

# QUANTITATIVE RESEARCH METHODS I--SYLLABUS

## COURSE OBJECTIVES

Quantitative Research Methods I is the first of a two-course methods sequence designed to provide Ph. D. students in Urban Studies with tools and skills necessary in quantitative/qualitative research. The first course in the sequence focuses on linear regression techniques. A good understanding will enable students to apply these techniques, as well as acquire on their own additional multivariate statistical techniques rooted in linear methodology, such as discriminant analysis, factor analysis, or structural equations.

This course presents single-equation regression models with two and three variables, including estimation and inference. It also examines how regression is used and interpreted when data do not conform to some of its basic assumptions, such as normality or homoscedasticity of errors. The course identifies: the nature of the deviations from assumptions; the resulting estimation and interpretation problems; practical consequences; detection; and, some remedies.

At the conclusion of the first course, students will:

- understand the nature of the basic linear regression model and its statistical underpinnings and basic assumptions;
- formulate research questions that require the use of linear regression;
- set up, solve and evaluate a regression model;
- interpret results obtained using a statistical package, as well as critique results reported in professional journals by other researchers.

A major component of this course is the reading and presentation of articles in the students' areas of interest. Each student will select and present two articles using the methodologies studied.

## COURSE METHOD

The course consists of:

- lectures on statistical techniques and procedures;
  - class discussions and student presentations on assigned questions;
  - discussions of homework solutions, projects questions and results.
  - student presentations of professional articles in their field of interest.
- 3 Students are expected to: attend all classes; participate actively in discussions, asking clarifying questions; use the computer for solving homework sets and (always) for text editing; make presentations.
  - 3 Homework/project outputs should be **TYPED** and handed in **ON TIME**. Since communication skills complement analytic ones, pay attention to completeness, clarity and aspect. Grading is based on sound analysis and effective interpretation and communication of results.
  - 3 Prepare for class sessions by reading text assignments and identifying topics that need clarification. Feel free to raise questions to ensure thorough understanding and ability to apply procedures in contexts outside the classroom.

**Class presentations** -- Each student will present the following during the Semester:

- two journal articles from his/her field of interest which feature regression methods;
- solutions to homework problems.

The syllabus on the WEB<sup>1</sup> at  
<http://urban.csuohio.edu/~sanda/syl/stat803.htm>

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<sup>1</sup> Note that the syllabus distributed in class is the most current for content and dates.

## TEXTS

- Damodar N. Gujarati  
*Essentials of Econometrics*, New York: McGraw Hill Irwin, 2006 (3<sup>d</sup> edition).
- Peter Kennedy (optional, at the library)  
*A Guide to Econometrics*, Cambridge: MIT Press, 1984.

## ADDITIONAL READINGS<sup>2</sup>

- Analytical Software (1992). ***STATISTIX 3.5: An Interactive Statistical Analysis Program for the IBM PC***. St. Paul.
- Bevington, P. R. and D. K. Robinson. 1992. ***Data reduction and error analysis for the physical sciences***. McGraw-Hill, Boston. 328 pp.
- Bishop, Yvonne M. M., Stephen E. Fienberg, Paul W. Holland (1975). ***Discrete Multivariate Analysis: Theory and Practice***. Cambridge: The MIT Press.
- Cleveland, W. S. 1993. ***Visualizing data***. AT&T Bell Labs, Murray Hill NJ. 360 pp. [*how to plot scientific data, available free, in the dataviz toolbox for Matlab.*]
- Carlson, William and Betty Thorne, ***Applied Statistical Methods***. Upper Saddle River, NJ: Prentice Hall, 1997.
- Cohen, Jacob, Patricia Cohen (1983). ***Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences***. Hillsdale: Lawrence Erlbaum Associates, Publishers.
- Dalal Siddhartha, Edward Fowlkes, and Bruce Hoadley. December 1989. "Risk Analysis of the Space Shuttle: Pre-Challenger Prediction of Failure." *Journal of the American Statistical Association*, pp. 945-957.
- DeGroot, Morris. 1986. ***Probability and Statistics***. Reading, Massachusetts: Addison-Wesley Publishing Co., Second Edition. (A more advanced book than Larsen and Marx.)
- Fienberg Stephen E. (1977). ***The Analysis of Cross-Classified Categorical Data***. Cambridge: The MIT Press.
- Freedman, D., R. Pisani, and R. Purves. 1998. ***Statistics***, 3rd edition. WW Norton & Col., New York.
- Freedman, Pisani, Purves and Adhikari, ***Statistics***, Norton.
- Freund John and Gary Simon. 1997. ***Modern Elementary Statistics***. Englewood Cliffs, NJ: Prentice-Hall, Ninth Edition. (A more basic book than Carlson and Thorne.)
- Gifford N. L. (1983). ***When in Rome: An Introduction to relativism and Knowledge***. Albany: SUNY Press.
- Goldenberg Sheldon (1992). ***Thinking Methodologically***. Harper Collins Publishers.
- Gonick, L. and W. Smith. 1993. ***The cartoon guide to statistics***. Harper Perrenial, New York. 230 pp.
- Groves Robert. 1989. ***Survey Errors and Survey Costs***. New York: John Wiley and Sons. (A detailed analysis of considerations involved in the design of surveys.)

