Statistical Packages for Biopsych
PSYC 892 004
FALL SESSION, 2006

Mondays 1:30pm – 4:10pm
Location: IN, Rm. 318

Instructor:
Katherine McKnight, Ph.D.
Office & Phone: Thompson Hall, rm. 131; 703-993-1349
Office hours: Monday, 4:10-5:10pm

The real purpose of [the] scientific method is to make sure Nature hasn't misled you into thinking you know something you actually don't know.
--R. Pirsig (from "Zen and the art of Motorcycle Maintenance")

Too many people freeze like deer in the headlights of an oncoming car when they hear about statistics. – David Pittenger (1957 -)

Course description & objectives:

This course is an introduction to experimental design and analysis of variance, the major statistical method for analyzing experimental data in the behavioral sciences. We will learn the logic of experimental designs and match different designs with appropriate analytic methods. We first focus on the basics of ANOVA and expand on them with multi-factorial designs, repeated measures and fixed vs. random sources of variability. One of my goals for this course is to demonstrate that statistics are a tool for reasoning and decision-making and they are not independent of study design. Conducting research is a lot like detective work. If the evidence is weak, the conclusions are called into question and often disregarded. Therefore it is important for scientists to use the best methods and appropriate data analyses given the study question. Our research and data analytic methods are the means to gathering the best evidence we can to make a solid case for our scientific conclusions.

Another goal is to familiarize you with SPSS, a statistical package that can be used for analyzing experimental data of focus for this course. You will learn to generate data sets and run a variety of ANOVA models and interpret the output. By learning the tools for analyzing experimental data, you learn the logic of experimental designs and the conceptual basis for analysis of variance.

Required Reading:
1) *Design and Analysis: A Researcher's Handbook (4th Edition),* by Geoffrey Keppel & Thomas Wickens (*referred to as K&W in the syllabus*)
2) Supplemental readings as announced. These will be available either on the Electronic Reserves or emailed to you.

Grading:
I will use your performance on in-class assignments, homework & exams for assigning you a grade for the class. Your grade will be based on your performance in the following areas:

In class assignments: Occasionally you will be given some work to do in class that you will turn in. Grading criteria will be discussed per assignment.

Homework: You will be given chapter exercises on a weekly basis that you will turn in. Grading criteria will be discussed per assignment. If you miss a class, it is up to you to find out whether an assignment was given.

<u>Exams</u>: There will be 2 exams, the Midterm and the Final. Both are cumulative and their format will be discussed in class. The Final will include the selection of an appropriate data analytic strategy given the proposed research question, and a description as to why you chose that particular strategy (or strategies).

<u>Grading criteria</u>:

♦ **For an 'A'**, a student must:
  ♦ pass at least 90% of the in-class and homework assignments combined, *and*
  ♦ average at least 90% on the exams

♦ **For a 'B'**, a student must:
  ♦ pass at least 80% of the in-class and homework assignments combined, *and*
  ♦ average at least 80% on the exams

♦ If a student meets one, but not all criteria for a B, that student will receive a C grade.

♦ If you're concerned about your grade, see me during the semester, <u>not at the last minute</u>!

♦ An "Incomplete" grade requires written application to the Instructor at least 2 days prior to the final exam. The application must include the reason for the request, the course work completed to date, and a schedule for finishing the remaining course work.

Academic Honor Code:
   Please familiarize yourself with the Honor System and Code, as stated in the GMU catalog. The University Honor Code policy is at http://www.gmu.edu/catalog/apolicies/honor.html

Syllabus Changes
   Any changes in the syllabus will be discussed in class beforehand and posted on the course website. Students are responsible for the changes.

Important Dates
   • Sept 12—last day to drop without penalties & last day to add classes
   • Oct 9—Columbus Day; Mon classes meet Tues, Tues classes don't meet this week
   • Dec 12-19—Final's week: Our final is Dec 13 (Wed) 1:30 – 4:15pm.

