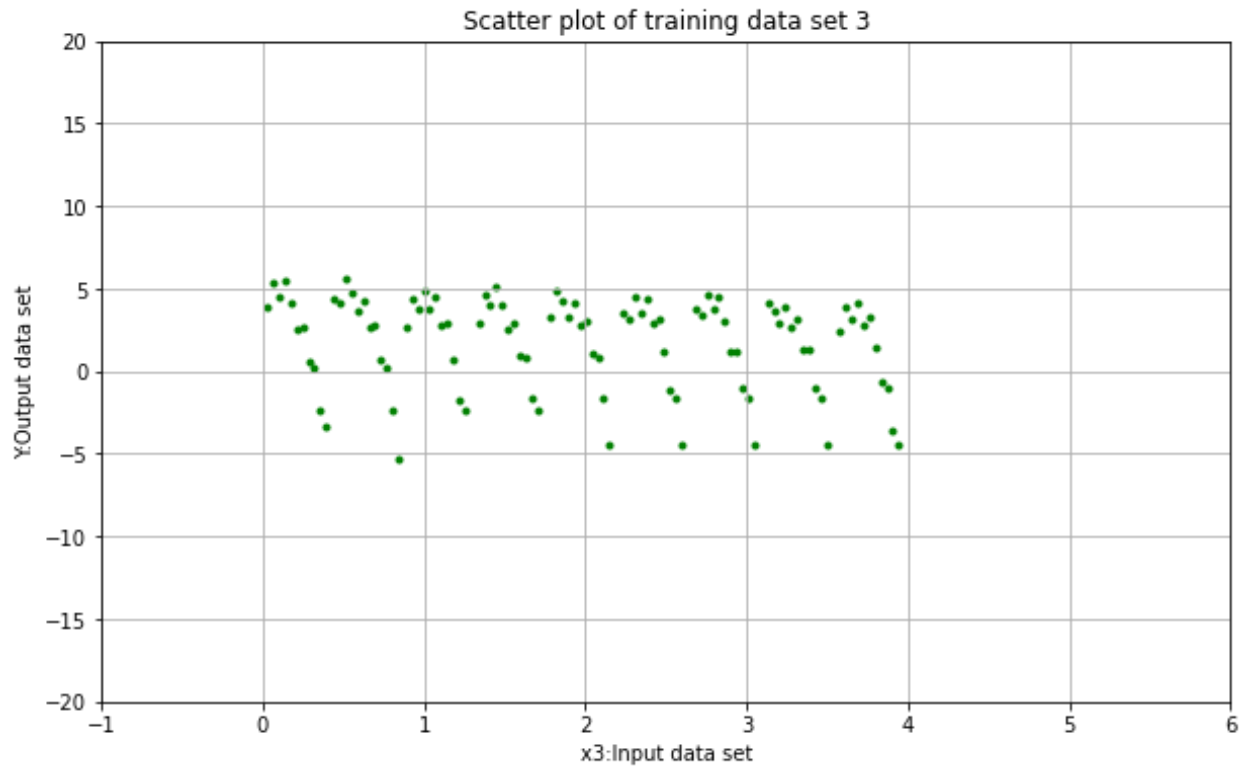
Problem #1.2

X1 final regression model and loss model with a learning rate of 0.01.
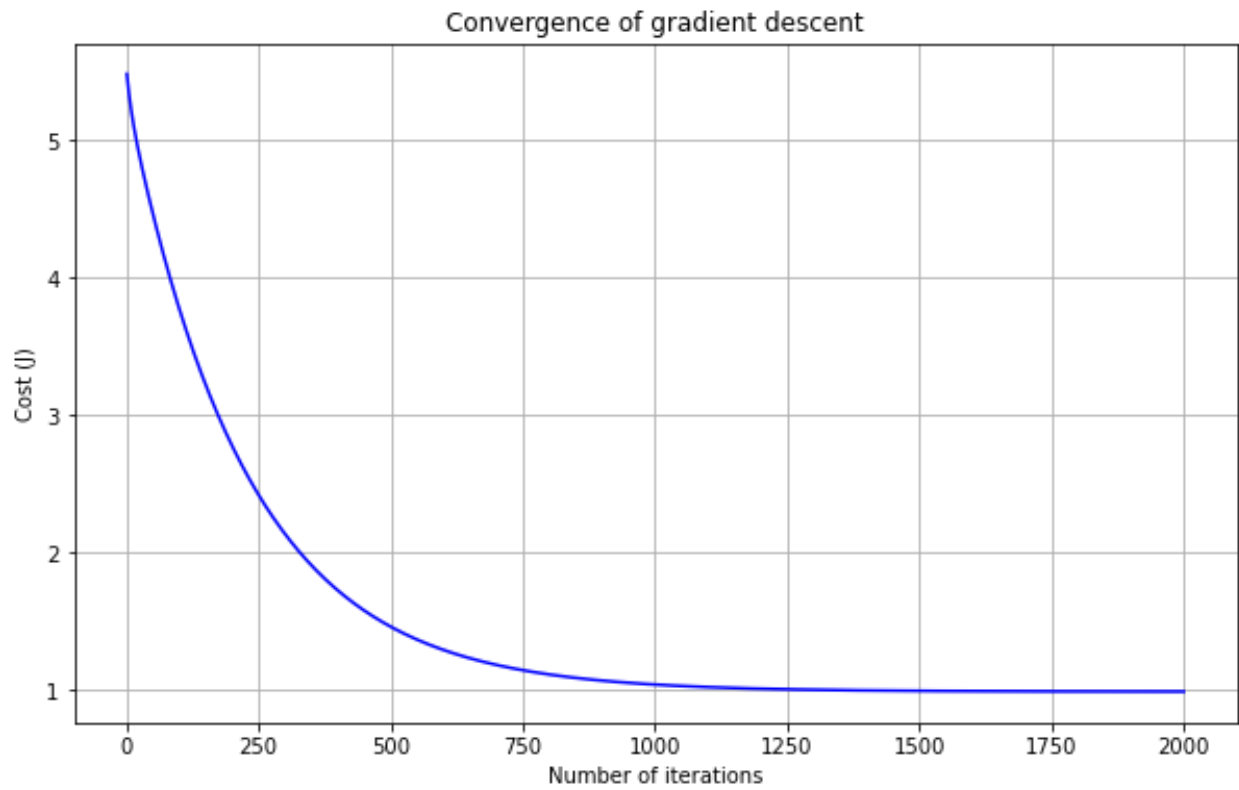
