

MA 575 Linear Models:

Course Syllabus

Fall 2013



Instructor:

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Office Hours: Wednesdays 3–5pm (Starting on WEDNESDAY 11TH, OF SEPTEMBER.)

Course Website: <http://math.bu.edu/people/cgineste/classes/ma575/w/index.html>

Teaching Fellow:

TBA

Office: TBA

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Office Hours: TBA

Class Meetings: TR (Tues, Thurs) 9:30- 11:00am, CAS 313.

Course Description: This course provides a post-introductory look at linear regression modeling. Topics will be taken from the following: simple and multiple linear regression; weighted and generalized least squares; regression with polynomials or factors; transformations; regression diagnostics; variable selection; and extensions of linear models. Note that while some or all of the topics covered may be familiar from lower-level courses, in this course our aim is to obtain a deeper insight into the practice of linear regression modeling through incorporation of probabilistic and mathematical aspects of the topic into our study.

Prerequisites: CAS MA 214, 242 (or 442), and 581; or consent of instructor.

Text: Weisberg, S. (2005) *Applied Linear Regression, Third Edition*. John Wiley & Sons, Inc.

Software: We will use the statistical software **R** for computing in this course. The software is a standard for users both in and outside of statistics, particularly those that need to do programming of new methods (e.g., from a recent paper in a given area). The software is free and compatible with Windows, Mac, and Linux/Unix. It may be downloaded from cran.us.r-project.org. The main website for the **R** project is www.r-project.org. For those who do not wish to install **R** on their own machines, it can be accessed in

a command-line version on the BU machine `acs-linux` and, for those students in the department, on the machines in the Department of Mathematics and Statistics.

It is expected that all students will be responsible for getting up to speed on the basics of the **R** package on their own within the first week or so. A computing primer for **R**, written by Sanford Weisberg, is available for purchase as a course-packet from the BU bookstore. In addition, there is documentation on-line, from the **R** website, and in the form of various books. See, for example,

<http://cran.r-project.org/doc/manuals/R-intro.html>

Course Requirements and Evaluation:

1. **Homework:** There will be weekly homework assignments. Homeworks and their solutions will be available for download and printing from the course website. Homeworks will be reviewed, but not formally assigned scores. Homeworks will be due every Thursdays, starting on **Thursday, September 12, 2013**.

Please Note: As a rule, late homeworks will **not** be accepted.

2. **Quizzes:** A quiz will be given in connection to each homework assignment, immediately at the start of the class during which the homework is due. Thus, quizzes will be administered every Thursdays, starting on **Thursday, September 12, 2013**,

Please Note: As a rule, make-up quizzes will **not** be offered. A missed quiz will be assigned a mark of 0. However, each student will be allowed to drop the three lowest scores during the course, and the scores on the remaining quiz grades will be re-weighted accordingly.

3. **Midterm:** One midterm exam will be given during the semester, in class, on **Tuesday, October 22, 2013**, at 9.30am in the usual lecture room, in CAS 313. The midterm exam will cover the first half of the course, comprising weeks 1 to 5.

Please Note: A make-up midterm will **not** be offered. Instead, the student's score on the final exam will be re-weighted accordingly, such that the final exam will weight 70% of the total grade. (See below.)

4. **Final Exam:** There will be a final exam for this course, which has been scheduled by the University Registrar to be held on **Monday, December 16 2013, 9-11am**. The final exam will cover material from the second half of the course, comprising weeks 7 to 15.

Please note: The final exam will be held on the appointed date, at the appointed time, and will not be offered at any other dates or times. Please plan your holidays accordingly.

5. **Grading:** The final grade for the course will be determined according to the following formula.

$$\text{Final Grade} = (0.30 \times \text{Quizzes}) + (0.30 \times \text{Midterm}) + (0.40 \times \text{Final Exam}).$$

CAS and GRS Academic Codes of Conduct:

Undergraduates are responsible for knowing, and abiding by, the provisions of the CAS Academic Conduct Code, which is posted at

<http://www.bu.edu/academics/resources/academic-conduct-code/>

Similarly, graduate students are responsible for knowing, and abiding by, the provisions of the GRS Academic Conduct Code, which is posted at

<http://www.bu.edu/cas/students/graduate/forms-policies-procedures/academic-discipline-procedures/>

Violations of the code are punishable by sanctions including expulsion from the University.

Math Help Services:

Prof. Diane Meuser and some Mathematics majors are running a math help service for any students, from any class. This takes place every **Tuesdays**, between 7:30pm and 10:30pm, in Rich Hall Cinema Room, First Floor of Rich Hall, West Campus. The meetings will begin on Tuesday SEPTEMBER, 10.

The following information is available from this website:

<http://math.bu.edu/people/dmm/FacRes/mathhelp.html>

“If you are a student who is taking mathematics courses, you are encouraged to come to Math Help to meet other students and work together with them. You may be able to get help from others, regardless of what course you are in. You may also be able to help some other students, and are encouraged to do so.

There are also plenty of tables for students to work at, so it is perfectly OK to come there to do your work, either alone, with others, or perhaps meet students from your class, and then just ask for help when and if you have questions.”

Detailed Course Syllabus:

Weeks during which a homework is due, and during which a quiz will be administered are marked with *H-Q*. During these weeks, the due date for the homework and the day, when the quizzes is given, is always on THURSDAY.

Table 1. Week-by-week Syllabus

<i>Weeks</i>	<i>Date</i>	<i>Hmk-Quz</i>	<i>Tuesdays</i>	<i>Thursdays</i>
1	09/02		<i>Course overview</i>	Probability and Linear Algebra
2	09/09	<i>H-Q</i>	C1: Scatterplots in R	C2: Ordinary Least Squares
3	09/16	<i>H-Q</i>	C2: Properties of Estimates	C2: Comparing Models
4	09/23	<i>H-Q</i>	C3: Multiple Regression	C3: Fit Statistics
5	09/30	<i>H-Q</i>	C4: Parameter Interpretation	C4: Experimentation, Missingness
6	10/07	<i>H-Q</i>	C4: Bootstrap estimation	C5: Weighted Least Squares
7	10/14		No class	<i>Midterm review</i>
8	10/21		Midterm Exam	C5: WLS Fit Statistics
9	10/28	<i>H-Q</i>	C6: Polynomial Regression	C6: Random Coefficient Models
10	11/04	<i>H-Q</i>	C7: Data Transformation	C7: Box-Cox Estimation
11	11/11	<i>H-Q</i>	C8: Residuals	C8: Model Fit Assessment
12	11/18	<i>H-Q</i>	C9: Outliers and Influence	C9: Q-Q plots and Normality
13	11/25		C10: Multicollinearity	<i>Thanksgiving</i>
14	12/02	<i>H-Q</i>	C10: Variable Selection	Lasso and Machine Learning
15	12/09		C12: Logistic Regression	<i>Study Period</i>

In this table, C_k refers to the k th chapter of the textbook.