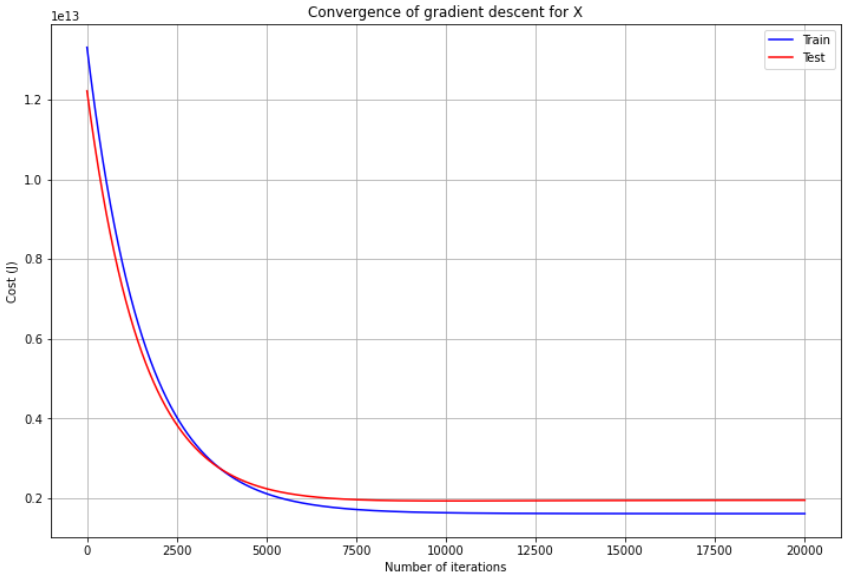
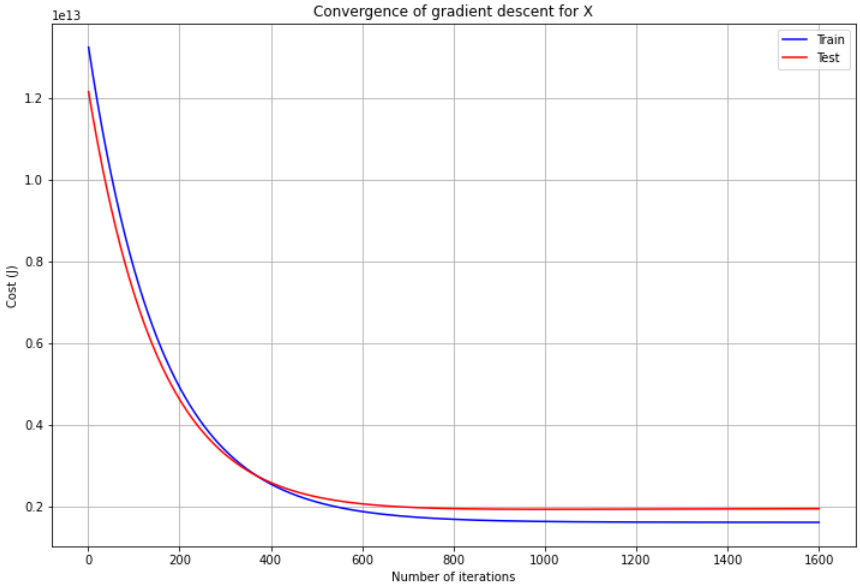
Homework 1