Linear Regression Fit

Convergence of gradient descent
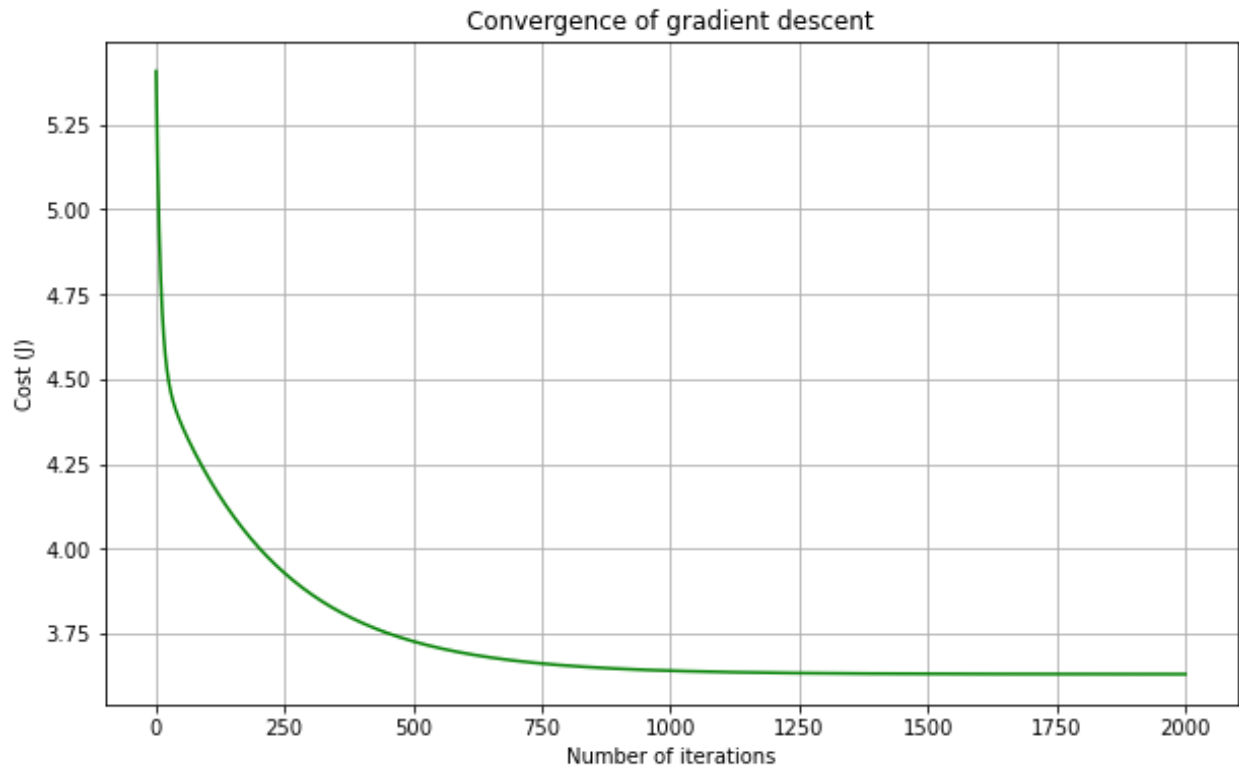
X2 final regression model and loss model with a learning rate of 0.01.

