

Question 1

a)

Code attached in separate file.

b) RMSE for $b \in \{5, 7, 9, 11, 13, 15\}$ and $\sigma_2 \in \{.1, .2, .3, .4, .5, .6, .7, .8, .9, 1\}$

b	Sigma-squared	RMSE
5	0.1	1.966276096
5	0.2	1.933135343
5	0.3	1.923420204
5	0.4	1.922197596
5	0.5	1.924769115
5	0.6	1.929212547
5	0.7	1.934634068
5	0.8	1.940583099
5	0.9	1.946819936
5	1	1.953212501
7	0.1	1.920163258
7	0.2	1.904876517
7	0.3	1.908080328
7	0.4	1.915901676
7	0.5	1.924804076
7	0.6	1.933701399
7	0.7	1.942253767
7	0.8	1.950380038
7	0.9	1.958093065
7	1	1.965438039
9	0.1	1.897648752
9	0.2	1.90251913
9	0.3	1.917647689
9	0.4	1.93251433
9	0.5	1.945699473
9	0.6	1.957234791
9	0.7	1.967403257

9	0.8	1.976491749
9	0.9	1.984740772
9	1	1.992341211
11	0.1	1.890507115
11	0.2	1.914981009
11	0.3	1.938848779
11	0.4	1.957936245
11	0.5	1.973215825
11	0.6	1.985764208
11	0.7	1.996375139
11	0.8	2.005603219
11	0.9	2.013835445
11	1	2.0213448
13	0.1	1.895848501
13	0.2	1.935585901
13	0.3	1.964597321
13	0.4	1.985501994
13	0.5	2.001314273
13	0.6	2.013878451
13	0.7	2.024310379
13	0.8	2.033306779
13	0.9	2.041317491
13	1	2.048641552
15	0.1	1.909603216
15	0.2	1.959548832
15	0.3	1.990803585
15	0.4	2.011915453
15	0.5	2.027370285
15	0.6	2.039465166
15	0.7	2.049463379
15	0.8	2.058104891
15	0.9	2.065845269
15	1	2.072976059

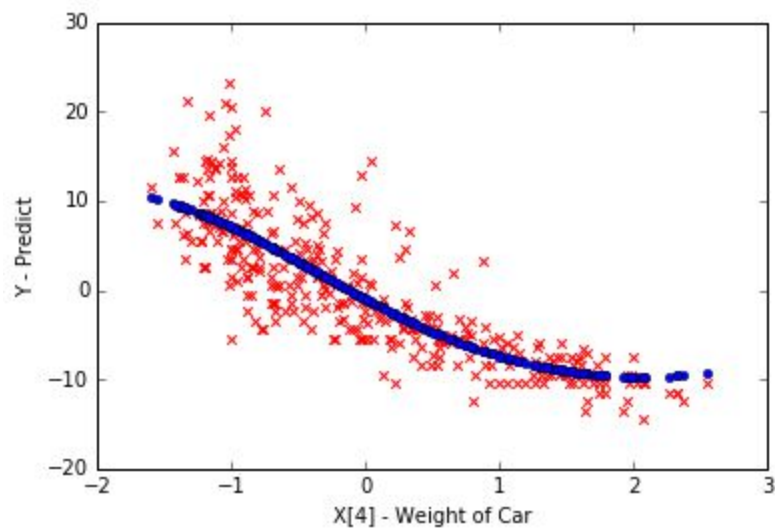
c) The best value is :

b	sigma squared	RMSE
11	0.1	1.890507115

This performance is better than the method used in HW1 , where the minimum RMSE was 2.19 for a second order regression .

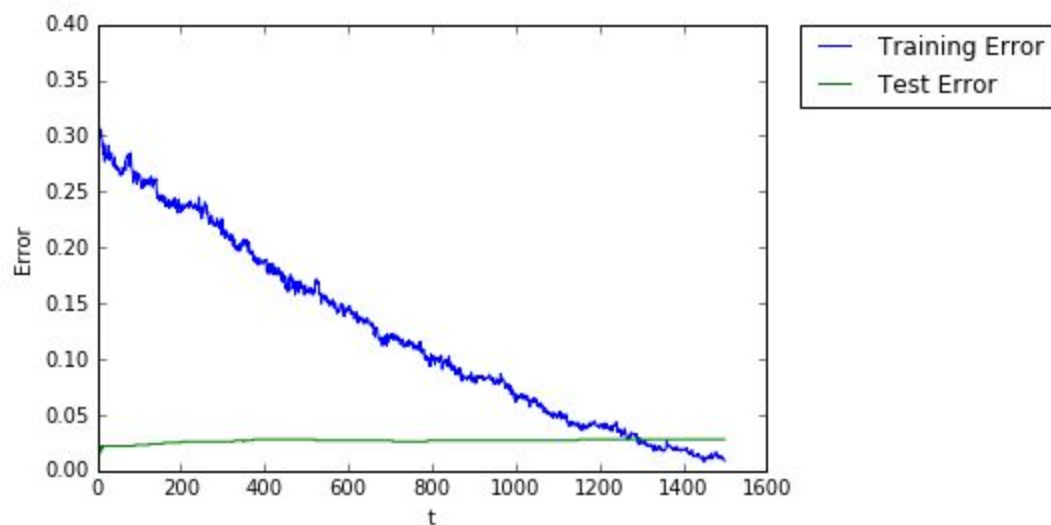
One drawback of this approach is that it cannot be used efficiently for Sparse data.

