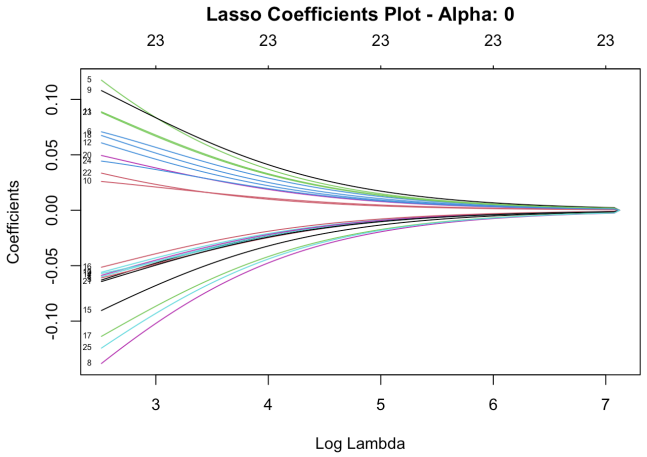
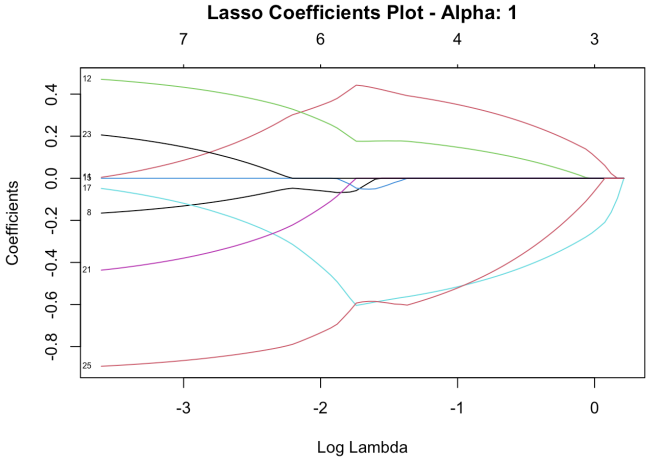
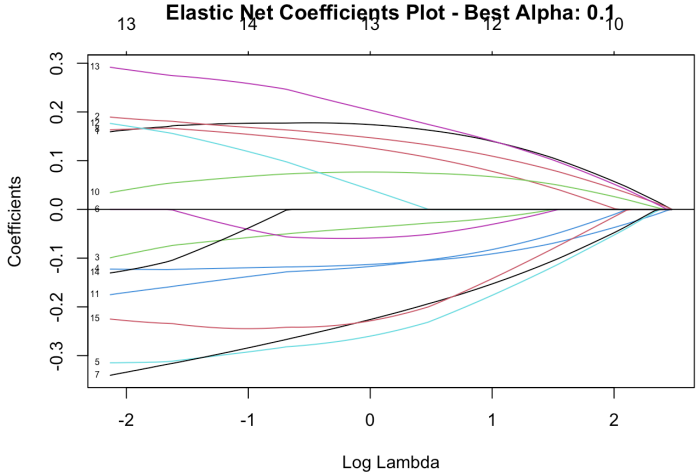
BAX 442 HW#4
Team F: Charles Wang, Qinyi Qiu, Richard Liu, Jie Zhu, Yuxin Yi

1. Provide and Explain the Coefficients Plots for the best Ridge, EN, Lasso regressions.







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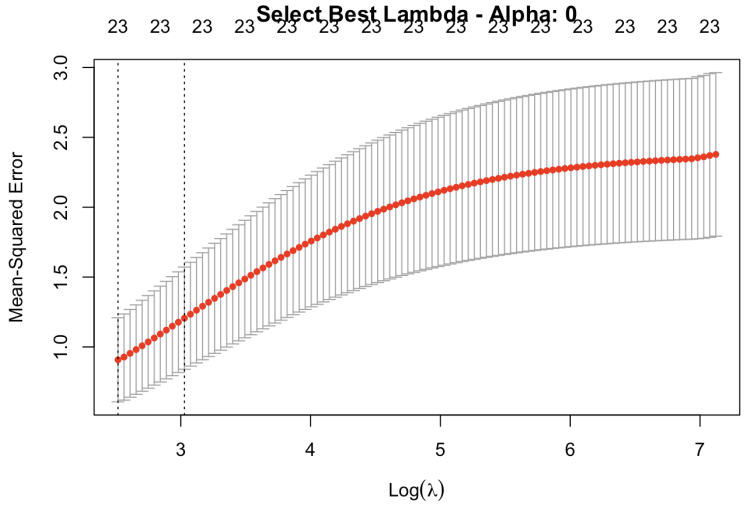
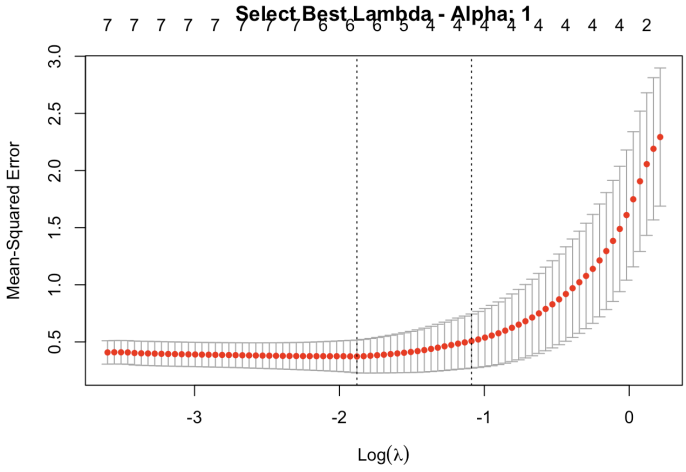
The images contain graphs with alpha at 0, 1, and 0.1. The best Ridge regression happens when the alpha is 0. This indicates only a ridge penalty and no lasso penalty. The graph with alpha 0 shows that the coefficients decrease smoothly and do not become exactly zero. The best EN regression happens between ridge and lasso, which means alpha 0 to 1. It is a combination of two penalties. From our estimate, 0.1 is the best alpha. The graph shows that some coefficients shrunk to zero while others became 0. The Best Lasso regression happens when alpha is 1. This indicates only a lasso penalty and no ridge penalty. The graph with alpha 1 shows that some coefficients go directly to zero, which is the selection feature by lasso.