Linear Regression Fit

Convergence of gradient descent

X2 final regression model and loss model with a learning rate of 0.01.

Linear Regression Fit

Convergence of gradient descent
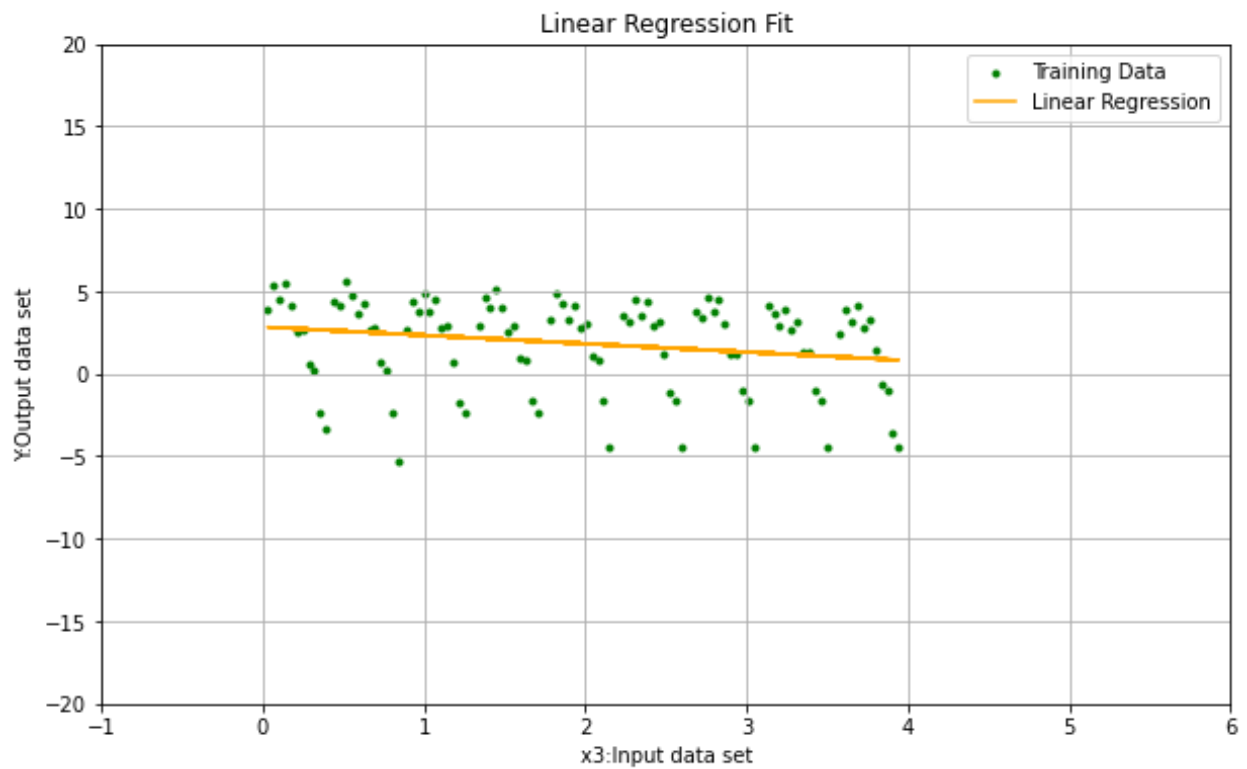
Problem #1.3

The explanatory variable with the lowest loss is X1. When calculating the cost for the given X inputs the lowest reported value for X1 was about 0.986, X2 was about 3.599, and X3 was about 3.630.