GitHub: https://github.com/pballou/ECGR_4105/tree/master/Homework/homework_1

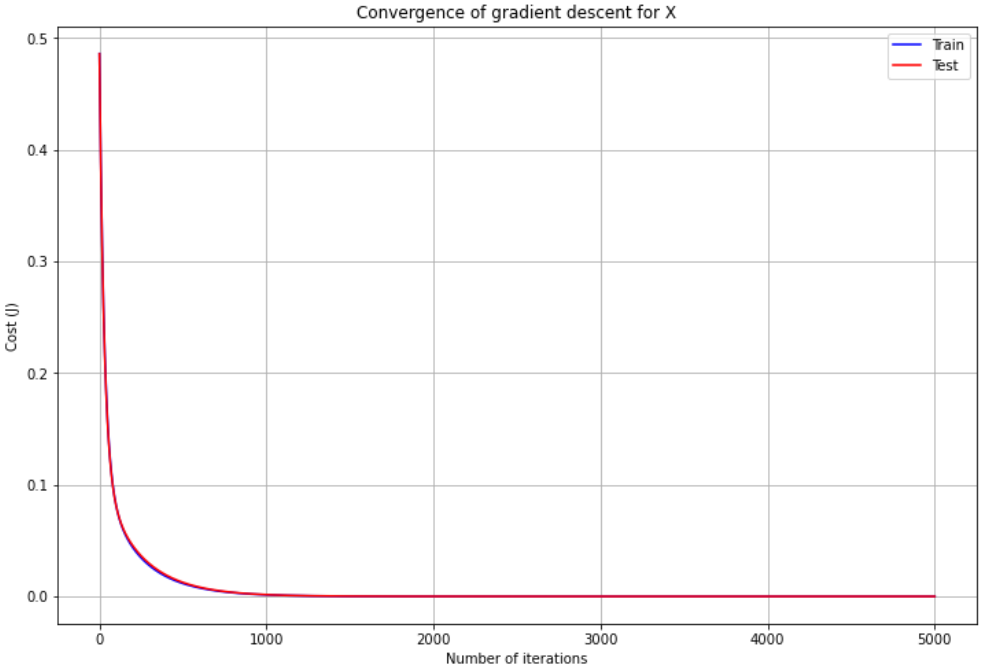
1. No pre-processing. Part a trained on only 6 input variables, and part b used 11. The loss is huge because there was no input scaling, and I had to use a very small alpha
   a. alpha = .00000000001
      Training cost: 1606259143218.0923
      Testing cost: 1944119106864.634



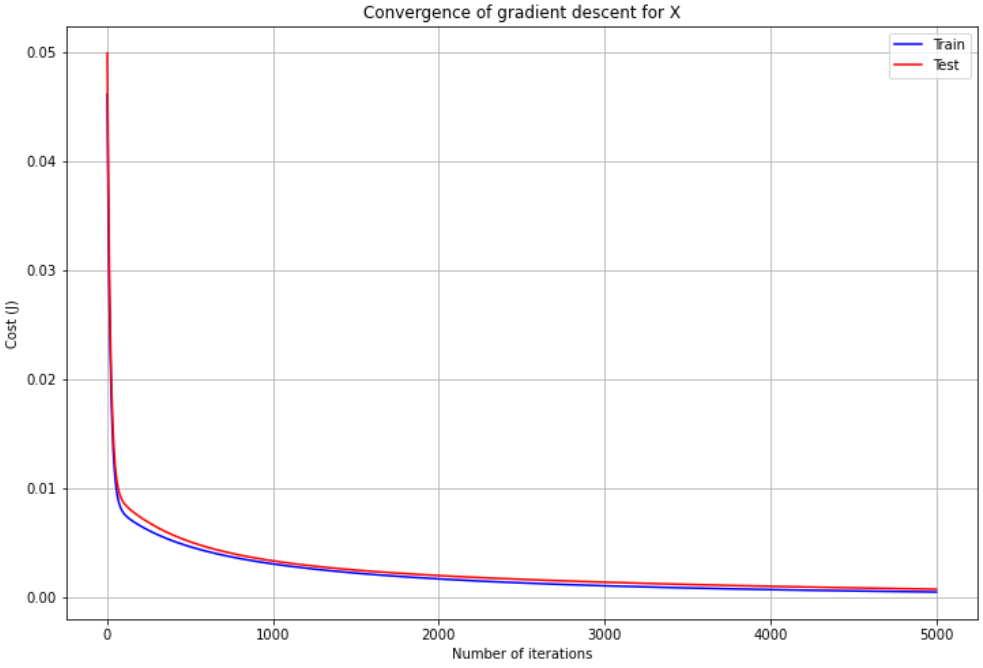
   b. alpha = .0000000001
      Training cost: 1606703724154.2678
      Testing cost: 1940242093479.1543



