MATH 484/564 HOMEWORK #2

Due: September 26, Thursday

How to submit: submit in class

MATH 484 students: do problems 1, 2, 3, 5.

MATH 564 students: do problems 1, 2, 3, 4, 5.

Problem 1 Derive SST, SSE, and SSR in matrix forms, write in the quadratic form $Y^T AY$.

Problem 2 Show that the $E(MSPE) = \sigma^2$ for the simple linear regression model with normal error $\epsilon \sim N(0, \sigma^2)$.

Problem 3 Derive that SSE=SSLF+SSPE.

Problem 4 A student fitted a linear regression function for a class assignment. The student plotted the residuals e_i against y_i, and found a positive relation. When the residuals were plotted against the fitted values $\hat{y}_i$, the student found no relation. How could this difference arise? Which is the more meaningful plot? Explain why.

Problem 5 Consider the real estate sales dataset in APPENC07.txt. The description of the dataset is in Appendix C.7 of the book. You will regress the sales price (Y) on the finished square feet (X) using SLR.

The dataset has 522 observations. You only need to randomly choose 100 observations to do this problem.

1) Obtain the 95% confidence band for the true regression line and plot it. Then plot the 95% prediction interval on the same plot. (Reference: page 18 of Part I slides.)

2) First use formulas to calculate the Confidence Interval and Prediction Interval at $X = \bar{x}$, and then use R program to verify them.