STATISTICS I

Psychology 273
Fall 2003
TTh 9:10-10:25, 229 Social Sciences

Instructor:

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Course Web site: http://www.duke.edu/~rhoyle/teaching/psy273/

Readings

Required

Maxwell, S. E., & Delaney, H. D. (2004). *Designing experiments and analyzing data: A model comparison perspective* (2nd ed.). Mahwah, NJ: Erlbaum.

Spector, P. E. (2001). *SAS programming for researchers and social scientists* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Optional

Littell, R. C., Stroup, W. W., & Freund, R. J. (2002). *SAS for linear models* (4th ed.). New York: Wiley.

Primary Goals of the Course

○ to introduce the general linear model (GLM), particularly manifestations typically classified under the analysis of variance (ANOVA) rubric;

○ to promote a clear understanding of the model-comparison approach to statistical hypothesis testing in the GLM, with a particular focus on ANOVA;

○ to present computational details critical to an understanding of the proper application of ANOVA to data generated by factorial designs common in psychological science;

○ to master the concepts of statistical power, effect size, and confidence interval as they relate to statistical hypotheses tested by ANOVA;

○ to provide opportunities to interpret and critique results of ANOVAs by reading published examples from the recent literature and evaluating results of analyses completed as part of the course;

○ to facilitate the application of ANOVA to an appropriate set of data and the completion of a detailed report of the results.

Elements of the Course

Readings

The readings for the course primarily come from the required textbook. Just revised by Maxwell and Delaney, the book is rare among graduate-level statistics texts in its foundation in the model-comparison approach to statistical hypothesis testing using data generated by factorial designs. We will cover all the material in the first nine chapters and Chapters 13 and 14. From time to time, I will ask you to read a journal article or book chapter that expands on material in the textbook. Please plan to spend significant time with the reading material *before* the class during which it is covered. Most of the time, reading through the material once will not suffice. Read it; read it again; take notes on it; discuss it with fellow class members; prepare questions about it to raise in class or during lab sessions.

Homework

During the semester, you will complete a number of homework assignments. The completed assignments will neither be handed in nor graded; however, you will find conscientious completion of them to be an essential part of mastering the course material. As such, completion of the homework assignments will be one of the most important aspects of preparing for the exams. As a rule, the homework assignments you receive will reference material covered in the previous two or three class meetings. You will be expected to have completed the homework assignment by the beginning of the next lab session. The teaching assistant will devote time during lab sessions to answering questions and addressing issues associated with the homework assignments.

Software

We will limit our use of statistical software to the SAS System, which is widely available on campus and throughout the Triangle. Neither the teaching assistant nor I will "teach" SAS in this course. Rather, we will provide demonstrations, handouts, and exercises designed to start you down the road to proficiency. In addition, you will find the Spector (2001) paperback to be a useful reference for data management and basic data analyses using SAS. Otherwise, I will use SAS demonstrations and SAS output as a tool to teach you how to apply and interpret results from analyses of variance.

Exams

You will complete two written examinations during the course; the first exam, which covers Chapters 1-6, will contribute 20%, and the second exam, on Chapters 7-9, 13, and 14, will contribute 30% toward your grade for the course. The exams will include multiple choice and short answer items as well as a section requiring you to interpret or manipulate information from computer output. You will have a maximum of 3 hours to complete each exam, for which you will be allowed to reference as many notes as you can fit on one side of an 8½ x 11 sheet of paper. Aside from you "cheat sheet," you may bring only a calculator and pencil(s) to the exam sessions.

Presentation

You will give a 10-minute presentation in which you describe and evaluate a published application of analysis of variance. You are to choose an article published after 1999 in a major journal in your field of interest. The article you choose to present must be approved by the instructor or teaching assistant. In the presentation, you are to do the following:

- State the primary research question.
- Describe the data (e.g., *N*, missing data problems, measures, distributions)
- Describe how analysis of variance was used to address the primary research question.
- Critique the presentation of the results (e.g., tables, figures, details about the analyses).
- State whether, in your opinion, analysis of variance was appropriately chosen and applied. Note any alternative analyses not described in the article that might shed additional light on the primary research question.

