Linear Models: STAT 312a / STAT 612a

Fall 2015 Monday, Wednesdays 11:35 - 12:50 17 Hillhouse, Rm 115

Instructor:	**Taylor Arnold**
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Office:	24 Hillhouse
Office Hours:	Wednesdays 13:00 - 15:00, or by appointment
Teaching Assistant:	TBD
TA Hours:	TBD

Course Description:

The geometry of least squares; distribution theory for normal errors; regression, analysis of variance, and designed experiments; numerical algorithms, with particular reference to the R statistical language.

Grading:

- 60% Problem Sets (6% each)
- 20% Mid-Term I
- 20% Mid-Term II

Suggested References:

- Rao, Calyampudi R., and Helge Toutenburg. *Linear models*. Springer New York, 1995.
- Hayashi, Fumio. *Econometrics*. Princeton University Press. (2000).
- Golub, Gene H., and Charles F. Van Loan. *Matrix computations*. Vol. 3. JHU Press, 2012.
- Bühlmann, Peter, and Sara Van De Geer. *Statistics for high-dimensional data: methods, theory and applications*. Springer Science & Business Media, 2011.

Problem Sets:

Problem sets are assigned roughly once per week; after accounting for breaks and exams this yields a total of 10 sets. They are due promptly at the beginning of class (either hand-written or printed; only e-mail as a last resort). Late assignments are assesed a 10% penalty per day late unless accompanied by a Dean's excuse or an exception has been provided by the instructor *prior to* the due-date. You may discuss problem sets with other students, but must write up your own solutions. This means that you should have no need to look at other student's final written solutions.

Tentative due dates for problem sets: 09-14, 09-21, 09-28, 10-05, 10-19, 11-02, 11-09, 11-16, 12-07, and 12-16. The final assignment is due the last day or reading period and may be handed in to the office at 24 Hillhouse.

Tentative Schedule:

- 2015-09-02: Course introduction; simple linear model assumptions and MLEs (RT 2.1-2.7)
- 2015-09-07: Hypothesis tests; best linear unbiased estimators (RT 2.8-2.10)
- 2015-09-09: Multivariate linear regression; normal equations and OLS (FH 1.1-1.3)
- 2015-09-14: Finite sample distribution theory for multivariate regression (FH 1.4)
- 2015-09-16: Distribution theory continued; Multivariate MLE (FH 1.5)
- 2015-09-21: Geometry of regression; best linear unbiased estimators (RT 3.3-3.4)
- 2015-09-23: Analysis of variance (RT 3.9)
- 2015-09-28: Large sample theory for multivariate regression (FH 2.2)
- 2015-09-30: Large sample theory for multivariate regression, cont. (FH 2.3)
- 2015-10-05: Large sample theory for multivariate regression, cont. (FH 2.4)
- 2015-10-07: Weighted least squares and heteroskedasticity (FH 1.6, 2.9)
- 2015-10-12: MIDTERM I
- 2015-10-14: Solving full rank least squares (GV 5.2, 5.3)
- 2015-10-19: Sensitivity of the least squares solution (GV 5.3)
- 2015-10-21: FALL BREAK
- 2015-10-26: Iterative methods for least squares (GV 10.2, 10.3)
- 2015-10-28: Principal component regression; Ridge regression (RT 3.14)
- 2015-11-02: Shrinkage estimators (RT 3.14)
- 2015-11-04: Lasso regression; geometric formulation and basic theory (BV 2.1-2.3, 6.1-6.3)
- 2015-11-09: Calculating the lasso; LARS path algorithm (BV 2.12)
- 2015-11-11: Lasso theory (BV 6.1-6.7)
- 2015-11-16: Prediction measures; model selection criteria (RT 7.2, 7.9)
- 2015-11-18: MIDTERM II
- 2015-11-23: THANKSGIVING BREAK
- 2015-11-25: THANKSGIVING BREAK
- 2015-11-30: Bayesian regression
- 2015-12-02: Least absolute deviation (RT 9.2)
- 2015-12-07: M-estimators (RT 9.3, 9.5)
- 2015-12-09: Statistical tests for robust estimators (RT 9.6)