Math 583 HW 6 Fall 2017. Due Wednesday, Oct. 11.
Quiz 6 on Friday, Oct. 13 is similar to HW 6. Use 3 sheets of notes.

Problem numbers are from the Olive text.
A) 3.2. Consider choosing $\hat{\boldsymbol{\eta}}$ to minimize the criterion

$$Q(\boldsymbol{\eta}) = \frac{1}{a}(\boldsymbol{Z} - \boldsymbol{W}\boldsymbol{\eta})^T(\boldsymbol{Z} - \boldsymbol{W}\boldsymbol{\eta}) + \frac{\lambda_{1,n}}{a}\sum_{i=1}^{p-1}|\eta_i|^j$$

where $\lambda_{1,n} \geq 0$, $a > 0$, and $j > 0$ are known constants. Consider the regression methods OLS, forward selection, lasso, PLS, PCR, ridge regression, and relaxed lasso.
a) Which method corresponds to $j = 1$?
b) Which method corresponds to $j = 2$?
c) Which method corresponds to $\lambda_{1,n} = 0$?

B) 3.20. This problem is like Problem D) (3.19) on homework 5, but ridge regression is used instead of forward selection. This simulation is similar to that used to form Table 3.3, but 100 runs are used so coverage in [0.89,1.0] suggests that the actual coverage is close to the nominal coverage of 0.95.

The model is $Y = \boldsymbol{x}^T\boldsymbol{\beta} + e = \boldsymbol{x}_S^T\boldsymbol{\beta}_S + e$ where $\beta_S = (\beta_1, \beta_2, ..., \beta_{k+1})^T = (\beta_1, \beta_2)^T$ and $k = 1$ is the number of active nontrivial predictors in the population model. The output for *test* tests $H_0 : (\beta_{k+2}, ..., \beta_p)^T = (\beta_3, ..., \beta_p)^T = \mathbf{0}$ and H_0 is true. The output gives the proportion of times the prediction region method bootstrap test fails to reject H_0. The nominal proportion is 0.95.

After getting your output, make a table similar to Table 2.2 with 4 lines. If your $p = 5$ then you need to add a column for β_5. Two lines are for reg (the OLS full model) and two lines are for ridge regression (with 10 fold CV). The β_i columns give the coverage and lengths of the 95% CIs for β_i. If the coverage ≥ 0.89, then the shorter CI length is more precise. Were the CIs for ridge regression more precise than the CIs for the OLS full model for β_3 and β_4?

To get the output, copy and paste the source commands from (http://parker.ad.siu.edu/Olive/slrhw.txt) into *R*. Copy and past the library command for this problem into *R*.

If you are person j then copy and paste the *R* code for person j for this problem into *R*.

You are person $j = 1$.

C) 3.21. This is like problem B) except lasso is used. If you are person j in Problem B), then copy and paste the *R* code for person j for this problem into *R*. Make a table with 4 lines: two for OLS and 2 for lasso. Were the CIs for lasso more precise than the CIs for the OLS full model for β_3 and β_4?

D) 4.13. This problem is like Problem B) (4.7) on homework 2, except elastic net is used instead of lasso.

a) Copy and paste the commands for this problem into *R*. Include the elastic net response plot in *Word*. The identity line passes right through the outliers which are

obvious because of the large gap. Prediction interval (PI) bands are also included in the plot.

b) Copy and paste the commands for this problem into *R*. Include the elastic net response plot in *Word*. This did elastic net for the cases in the `covmb2` set B applied to the predictors which included all of the clean cases and omitted the 5 outliers. The response plot was made for all of the data, including the outliers. (Problem 4.7 c) shows the DD plot for the data.)