

RMTD 482
Introduction to Linear Models

Instructor: Meng-Jia Wu Bohanon, Assistant professor (mwu2@luc.edu)

Classroom: Corboy Law Center - Room 710

Class hours: Wednesdays, 4:15-6:45pm

Office hour: By appointment

Office: Lewis Towers, Room 1040

School of Education Conceptual framework

Our School's conceptual framework is "professionalism in service of social justice". This course contributes to this framework by equipping students with knowledge and experience for conducting valid quantitative research. Through conducting, interpreting, and reporting reliable social science studies, researchers can help further the scholarly understanding of the events and practices that influence the field of education. The ultimate outcome of this understanding is to ensure that that all individuals, no matter their ability, race, religion, socioeconomic status, age or gender benefit from effective social science research.

Course content

This course introduces students to techniques of data analysis and statistical inference commonly used in educational and psychological research. The major topics are simple/multiple regression, simple analysis of variance (one-way ANOVA), and factorial analysis of variance (two-way ANOVA), multiple comparisons, analysis of covariance (ANCOVA), repeated designs, and nonparametric approaches.

Knowledge of basic algebra is required, as is an understanding of the fundamental principles of descriptive statistics and hypothesis testing (as taught in RMTD 404/421 or equivalent). Knowledge of calculus is not required.

Technological knowledge and skills

Students use SPSS (Statistical Package for the Social Sciences) to analyze data from NELS (National Education Longitudinal Study) in this class. NELS is one of the largest and most important datasets collected by the U.S. government. It includes extensive measurements of students' beliefs, aspirations, attitudes, and background, as well as related information from teachers, parents, and schools. Students are expected to be able to graphically summarize data (e.g., using histograms and/or plots) and conduct analyses using the methods introduced in this class.

Diversity

School of Education is committed to ensure the learning environment and activities are designed with respect of individual and cultural differences. The examples used in this class are chosen to reflect the diversity.

Required text

Howell, D.C. (2009). *Statistical Methods for Psychology* (7th ed.). Pacific Grove, CA: Duxbury. ISBN-10: 0495597848; ISBN-13: 978-0495597841.

Recommended texts

Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.) Thousand Oaks, CA: SAGE Publications. ISBN-10: 1847879071; ISBN-13: 978-1847879073.

Course Objectives

By the end of the course the student should have demonstrated the ability to:

1. identify continuous and discrete (or categorical) variables as either dependent or independent, and choose appropriate statistical procedures for their analysis;
2. describe relationships between predictor variables and a continuous outcome variable;
3. calculate point estimates, confidence intervals and hypothesis tests for regression slopes;
4. delineate assumptions of linear statistical models and examine data to evaluate their conformity to those assumptions;
5. formulate and interpret multiple regression models appropriate for various research problems and interpret computer output relevant to those models;
6. think about the regression analysis in matrix form;
7. formulate between-groups and within-group analysis-of-variance(ANOVA) models, estimate their parameters, and test hypotheses about those parameters; including
 - a. identify situations in which it is correct to apply,
 - b. identify the assumptions underlying parametric ANOVA,
 - c. differentiate between fixed and random effects models,
 - d. identify situations in which various transformations are appropriate for ANOVA,
 - e. compute and interpret effect size indicators for the ANOVA.
8. design and implement tests of specific *a priori* and post hoc contrasts in the context of analysis of variance models. Specifically
 - a. identify and differentiate between comparison and familywise error rates,
 - b. describe when a priori and post hoc comparisons are appropriate,
 - c. compute planned and post hoc comparison procedures, and
 - d. identify the various post hoc comparison procedures (e.g., Tukey's HSD and Scheffe test), and conditions wherein each procedure is appropriate.
9. recognize similarities and differences between regression and analysis-of-variance models;
10. understand the roles of error terms in linear models;
11. write coherent summaries and interpretations of data analyzed by the above procedures.

Homework

Six homework assignments will make up the points devoted to homework. The assignments are not all equal in length. You are encouraged to pair with another student in the class and work as a group to discuss the questions and the direction of analysis asked in the HWs. You are also allowed and encouraged to discuss with other groups. However, each group should write up the answers separately and turn in a copy of the group work by the due date. The two students in a group will receive the same grade for their group work.

Each group is given a total of six (6) late days that can be used throughout the semester without any consequence to the final grade. No late date can be used on the last assignment so the answer key, which will be provided for each HW, can be posted in time for the purpose of preparing for the final exam. If more than 6 late days are accumulated, it will affect your final course grade, as described below.