d)

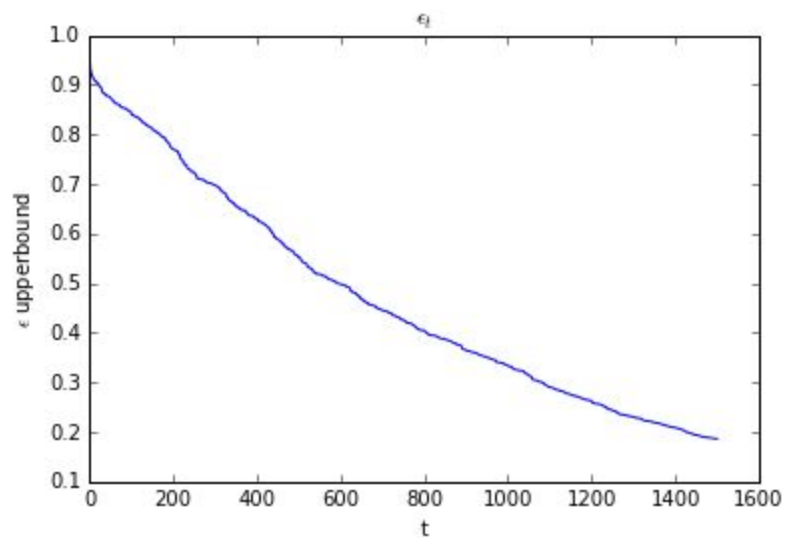


Question 2)

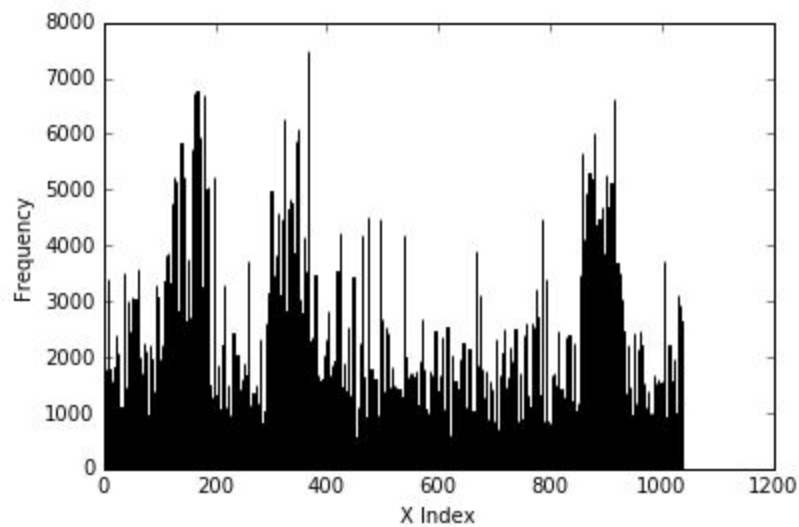
a)



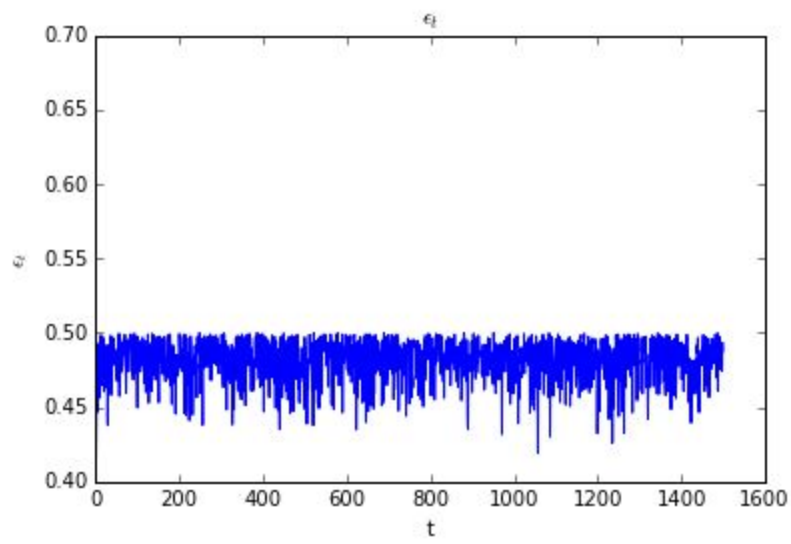
b) Upper bound on the training error as a function of t



c) Histogram for frequency of Boosting samples from X_{train}



d) Error vs T



Alpha vs. t