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<sup>2</sup> For course-related WEB sites, visit the syllabus on the WEB.

- Hanselman, D and B. Littlefield. 2001. *Mastering Matlab®: a comprehensive tutorial and reference*. Prentice-Hall, Upper Saddle River NJ. [supplement to the extensive Matlab manuals. \$46.94 at <http://www.walmart.com>]
- Hogg and Craig, *Introduction to Mathematical Statistics*, Macmillan
- Hogg and Tanis, *Probability and Statistical inference*, Macmillan.
- Hollander, M. and D. A. Wolfe. 1999. *Nonparametric Statistical Methods*, 2nd edition. John Wiley & Sons, New York. 787 p. [nonparametric (distribution-free) methods.]
- Kaplan, D. T. 1999. Resampling Stats in Matlab®.. Resampling Stats inc (www.resample.com). [Manual for the resampling statistics toolbox for Matlab. Collection of routines.]
- Hoover Kenneth R. (1992). *The Elements of Social Scientific Thinking*. New York: St. Martin's Press.
- Hanselman, D and B. Littlefield. 2001. *Mastering Matlab®: a comprehensive tutorial and reference*. Prentice-Hall, Upper Saddle River NJ.
- Intriligator Michael D. (1978). *Econometric Models, Techniques & Applications*. Englewood Cliffs: Prentice-Hall.
- Kaplan, D. T. 1999. Resampling Stats in Matlab®. Resampling Stats inc ([www.resample.com](http://www.resample.com)).
- Kemeny J. G. & J. L. Snell (1962). *Mathematical Models in the Social Sciences*. Boston: MIT Press.
- Larsen, R. J. and M. L. Marx. 2001. *An introduction to mathematical statistics and its applications*, 3rd edition. Prentice Hall, Upper Saddle River, NJ 07458.
- Larsen, R. J. and M. L. Marx (1985). *An Introduction to Probability and Its Applications* Englewood Cliffs, New Jersey; Prentice-Hall, Inc.
- Larsen, R. J. and M. L. Marx (1990). *Statistics*. Englewood Cliffs, New Jersey; Prentice-Hall, Inc.
- Larsen, R. J., M. L. Marx and Bruce Cooil (1996). *Statistics for Decision-Making and Problem-Solving*. Englewood Cliffs, New Jersey; Prentice-Hall, Inc.
- Maddala G. S. (1977). *Econometrics*. New York: McGraw-Hill Book Company.
- Manly, B. F. J. 1997. *Randomization, bootstrap and Monte Carlo methods in biology*. Chapman & Hall, London. 399 p. [generate confidence intervals and test hypotheses without having to assume a parametric distribution]
- Miller & Miller (1999). *Freund's Mathematical Statistics*, 6th ed., Prentice-Hall
- Middleton, G. V. 2000. *Data analysis in the earth sciences using Matlab®*. Prentice-Hall, Upper Saddle River, NJ.
- Mosteller, F. 1965. *Fifty challenging problems in probability with solutions*. Dover, New York.
- Morrison Donald F. (1976). *Multivariate Statistical Analysis*. New York: McGraw-Hill Book Company.
- Nahin, P. J. 2000. *Duelling idiots and other probability puzzlers*. Princeton University Press, Princeton N.J. (contains Matlab code that we will use to solve problems from Larsen & Marx (2001).)
- Phillips D. C. (1987). *Philosophy, Science & Social Inquiry*. Oxford: Pergamon Press.