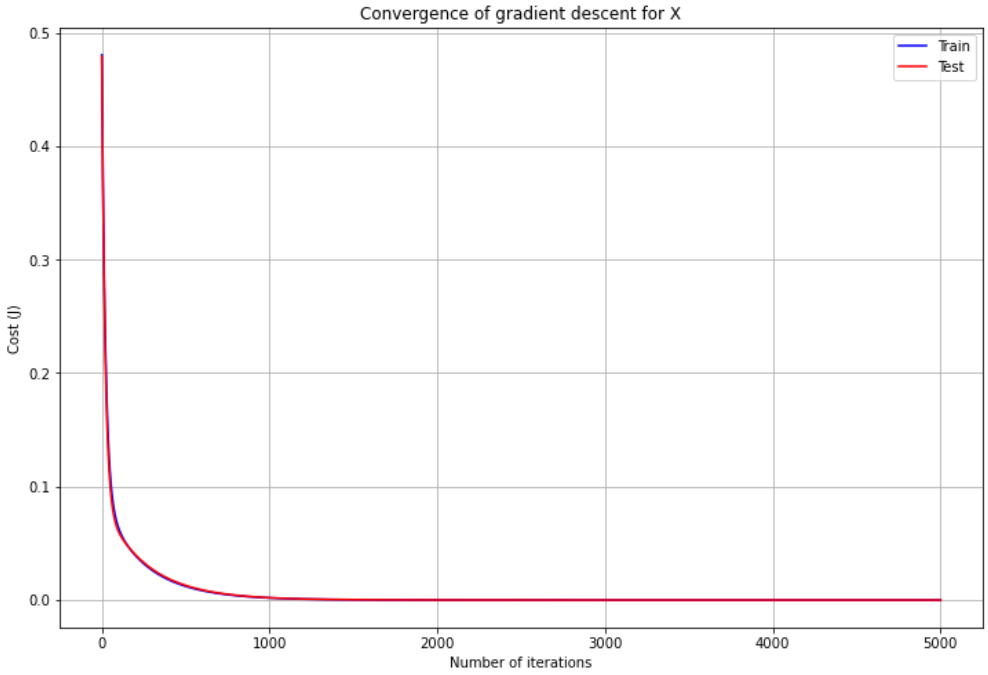
2. Used min max for normalization and standard scaler for standardization
    a. Part a: While standardizing and regularizing produced much better results than problem 1, the standardized set produced less loss than the regularized.
        i. Standardized results
        Standard scaler training cost: 8.603522950138437e-11
        Standard scaler testing cost: 9.390932165456731e-11