<u>Number of late days</u>	<u>Consequences</u>
0-6	None
7-10	HW scores will be graded down 20% for each late day
11-13	Downgrade one level on final grade (e.g., A reduced to A-)
14+	Downgrade two levels on final grade (e.g., A reduced to B+)

If you would like to appeal any grade after your HW is graded, you must make the appeal in writing and submit it along with the graded HW to the instructor.

Examination

There will be one final exams for this course. The exam is open-book and open-note, and you may use your calculator during the exam. However, books, notes, and calculators may **not** be shared or circulated during exams, so be sure to bring your own materials.

Participations

Regular attendance and participation in class discussions are expected. Contact the instructor **ahead** of the class meeting if you cannot attend the class.

Grades

Grades will be based on points accumulated on homework and examinations. There will be 100 total possible points, distributed as follows:

Homework assignments	60%
Final exam (scheduled time only)	30%
Participation	10%

The grade ranges in terms of percentage are:

100.0-92.0 = A	87.9-84.0 = B+	74.9-72.0 = C+	64.9 and below = F
91.9-88.0 = A-	83.9-80.0 = B	71.9-70.0 = C	
	79.9-75.0 = B-	69.9-65.0 = C-	

Other important issues

Academic Honesty

Academic honesty is an expression of interpersonal justice, responsibility and care, applicable to Loyola University faculty, students, and staff, which demands that the pursuit of knowledge in the university community be carried out with sincerity and integrity. The School of Education's Policy on Academic Integrity can be found at:

http://www.luc.edu/education/academics_policies_integrity.shtml. For additional academic policies and procedures refer to:

http://www.luc.edu/education/academics_policies_main.shtml

Accessibility

Students who have disabilities which they believe entitle them to accommodations under the Americans with Disabilities Act should register with the Services for Students with Disabilities (SSWD) office. To request accommodations, students must schedule an appointment with an SSWD coordinator. Students should contact SSWD at least four weeks before their first semester or term at Loyola. Returning students should schedule an appointment within the first two weeks of the semester or term. The University policy on accommodations and participation in courses is available at:

<http://www.luc.edu/sswd/>

Harassment (Bias Reporting)

It is unacceptable and a violation of university policy to harass, discriminate against or abuse any person because of his or her race, color, national origin, gender, sexual orientation, disability, religion, age or any other characteristic protected by applicable law. Such behavior threatens to destroy the environment of tolerance and mutual respect that must prevail for this university to fulfill its educational and health care mission. For this reason, every incident of harassment, discrimination or abuse undermines the aspirations and attacks the ideals of our community. The university qualifies these incidents as incidents of bias.

In order to uphold our mission of being Chicago's Jesuit Catholic University-- a diverse community seeking God in all things and working to expand knowledge in the service of humanity through learning, justice and faith, any incident(s) of bias must be reported and appropriately addressed. Therefore, the Bias Response (BR) Team was created to assist members of the Loyola University Chicago community in bringing incidents of bias to the attention of the university. If you believe you are subject to such bias, you should notify the Bias Response Team at this link:

<http://webapps.luc.edu/biasreporting/>

Tentative schedule

Date	Topics	Readings	HW Due
8/31	Introduction to Linear Models <i>Linking two samplse t-tests to general linear models</i>		
9/7	Simple Regression: <i>Statistics & assumptions for using basic general linear models</i>	Ch. 9	
9/14	Multiple Regression I <i>Population model & estimations</i>	Ch. 15	HW1: SR
9/21	Multiple Regression II <i>Model building & model quality</i>	Ch. 15	
9/28	Multiple Regression III <i>Multicollinearity & model validation</i>	Ch. 15	
10/5	Simple Analysis of Variance (ANOVA) <i>Population model & estimations</i>	Ch. 11	HW2: MR
10/12	Simple Analysis of Variance (ANOVA) <i>Fixed/random effects models & dummy variables</i> Multiple comparisons I <i>Error rate & A priori contrasts</i>	Ch. 11 & Ch. 12	
10/19	Multiple comparisons II <i>Post hoc contrasts</i>	Ch. 12	HW3: ANOVA
10/26	Factorial analysis of variance (two-way ANOVA) I <i>Population model, estimations</i>	Ch. 13	HW4: Multiple comparisons
11/2	Factorial analysis of variance (two-way ANOVA) II <i>Interactions</i>	Ch. 13	
11/9	Analysis of covariance (ANCOVA) <i>Population model, selection of covarites, & estimations</i>	Ch. 16	HW5: 2-way ANOVA

11/16	Repeated ANOVA <i>Population model, design, & estimations</i>	Ch. 14	
11/23	~*~ Thanksgiving break: No class ~*~		
11/30	Nonparametric Approaches <i>What can you do when the assumptions of the aforementioned methods are violated?</i>	Ch. 18	HW6: ANCOVA
12/7	Review		
12/14	Final exam!		