Problem #1.4

The impact of different learning rates changes the loss value to start and end at different values. As seen in the cost history's array below, having a 0.01 learning rate will yield a higher loss value. When using a learning rate of 0.1 the loss function is seen to have the lowest loss value from the ranges of 0.01 to 0.1.

[5.48226715, 5.44290965, 5.40604087, ..., 0.98560732, 0.9856046, 0.9856019]
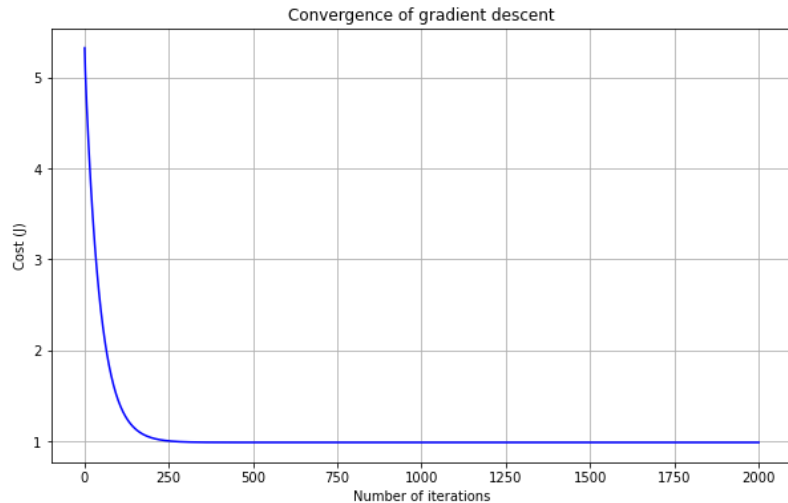
Learning Rate 0.01

[5.32852962, 5.18676104, 5.07204859, ..., 0.98499308, 0.98499308, 0.98499308]
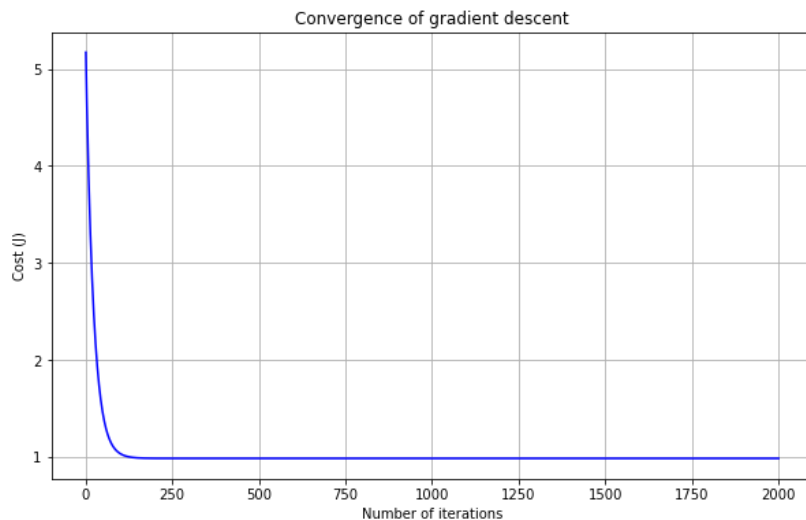
Learning Rate 0.05

[5.16999006, 4.96338989, 4.7855721, ..., 0.98499308, 0.98499308, 0.98499308]