2. Provide and Explain MSE vs Lambda Plots for Ridge, Best-alpha EN, Lasso





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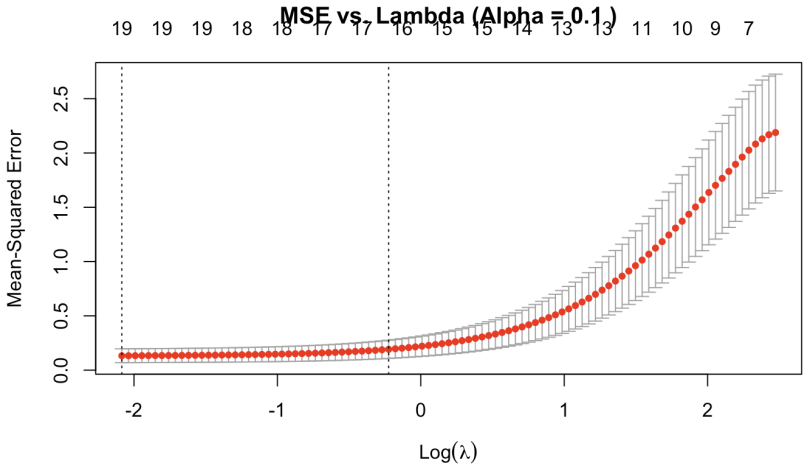

The first graph with alpha = 0 is MSE vs Lambda Plot for Ridge regression. It shows that MSE decreases as lambda increases.

The second graph with alpha = 1 is MSE vs Lambda Plot for Lasso regression. It shows that MSE first declines rapidly with the increase of lambda and then becomes stable.

The third graph with alpha = 0.1 is MSE vs Lambda Plot for Best alpha Elastic Net regression. It shows that MSE declines as lambda increases and reaches a stable minimum.

3. In one table with proper row/col names, present the parameter estimates from Ridge, Best-alpha EN, and Lasso -- all at their respective best lambdas.

Ridge	Lambda	Index	Measure	SE	Nonzero
min	0.3009	80	0.1404	0.05915	14
1se	1.0084	54	0.1935	0.08812	13
Lasso	Lambda	Index	Measure	SE	Nonzero
min	11.87	100	0.7612	0.2551	15
1se	18.04	91	1.0067	0.3129	15
Best Alpha Elasticity	Lambda	Index	Measure	SE	Nonzero

min	0.04573	71	0.2416	0.1237	6
1se	0.17623	42	0.3653	0.1327	6

4. Which are the TOP 3 attributes according to the best Lasso, EN, Ridge?

   According to the best Lasso, elasticity net, and ridge model estimation, the TOP 3 attributes are “Interesting”, “Successful”, and “Uncomfortable”

5. Compute the extent of bias in percentage using the estimated parameters from the three methods for Top 3 attributes relative to the corresponding OLS estimates via lm (using the same variables from point 4). Which regression estimates should you use?
   a. Referring to the table here, we can see that for **Lasso regression**, each of the biases is lowest among the 3 model estimations; these 3 attributes in Lasso almost do not affect the estimation.
   b. For **Ridge regression**, the biases are relatively large, with all the numbers greater than 0.5, meaning that this might not be the best model.
   c. The **Elastic Net regression** model also has moderate bias with numbers greater than 0.25 since it’s the combination of Lasso and Ridge regression.
   d. Considering the bias, the LASSO model might be the preferred choice because it introduces the least amount of bias while still benefiting from the regularization (which can address issues such as multicollinearity and overfitting).

	Interesting	Uncomfortable	Successful
Lasso	-0.00785	0.0530	-0.00551
Ridge	0.841	0.751	0.845
EN	0.544	0.269	0.569