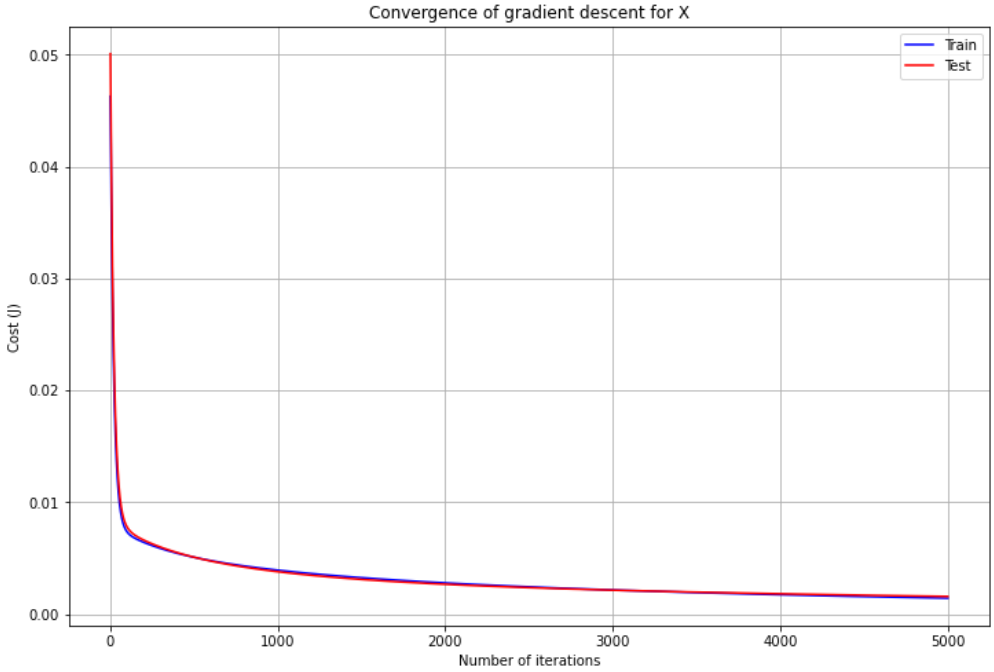
        ii. Regularized results
        Min max training cost: 0.0005081286497741986
        Min max testing cost: 0.0007631190873710804



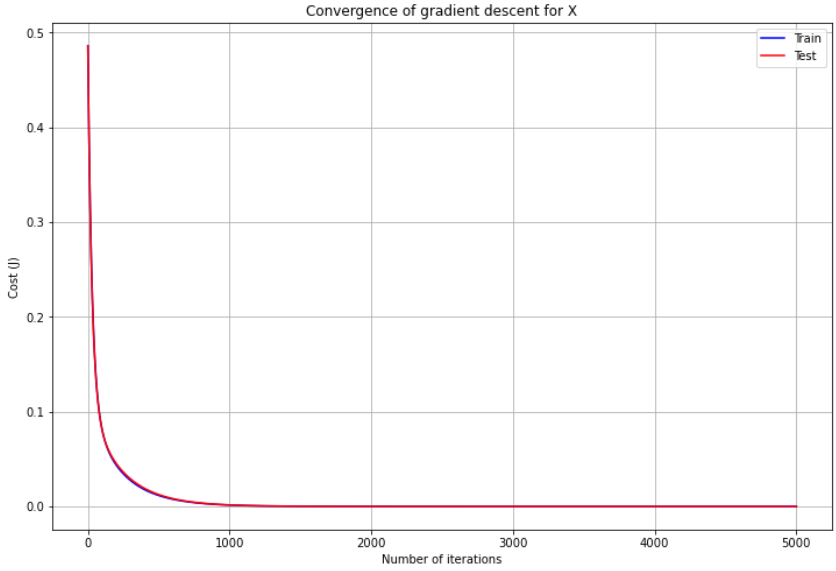
b. Part b: While standardizing and regularizing produced much better results than problem 1, again, the standardized set produced less loss than the regularized.
   i. Standardized results
   Standard scaler training cost part b: 6.462262312601764e-10
   Standard scaler testing cost part b: 7.131091466141552e-10



   ii. Regularized results
   Min max training cost part b: 0.001434780826566402
   Min max testing cost part b: 0.0015886939687538653



3. This problem was the same as 2, except I added penalty parameters to the gradient descent function
    a. Part a: Adding the penalty parameters actually made the loss increase slightly compared to 2a. I think the original model was optimally trained for this dataset already, so adding the penalties probably made it underfit. The standard scaler produced a lower loss than the min max in part a and b.
        i. Standardized results
        Standard scaler training cost: 1.1257937437554153e-09
        Standard scaler testing cost: 1.2092123592210432e-09



    b. Part b: The standard scaler produced a lower loss than the min max, and again, overall was slightly worse than 2b
        i. Standardized results
        Standard scaler training cost part b: 2.8337931624083455e-09
        Standard scaler testing cost part b: 2.9944181125407805e-09