Learning Rate 0.1

Looking at the number of iterations done to minimize the cost increasing the learning rate causes the number of iteration done to minimize cost is decreased. As seen from a learning rate of 0.05 the graph is reaching the minimum value around the 200th iteration, while with a learning rate of 0.1 it can be seen that the number of iteration to minimize is reduced to less than 100.
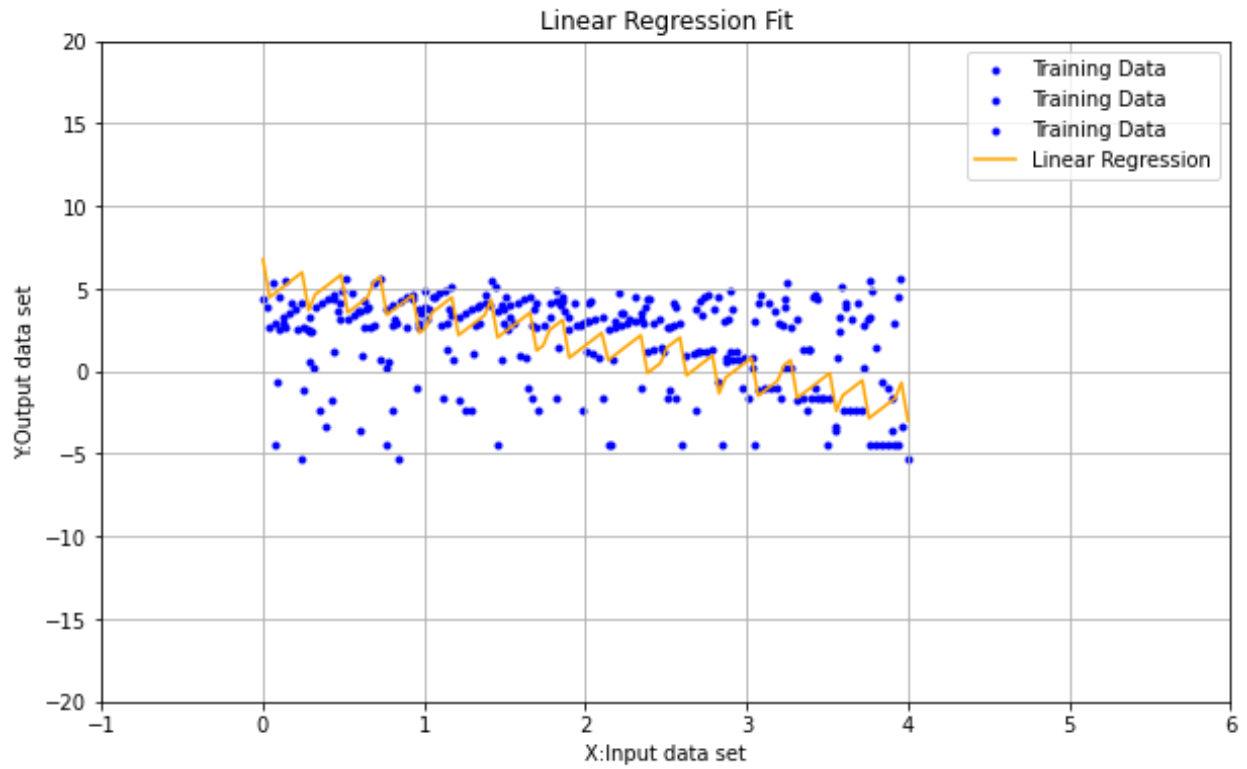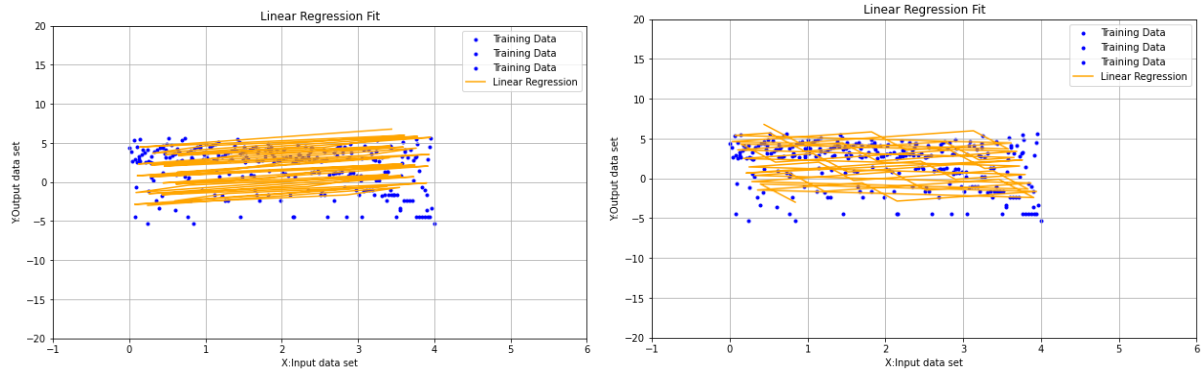

