

# Math439: Linear Statistical Models

Fall 2012

**Instructor:** Dr. Nan LIN  
Office: Room 205, Cupples I  
Email: nlin@wustl.edu  
**Time and location:** 1pm-2:30pm (Tue and Thur), Room 207, Cupples I  
**Office hours:** Mon 3-4pm and Wed 4-5pm  
**Grader information:** Yao XIE (yxie@math.wustl.edu)

## General information

**Textbook 1:** *Linear Models with R*, by Julian J. Faraway. Chapman & Hall/CRC, 2004. ISBN: 1584884258

**Textbook 2:** *Extending the Linear Model with R*, by Julian J. Faraway. Chapman & Hall/CRC, 2005. ISBN: 158488424X

**References:** *Applied Linear Statistical Models*, by Michael H. Kutner, Christopher J. Nachtsheim, John Neter and William Li. McGraw-Hill, 2004, 5th edition. ISBN: 0072386886

**Class webpage:** All homework assignments, handouts, and other information will be available on Blackboard (<http://bb.wustl.edu/>). Students should check the class webpage frequently for updates.

## Course Description

This is an advanced undergraduate/master level course in linear statistical methods. This course teaches the theory and practice of linear regression, analysis of variance (ANOVA) and their extensions, including testing, estimation, confidence interval procedures, modeling, regression diagnostics and plots, polynomial regression, colinearity and confounding, model selection, geometry of least squares, etc.. The theory will be approached mainly from the frequentist perspective and use of the computer (mostly R) to analyze data will be emphasized. The coverage of this class includes all chapters in Textbook 1 and possibly Chapters 8-10 of Textbook 2.

## Prerequisite

Calculus; linear algebra; probability and statistics at the level of Math3200. Knowledge of Math493-494 and R is strongly recommended. More specifically, this class assumes familiarity with the following topics:

- Calculus
- Matrix algebra, such as vectors, matrices, matrix inverse, determinants, linear transformation, quadratic forms.
- Gaussian distributions
- Joint, conditional distributions
- Law of large numbers, central limit theorem
- Estimation
- Bias, variance, covariance

- Hypothesis testing
- Confidence intervals.

## Computing

Students are **required** to use R to complete all assignments. R is a free software that can be downloaded from <http://cran.r-project.org/>. It works under major operating systems, including Windows, Linux and Mac OS. An add-on package called ‘faraway’ needs to be installed to run the sample programs in the textbook.

R is very different from SAS. The instructor may provide some sample SAS codes to facilitate previous SAS users to convert to R. On the other hand, the structure of R is similar to Matlab, so some previous experience with Matlab can be very helpful for those new to R.

## Homework

Homework will be assigned approximately every other week. Students will have one week to finish and turn in the homework. Homework is **due in class** on the due date. The grader will grade homework and assign a score for each homework set. Late homework submitted **within 2 days of due date will receive 25% penalty** for each day late. Any homework late by more than 2 days will not be graded and receive zero point.

## Examinations

There will be one midterm exam and one cumulative final exam. The midterm exam will be held in the regular class time. Both exams will be closed book and closed notes. However, one two-sided 8.5 by 11 inch “cheat sheet is allowed for the midterm exam, and two two-sided 8.5 by 11 inch cheat sheets are allowed for the final exam. Students can bring a calculator to the exams, but sharing calculators is not allowed.

Make-up exams will **NOT** be given under any circumstances. If verifiable documentation is given for a legitimate absence, then your final exam grade will be reweighted. If a student misses the midterm exam, her/his final will count 50% of the final grade, instead of the usual 30%. However, no reweighting will be given if the final exam is missed.

*Exam time and location:*

- Midterm: 1pm-2:30pm, Thursday October 18, 2012, at Room 207, Cupples I
- Final: 1pm-3pm, Tuesday December 18, 2012, at Room 207, Cupples I

## Grading

Grades will be based on the homework sets (50%), the midterm (20%), and the final exam (30%). Cr means D or better if you elect “Credit/No Credit.” The final letter grade is given according to the following scale.

[95, 100]	A+	[83, 85)	B+	[65, 75)	C
[87, 95)	A	[77, 83)	B	[60, 65)	D
[85, 87)	A–	[75, 77)	B–	< 60	Fail

## Learning Tips

1. Try to show up in all the lectures. Make good notes.
2. Ask questions in class. Your questions may be others' as well. No questions are too elementary, and all deserve to be answered.
3. Discuss with your classmates about your questions. It is perfectly acceptable to work together on homework assignments.
4. Finish homework in time.

## Class Policies

1. Late homework: Late homework submitted **within 2 days of due date will receive 25% penalty** for each day late. Any homework late by more than 2 days will not be graded and receive zero point.
2. Exam conflicts: Prior permission and arrangement only.
3. Collaboration: I encourage discussion of homework in broad, conceptual terms where one student is trying to educate another without giving away the answer, but **all work turned in must be your own**. For example, each student must write his/her own programs in entirety.
4. Academic Integrity: All students are expected to adhere to the university's academic integrity policy. Any student who is found to have cheated on an assignment or exam will receive a zero score for that work, regardless of the extent of the offense.