

**Quantitative Research Methods II (EDMS 646)**  
**Section 0102 Fall 2008**  
**EDU 0212**  
**Thursday – 4:15-7:00pm**

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**Instructor**

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**Office Hours**

Monday 12:00-1:00pm  
or by appointment

**Teaching Assistant**

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**Office Hours**

Monday 1:00-2:30pm  
Tuesday 2:30-4:00pm  
or by appointment

**Course Description**

This course is the second in a series of the graduate-level statistics courses. It covers topics on one-way ANOVA, multiple comparison procedures, factorial ANOVA, ANCOVA, and nested designs. This course assumes understanding of normal distribution, z-tests, t distribution, t-tests, correlation, simple linear regression, chi-square tests of goodness-of-fit and independence. Familiarity with SPSS is also assumed. This course focuses on the proper understanding and application of the analysis of variance methods in educational and psychological research. Technical aspects of the statistical analyses will be presented and emphasized.

**Required Textbook**

- Lomax, R.G. (2007). *Statistical Concepts: A Second Course*, (3rd ed). Mahwah, NJ: Lawrence Erlbaum Associates.
- Supplementary materials-Course packet.

**Additional Reference Textbooks**

- Agresti, A., & Finlay, B. (1997). *Statistical Methods for the Social Sciences* (3rd ed.) Upper Saddle River, NJ: Prentice Hall.
- Glass, G. V., & Hopkins, K. D. (1996). *Statistical methods in education and psychology* (3rd ed.) Needham Heights, MA: Allyn and Bacon.
- Hays, W. (1999). *Statistics* (5th ed.). New York: Hot, Rinehart, & Winston.
- Hinkle, D.E., Wiersma, W., & Jurs, S.G. (2003). *Applied Statistics for the Behavioral Sciences, Fifth Edition*. Boston, MA: Houghton Mifflin.
- Howell, D.C. (2002). *Statistical Methods for Psychology* (5th edition). Pacific Grove, CA: Duxbury Press.
- Kirk, R. E. (1968). *Experimental design: Procedures for the behavioral sciences* (1st ed.). Pacific Grove, CA: Wadsworth.
- Neter, J., Kutner, M.H., Nachtsheim, C.J., & Wasserman, W. (2004). *Applied linear statistical models* (5th ed.). Chicago: Irwin.

## Course Topics and Readings

The following table lists the topics to be covered in this course. This timetable is tentative. Adjustment may be made along the semester.

Week	Date	Topics		Readings
1	9/4	Introduction and review of hypothesis testing	Critique	In-class notes for EDMS 645
2	9/11	One-way ANOVA		Lomax–Ch. 1 & CP: 101-127
3	9/18	One-way ANOVA and statistical power	HW1	Lomax–Ch. 1 & CP: 129-176
4	9/25	Statistical power		CP: 129-176
5	10/2	Two-factor ANOVA	HW2	Lomax–Ch. 3.1, 3.4 & CP: 177-200
6	10/9	Multi-factor ANOVA		Lomax–Ch. 3.2, 3.3 & CP: 201-211
7	10/16	Fixed, random, and mixed ANOVA	HW3	Lomax–Ch. 5.1-5.3 & CP: 213-225
<b>8</b>	<b>10/23</b>	<b>Mid-term exam</b>		
9	10/30	Within-subjects ANOVA and ANCOVA		Lomax–Ch. 5.4, 5.5 & Ch. 4 & CP: 227-246, 247-301
10	11/6	ANCOVA	HW4	Lomax–Ch. 4 & CP: 247-301
11	11/13	Comparisons and contrasts		Lomax–Ch. 2.1 & CP: 303-331
12	11/20	Multiple comparison procedures	HW5	Lomax–Ch. 2.2-2.4 & CP: 332-381
13	11/27	<b>Thanksgiving</b>		
14	12/4	Two-factor ANOVA comparisons		Lomax–Ch. 3.1.8-3.1.10 & CP: 383-417
15	12/11	Nested design and course review, Critique due	Final exam	Lomax–Ch. 6
<b>16</b>	<b>12/18</b>	<b>Take-home final exam due</b>		