Learning Rate 0.05

Learning Rate 0.1

Problem #2.1

X1 final regression model with a learning rate of 0.01. The following graph is the best representation of a Linear model as the other two models are seen to not match close to an linear model.
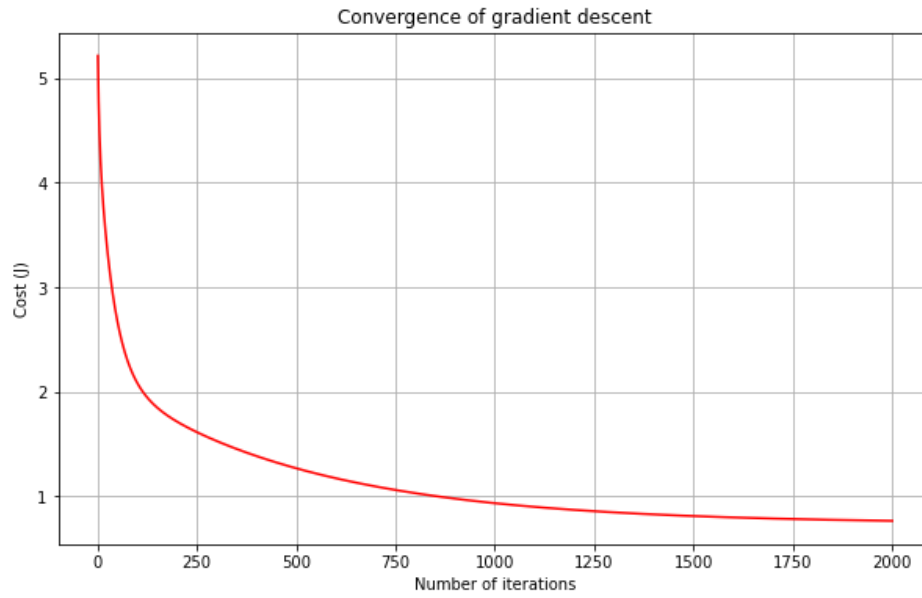
Linear Regression Model X1

Linear Regression Model X2 (left) and X3 (right)
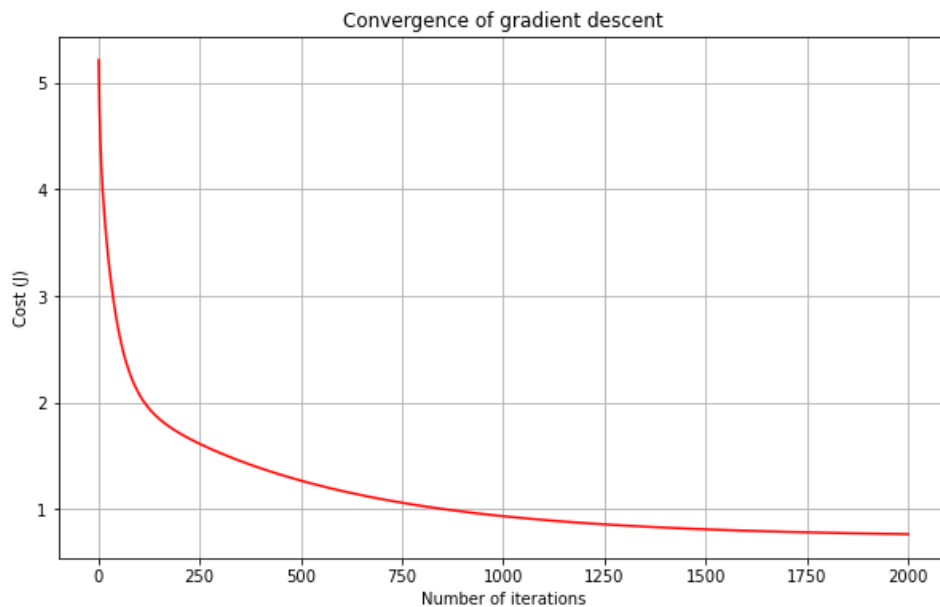
Problem #2.2

Loss Model of X.