Topics and Readings

Week 1 (Aug. 28) - *Introduction to the Course—Research Design, Statistics & Decision-Making*
   Intro to the course, intro to SPSS
   <u>Assignment for next class (Sept 11)</u>:
   • read Chapters 1 & 2
   • Be sure you are absolutely clear on all bolded terms in Ch.1 & 2—I will proceed through the course assuming that you are.
   • Work through the 2 problems on p. 31 and bring them to class on 9/11/06 to hand in & discuss

Week 2 (Sept. 4) –*NO CLASS: LA BOR DAY*

Week 3 (Sept. 11) –*The Concept of Variance and its Analysis*
   Review and discuss Ch1 & 2 of K&W, review questions & terms
   <u>Assignment for next week</u>:
   • read Chapter 3
   • Complete the following exercises: 3.1 (use Table A.1 in Appendix); 3.2, 3.3, 3.5 using SPSS, & 3.8 using hand calculations per the text

Week 4 (Sept. 18) – *F-ratios, Type I & II errors, unequal sample sizes*
Review and discuss F-ratios, Type I & II errors, statistical power, unequal ns
Assignment for next week:
- read chapters 4 & 5 in K&W
- Complete exercises 4.1, 4.4, & 4.7 and 5.1 & 5.2

Week 5 (Sept. 25) – *Comparing Means (Contrasts) & Trend Analysis*
Review and discuss contrasts and trend analysis
Assignment for next week:
- Read chapters 6 & 7 in K&W
- Complete exercises 6.1, 6.2a only, 6.3a&c and 7.1 & 7.3

Week 6 (Oct. 2) – *Simultaneous Comparisons & the Linear Model*
Review and discuss familywise error, methods for simultaneous comparisons, linear model assumptions
Assignment for next week:
- Read chapters 8 & 10 in K&W
- Complete exercises 8.1, 8.3 and explain what you've learned from this problem, 8.4, 8.6 & 8.7 and all problems (10.1-10.4) for ch10

Week 7 (Oct. 10-- NOTE THIS IS A TUESDAY!!!) – *Statistical Power, Multifactorial designs*
Review & discuss statistical power, main effects and interactions
Assignment for next week:
- Read chapters 11 & 12 in K&W
- Complete exercises 11.3, 11.5 & 11.7 and 12.2, 12.3a, & 12.5

Week 8 (Oct.16) *2-way ANOVA, Main & Simple Effects*
Review & discuss the features of 2-way ANOVA, analysis of main & simple effects
Assignment for next week:
- Complete take-home midterm exam, due IN CLASS next week
- Read pp. 289-90 re: GLM

Week 9 (Oct. 23) – *Midterm Exam* due IN CLASS; *GLM & Unbalanced designs*
TAKE-HOME MIDTERM DUE AT BEGINNING OF CLASS TODAY!
Assignment for next week:
- Read chapter 13 & 15 in K&W (no class next week, so you have 2 weeks to do this)
- Complete exercises 13.2, 13.3, 13.5a, 13.6a and 15.1, 15.3, 15.6a-c & 15.7

Week 10 (Oct. 30) - *NO CLASS, Dr. McKnight at AEA Conference*
Work on assigned readings & problem sets and have them completed for next week's class

Week 11 (Nov. 6) – *Interactions in 2-way ANOVA models & ANCOVA*
Review and discuss Midterm exam, then interaction in 2-way ANOVA models and ANCOVA
Assignment for next week:
- Read chapter 16 & 17 in K&W
- Complete exercises and 16a, bi & ii, & 16.3 and 17.1, 17.2a, 17.4, 17.5

Week 12 (Nov. 13) – *Within-Subjects Design & Analysis Issues*
Review and discuss within-subjects design & analysis issues
Assignment for next week:
- Read Chapters 19&20 in K&W

- Complete exercises 19.2 and 20.2, 20.3 & 20.5

Week 13 (Nov. 20) – *Mixed Designs*
Review and discuss mixed designs, analysis issues
Assignment for next week:
- Read Chapter 24 in K&W

Week 14 (Nov. 27) – *Random effects*
Review and discuss random vs. fixed effects
- read Chapter 25 in K&W
- catch up on your reading for the course, review for the final

Week 15 (Dec. 4) – *Nested designs, Summary of Course & Review for Final*
- catch up on your reading for the course
- Take-home final exam, due by 4:15pm on Dec 13, 2006 in my mailbox in Psychology

Week 16 (Dec 13) – *FINAL EXAM DUE NO LATER THAN 4:15PM*