- Ramsey, F. L. and D. W. Schafer. 1997. *The statistical sleuth: a course in methods of data analysis*. Duxbury Press, Belmont CA.
- Pindyck Robert and Daniel Rubinfeld. 1997. *Econometric Models and Economic Forecasts*. Press S. James (1982). *Applied Multivariate Analysis: Using Bayesian and frequentist methods of inference*. Malabar: Robert E. Krieger Publishing Company.
- Smith Herman W. (1991). *Strategies of Social Research*. Holt, Rinehart and Winston.
- Smith Robert. 1979. "Compensating Wage Differentials and Public Policy: A Review." *Industrial and Labor Relations Review*, pp. 339-352
- Denny, M and S. Gaines. 2000. *Chance in biology: using probability to explore nature*. Princeton University Press, 291 pp.
- Tabachnick Barbara and Linda S. Fidell (1989). *Using Multivariate Statistics*. Cambridge: Harper & Row.
- Taylor, J. R. 1997. *An introduction to error analysis: the study of uncertainties in physical measurements*, 2nd edition. University Science Books, Sausalito CA.
- Theil Henri (1971). *Principles of Econometrics*. New York: John Wiley & Sons.
- Wackerly, Mendenhall and Scheaffer, *Mathematical Statistics with Applications*, John Wiley & Sons

## PREREQUISITES

- College (scalar) algebra (ability to handle it);
- Elementary statistics (B or better in recent UST 601 or equivalent, subject to advisor approval);
- Ability to use some statistical package that accommodates regression (e.g., SPSS, MathCAD).

## EVALUATION PROCEDURE

The final grade will be a composite of:

Grades for	Weight
periodic assignments (expected each M)	10%
MathCAD labs	10%
Class presentations	15%
midterm 1 (class time) (2/27/2006)	20%
midterm 2 (class time) (4/10/2006)	20%
final (class time) (5/8/2006)	25%

- Late work will **not** be accepted.
- **All tests & papers are required.** Delays will be given **only** in emergency cases (proof required; vacation arrangements are not emergencies) and with advance notice.
- The midterm and final exams will test accumulated knowledge as well as ability to respond to new problems. While focusing on the most recent lecture topics, exams have to rely on concepts covered earlier; so in preparation review earlier material and avoid falling behind in readings or homeworks.

## OFFICE HOURS, LOCATION, PHONE

<b>Office:</b>	UR220.
<b>Office hours:</b>	Before class and by appointment.
<b>Office phone:</b>	216.687.2367
<b>E-Mail:</b>	<a href="mailto:sanda@urban.csuohio.edu">sanda@urban.csuohio.edu</a>

## IMPORTANT CSU DATES

See CSU Academic calendar, <http://www.csuohio.edu/registrar/calendar/>

## UNIVERSITY POLICIES

- Refer to the CSU Bulletin for add/drop/withdrawal procedures, S/U and incomplete grading.
- For class cancellations due to weather, call CSU information (216.687.2000) before class.
- Academic misconduct: plagiarism or cheating will result in an "F" for the course.
- Grades cannot be changed after their issuance at the end of the Semester.

## STUDENTS WITH SPECIAL NEEDS

Anyone anticipating the need for special accommodations for university-documented challenges to participate in class or complete assignments must identify him/herself by the 2<sup>d</sup> week of classes.

## COMPUTER LAB

Students can pick up their account information during hours when the computer lab is open (consult the WEB). For Spring: <http://urban.csuohio.edu/tech/facilities/labs/>

## SCHEDULE

(tentative, changes are likely and will be announced in class and on the web)

WEEK	READ GUJARATI	SUBJECT	
1. 1-23	<i>Chapters 1, 2</i>	Introduction--class organization, course content. <i>The nature and scope of econometrics.</i> <i>Basics of probability and statistics</i>	
2. 1-30	<i>Chapters 3, 4</i>	<i>Characteristics of probability distributions</i> <i>Some important probability distributions</i>	
3. 2-06	<i>Chapters 5, 6</i>	<i>Statistical inference</i> <i>Basic ideas of linear regression</i>	
4. 2-13	<i>Chapters 6, 7</i>	<i>Basic ideas of linear regression (cont.)</i> <i>Hypothesis testing</i>	<b>MathCAD lab #1</b>
5. 2-20	Prepare for Midterm I	<b>PRESIDENTS' DAY</b> - no classes	
6. 2-27		<b>MIDTERM 1</b> (class time, open book, chapters 1-7)	
7. 3-06	<i>Chapter 8</i>	<i>Multiple regression</i>	<b>MathCAD lab #2</b>
8. 3-13		<b>SPRING RECESS</b>	
9. 3-20	<i>Chapters 9, 10</i>	<i>Functional forms</i> <i>Dummy variables</i>	
10. 3-27	<i>Chapters 11</i>	<i>Model selection</i>	<b>MathCAD lab #3</b>
11. 4-03	<i>Chapters 12</i>	<i>Multicollinearity</i>	
12. 4-10		<b>MIDTERM 2</b> (class time, open book, chapters 1-12)	
13. 4-17	Chapter 13	<i>Heteroscedasticity</i>	<b>MathCAD lab #4</b>
14. 4-24	Chapter 14	<i>Autocorrelation</i>	
15. 5-1			
16. 5-8		<b>FINAL EXAM</b> (class time, open book, chapters 1-14)	