## Statistical Software

EDMS department supports SPSS versions 11.0 and higher (Windows and Macintosh). Examples in class will come from SPSS/Windows (14.0), which is available in the Benjamin Building's computer lab (0230) in the basement. Students may use whichever recent package they wish, but they should know that slight differences may exist among versions. Students can

- either use a campus lab to do SPSS assignments.
- or buy a version of the Student/Ware package, which include a manual and should get you through EDMS 651.
- or buy a version of the Grad Pack, which historically costs about \$225 and manuals must be purchased separately. This is for the student who plans to take more quantitative classes beyond EDMS 651, and/or who plans to conduct serious quantitative research.

## Course Objectives

### *Hypothesis Testing and Power*

- Explain sampling, sample, and population distribution in hypothesis testing
- Define  $\alpha$ ,  $1-\alpha$ ,  $\beta$ ,  $1-\beta$  under the framework of sampling distribution
- Interpret SPSS output
- Explain factor affecting statistical power
- Use power tables to find power and sample size

### *One-way ANOVA*

- Identify situations for proper application of one-way ANOVA
- Understand the assumptions for ANOVA and the conditions where F test-statistics is robust
- Write the linear model for ANOVA and identify the components of the model
- State null and alternative hypotheses for ANOVA
- Describe the partitioning of the total sum-of-squares in ANOVA
- Define and compute SS-total, SS-groups, and SS-within
- Identify degrees-of-freedom and compute mean-squares for different variability sources
- Develop and interpret ANOVA tables and understand the relationships of the various parts of the table
- Compute and interpret the F test-statistic in one-way ANOVA
- State the relationship between the t and F statistics

### *Contrasts*

- Define a contrast
- Explain the practical application of contrasts
- Produce a contrast for a specified problem
- Define and compute t or t' for a contrast using the definitional formula
- Explain the application of the Tukey and Scheffe' procedures
- Explain differences in power in different procedures
- Explain family-wise type I error
- Produce sets of orthogonal contrasts

### *Two-way ANOVA*

- Explain situations where two-way ANOVA would be applied
- Identify independent and dependent variables
- Produce the score model and define its components
- Understand assumptions
- Obtain estimated treatment and interaction effects
- Define and produce SSs using estimated effects
- Interpret the ANOVA table-df, additivity, MSs, and F
- Produce null and alternative hypotheses
- Explain expected values of MSs under null and alternative conditions
- Provide practical explanation of interaction
- Produce and interpret an interaction graph
- Explain the relationship of one-way and two-way ANOVA on the same data

### *Fixed, Random, and Mixed Effects Designs*

- Identify random vs fixed dimensions
- State null hypothesis for random dimensions
- Conduct appropriate tests for fixed vs random vs mixed designs
- Interpretation of two-way ANOVA table for the above designs

### *Repeated Measure Designs*

- State the research applications
- State advantages and disadvantages
- State the statistical hypotheses

Understand assumptions  
Describe the partitioning of the total sum-of-squares  
Interpret the ANOVA table and tests

#### *ANCOVA*

Explain the effects of increasing items/raters using variance component formula  
Explain the research situation for ANCOVA  
Identify correlation among variables in ANCOVA  
State advantages and disadvantages of ANCOVA: power, interaction, linearity, df  
Produce graphical representation of ANCOVA  
Set up ANCOVA in SPSS  
Describe the partitioning of the total sum-of-squares in ANCOVA and compare with one-way and two-way ANOVA  
Explain homogeneity vs heterogeneity of regression  
Interpret F tests in ANCOVA

### **Formal Course Assessment**

#### *Homework Assignments*

There will be 5 assignments spaced evenly throughout the semester to give students an opportunity to apply and practice concepts learned in class. It is expected that students will be using SPSS for their homework where computer work is required. When working the assignments, students are expected to pull together the material from lecture, the text, and the supplemental notes where applicable. Late homework assignments will be accepted with a penalty of 10% credit. Graded assignments will generally be returned on the following day in class after they are submitted. **Students are encouraged to work in groups on homework, but each student must turn in their own write-up.**

In the assignments students should cut and paste relevant portions of the computer output into the appropriate places in the homework to show how solutions are arrived. Assignments should be well-organized and must be word-processed.