You will present on either November 20th or 25th; your grade on the presentation will contribute 10% toward your grade for the course.

Research Report

The primary product of the course will be a written report of an analysis of variance you conduct on data of your choosing. Reports are to include the following (additional details will be provided in a handout):

- brief statement of the research question and hypotheses
- detailed method section
- detailed results section
- short conclusion section

About one-third of the way into the course I will ask you to pinpoint a data set that you will analyze and write up for the course. Near the midpoint of the course I will ask you to prepare a document in which you specify the names and characteristics of the variables your analysis will include and the strategy you will use in applying analysis of variance to your data. About two-thirds of the way into the course I will ask you to meet outside of class with another member of the class to discuss your data and plan of analysis and to exchange feedback on your projects. Two weeks before the write-ups are due, Tuesday, November 18th, you will provide a copy of a complete draft to two members of the class, and you will receive copies of drafts from two other class members. You will provide written reviews (details will be provided in a handout) for the authors of the drafts you receive (and copies for me); you will receive two reviews of your draft. The reviews, which will be graded and contribute 5% toward your grade for the course, are due one week later, Tuesday, November 25th, one week before the report is due. The final draft of the research report is due before noon on Tuesday, December 2nd. The research report will count 35% toward your grade for the course.

Course Grade

To summarize, course grades will be based on the average percentage of points obtained from five sources, weighted as follows:

Exam 1: 20%
Exam 2: 30%
Presentation: 10%
Reviews: 5%
Research report: 35%

Grades will be assigned according to the following scale:

E: 89.5%-100%
G: 79.5%-89.4%
S: 69.5%-79.4%
F: < 69.5%

Course Outline

Date	Topic	Readings/Assignments Due
Aug 26	introductions and overview of the course	no reading
	Unit 1: Foundation/Single-Factor Between-Subjects Designs	
Aug 28	philosophical and logical underpinnings	Chapter 1 & 2
Sept 2	one- and two-group designs	Chapter 3 (pp. 67-85)
Sept 4	general one-way design; tests; effect sizes	Chapter 3 (pp. 87-110)
Sept 9	assumptions; power	Chapter 3 (pp. 110-126); Appendix B
Sept 11	lab session	
Sept 16	individual contrasts	Chapter 4 (pp. 149-163)
Sept 18	tests; multiple contrasts	Chapter 4 (pp. 163-180)
Sept 23	multiple comparison procedures	Chapter 5
Sept 25	lab session	
Sept 30	trend analysis	Chapter 6
Oct 2	lab session	
Oct 7	**Exam 1**	
	Unit 2: Multifactor Between-Subjects and Within-Subjects Designs	
Oct 9	testing interactions in two-way designs	Chapter 7 (pp. 275-320)
Oct 16	nonorthogonal two-way designs	Chapter 7 (pp. 320-343)
Oct 21	higher-order designs	Chapter 8
Oct 23	lab session	
Oct 28	analysis of covariance	Chapter 9 (pp. 399-437)
Oct 30	alternatives to ANCOVA	Chapter 9 (pp. 438-452)
Nov 4	lab session	
Nov 6	one-way within-subjects designs	Chapter 11 (pp. 525-529) Chapter 13 (stop at the top of p. 671)
Nov 11	two-way within-subjects designs	Chapter 14 (pp. 682-704)
Nov 13	designs with within and between factors	Chapter 14 (pp. 704-742)
Nov 18	lab session	**review draft of research report due**
Nov 20	presentations	
Nov 25	presentations	**reviews of draft research reports due**
Dec 2	reading day	**final draft of research report due**
Dec 4	reading day	
Dec 9	**Exam 2** (9am-noon)	

Note. I reserve the right to adjust the schedule.