Problem #2.3

The higher the alpha was increased the less iterations it took to find the minimized cost value. Using 0.1 as alpha caused the cost to start at an lower value compared to using 0.01 as alpha.

[5.21542243 4.97171977 4.7765543 ... 0.76514569 0.76509252 0.76503946]
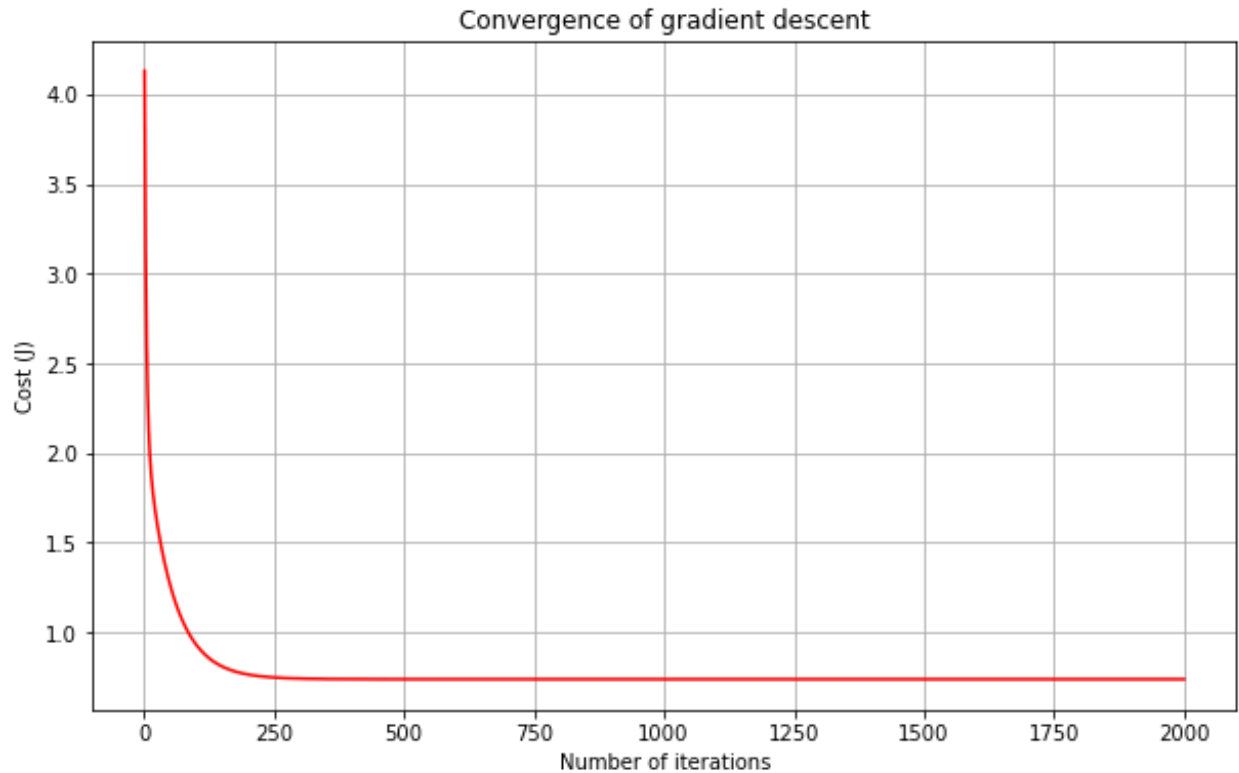
Cost History of X with alpha = 0.01

Loss Model of X with alpha = 0.01

[4.13064348 3.51770697 3.12758306 ... 0.73846424 0.73846424 0.73846424]

Cost History of X with alpha = 0.1

Loss Model of X with alpha = 0.1

Problem #2.4

Using the function yPredict = theta[1]*x1 + theta[2]*x2 + theta[3]*x3, where xj is the inputs. When x is [1,1,1] we got a result of -1.7368.

When x is [2,0,4] we got a result of -5.0698.

When x is [3,2,1] we got a result of -5.2116.

References

https://github.com/plee41/ECGR-4105