### GO TO THE WEB:

- ☑ <http://urban.csuohio.edu/~sanda/syl/stat803.htm> for the course web page;
- ☑ [http://www.cas.lancs.ac.uk/glossary\\_v1.1/basicdef.html](http://www.cas.lancs.ac.uk/glossary_v1.1/basicdef.html) Statistics Glossary for basic definitions
- ☑ <http://www.statgraphics.com/> Statlets and <http://www.statcrunch.com/> Statcrunch
- ☑ [http://www.cne.gmu.edu/modules/dau/math/dau1\\_frm.html](http://www.cne.gmu.edu/modules/dau/math/dau1_frm.html) for DAU Math refresher

## COMPUTER WORK

For solving problem sets, students should feel free to use any computer software with which they are familiar, such as SPSS, SAS, MathCAD, etc. An SPSS workshop is offered at LCUA at the beginning of each semester (and recommended).

Part of this course is a computer lab where students learn to work with the software MathCad, useful for simulating and visualizing data sets. Work should be saved on a diskette. At the end of the project each student will hand in the diskette with all the programs, as well as a printout of the results. The following lab protocols are available in .pdf format (for printing, go to the course syllabus on the WEB).

- [LAB#1: Tutorial and Two-Variable Regression](#)
- [LAB#2: Monte Carlo Simulation of the Two-Variable Regression](#)
- [LAB#3: Mean Prediction, Confidence Interval](#)
- [LAB#4: Cobb-Douglas Production Function](#)

## HOMEWORK FORMAT

- **Make it useful to you:** although answers are available, try to solve the problems on your own; the correct answer is useless if you do not know how to obtain it.
- **Make it easy to find:** label your products with your name, the homework number and date, and page numbers.
- **Make it easy to read:** type all text other than formulae and computations.
- **Make it easy to understand:** explain the logic. Include computations, in preparation for tests. Have printouts at the end; briefly state and interpret results referring to them. **State conclusions** where appropriate--don't leave the reader guessing, especially when using SPSS (restate in words what you believe your results mean in terms of the question.)
- **Make it complete:** the (max) 2 points per homework are given for effort & for tackling all questions, rather than for correct answers.

## HOMEWORK SCHEDULE

(tentative -- changes are expected and will be announced in class; if not taught in class, not required; due on Mondays unless noted)

### SCHEDULE

(tentative, changes are likely and will be announced in class and on the web)

<b>WEEK</b>	<b>DUE FROM GUJARATI</b>	<b><u>(NUMBERS REPRESENT CHAPTER.PROBLEM NUMBER):</u></b>
2. 1-30	<i>Chapters 1, 2</i>	1.6, 1.7, 2.4, 2.8.2.9, 2.12, 2.14, 2.16
3. 2-06	<i>Chapters 3, 4</i>	3.8, 3.12, 3.13, 3.15, 4.10, 4.11, 4.13, 4.16, 4.20
4. 2-13	<i>Chapters 5, 6</i>	5.6, 5.8, 5.9-11, 5.13-14, 5.16, 5.18, 5.20, 5.21
6. 2-27	<i>Chapters 6, 7</i>	<b>MIDTERM 1</b> (class time, open book, chapters 1-7)
7. 3-06		
8. 3-13		<b>SPRING RECESS</b>
9. 3-20	<i>Chapter 8</i>	
10. 3-27	<i>Chapters 9, 10</i>	
11. 4-03	<i>Chapters 11</i>	
12. 4-10	<i>Chapters 12</i>	<b>MIDTERM 2</b> (class time, open book, chapters 1-12)
13. 4-17		<i>Heteroscedasticity</i>
14. 4-24	Chapter 13	<i>Autocorrelation</i>
15. 5-1	Chapter 14	
16. 5-8		<b>FINAL EXAM</b> (class time, open book, chapters 1-14)

## PRESENTATION SCHEDULE

<b>WEEK</b>	<b>PRESENTERS</b>			
3. 2-06	<i>Tim</i>	<i>Liao</i>	<i>Eugene</i>	
4. 2-13	<i>Darcy</i>	<i>Rene</i>	<i>Hani</i>	<i>Uday</i>
7. 3-06	<i>Dafna</i>	<i>Frank</i>	<i>Yongme</i>	
9. 3-20	<i>Vince</i>	<i>Bashi</i>	<i>Yong-Je</i>	
10. 3-27				
11. 4-03				
13. 4-17				
14. 4-24				
15. 5-1				