#### *Exams*

There will be two exams: one is in-class midterm exam and the other take-home final exam. The content of the exam will cover topics presented in class up to that point. The in-class exam will be closed book and closed class note; however, students may prepare and use a reference sheet of a 8.5"x11" two-sided page of notes. Students should bring a calculator to the exams; but calculator sharing between students will not be allowed. **The take-home final exam is an open-book and open-notes exam. But students need to work independently. It is not allowed to work in pairs, or groups, or consult anyone else including classmates, students outside the class or any faculty.**

#### *Critique*

This assessment requires you find a journal article in your field of study, which utilized the ANOVA /ANCOVA methods we discuss in class. Make a copy. Read and summarize the study. Then, criticize the paper. Write up both the merits and weak points of the article in research design and data analysis. The due date is the last day of class: Dec. 11 in class.

## Course Grades

Students' homework, quizzes and exam will be combined using a weighted average grading scheme with the corresponding weights given below. Final letter grades will then be assigned based on the given scale.

<b>Assessment</b>	<b>Weight</b>	<b>Overall Course Percent</b>	<b>Grade</b>
Total homework points	50%	100% - 93%	A
Total midterm exam points	20%	92% - 88%	A-
Total critique points	15%	87% - 85%	B+
Total final exam points	15%	84% - 81%	B
		80% - 78%	B-
		77% - 75%	C+
		74% - 70%	C
		69% - 65%	C-
		64% - 60%	D+
		59% - 55%	D
		54% - 50%	D-
		≤ 49%	F

## *Incompletes*

Incompletes for this course will be given on a case-by-case basis. The most valid reason for an incomplete is an unforeseen event that gravely interferes with a student's ability to perform at an adequate level. Incompletes will not be given for unqualified poor performance.

## Accommodations for Emergencies

If the University closes on the day of class, there will be no class. If the University does not close but there is a threat of inclement weather, there will still have class unless notified otherwise. So, please check email and/or the course website on blackboard, sometime during the day of class for any last minute announcements. If you will be absent from class, please send me an email to notify. All students are expected to take the exams and to submit assignments and critique on the specified dates. You must contact me before an exam if you will be absent.

## Academic Accommodations

In compliance with the Americans with Disabilities Act (ADA), I will work with you if you have a documented disability that is relevant to successfully completing your work in this course. If you need academic accommodation for a **documented disability**, please contact me as soon as possible to discuss your needs. Students with documented needs for such accommodations must meet the same achievement standards required of all other students, although the exact way in which achievement is demonstrated may be altered. All requests for academic accommodations should be made as early as possible in the semester. For further information concerning disability accommodations, please contact Dr. William Scales at the Disability Support Service – (301) 314-7682.

## **Academic Integrity**

You are responsible to uphold the standards set for academic integrity in “Code of Academic Integrity” by the Student Honor Council. It is imperative that you be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the code of Academic Integrity or the Student Honor Council, please go to <http://www.shc.umd.edu> for details.

On plagiarism -- It is important that the student synthesize pertinent information from the readings and class lectures when writing up homework assignments. Synthesis does not occur when large blocks of text are copied from the textbook or lecture notes and used to answer questions. You should avoid extensive verbatim copying of information from the textbook or lecture notes when answering the longer questions on the assignments.

## **Make-Up Examinations**

The University policy states: “An instructor is not under obligation to offer a substitute assignment or to give a student a make-up assessment unless the failure to perform was due to an excused absence, that is, due to illness (of the student or a dependent), religious observance (where the nature of the observance prevents the student from being present during the class period), participation in university activities at the request of university authorities, or compelling circumstances beyond the student’s control. Students claiming excused absence must apply in writing and furnish documentary support for their assertion that absence resulted from one of these causes.”