

Advanced Psychological Statistics II

PSYX 521

Spring 2019

Meeting Times: Fridays, 12:30 – 3:20pm

Location: 246 Skaggs Building

Instructor: Daniel J. Denis, Ph.D.
Office: 369 Skaggs Building
E-mail: daniel.denis@umontana.edu
Spring Office Hours: M, 12-1; W, 12-2.

Course Overview

This course is a continuation of Psyx. 520 (Stat I). The goal is to learn and understand statistics, so that you can think about them **creatively** and **critically** when doing your own research, as well as when interpreting research in your field. The course is designed for graduate students in psychology. Issues in measurement will also arise over the course, and we will discuss how to deal with these issues. For instance, performing statistical analyses on a measurement of one's anxiety is only as good as how well the given measure "taps" into the construct of anxiety. Similarly, issues of measurement also rear their head when contemplating how to best parameterize the statistical model of linear regression, which sometimes requires the use of special coding schemes to accommodate various types of data. Given the advance of specialized statistical tools such as structural equation models (SEM), we will also try to critically evaluate the use of regression methods, and their failure to take measurement error in predictors into account. We will also discuss such elements as the intraclass correlation and coefficient alpha from the vantage point of classical test theory.

Course Objectives

By the end of the course, you should have a good to excellent grasp of the following topics:

- A more solid understanding of the principles of Stat I
- Random Effects Models
- Mixed Models, including Repeated Measures and Longitudinal Designs
- Randomized Block Designs
- A more broad understanding of Experimental Method (and alternatives)
- Simple Linear Regression, Correlation, and Bivariate Distributions
- Multiple Regression and the Nature of Multivariate Distributions
- Model Building with ANOVA or Regression
- Analysis of Covariance, Logistic Regression
- Generalized Linear Models

You will also be exposed to some or all of the following:

1. Bayesian Statistical Analysis (as an alternative to NHST)
2. Classical Measurement Theory in Test Construction.
3. Experimental vs. Non-Experimental Designs.
4. The Matrix Algebra of Multiple Regression Analysis.
5. Data Management Using SPSS.

6. Missing Data in Statistical Analyses.
7. Putting Statistics into Context: The Role of Statistics in Science.
8. Mediation Analysis.
9. Moderation Analysis.
10. An Introduction to R Statistical Software.
11. Path Analysis and Structural Equation Models
12. Advanced Repeated Measures & Longitudinal Designs
13. The Analysis of Categorical and Qualitative Data
14. Non-parametric Statistical Methods.

Credits: 4.0

Required Course Materials

Moodle Instructor Notes & Other Postings

Optional Texts

Hays, W. L. (1994). *Statistics*, 5th ed. Wadsworth Publishing Company, Belmont CA.

Howell, D. (2009). *Statistical methods for psychology*. Wadsworth Publishing.

Kirk, Roger E. (2007). *Statistics: An Introduction*. 5th ed. Thomson/Wadsworth.

Leech, N. L., Barrett, K. C., & Morgan, G. A. (2015). *IBM SPSS for Intermediate Statistics: Use and interpretation*. New York: Routledge.

Office Hours

Office hours are held weekly. You are also strongly encouraged to e-mail questions to the instructor and/or TA, as they arise. Writing your question out in an e-mail, as clearly as you can, is an excellent way to clarify what you do not understand, and often, you achieve a deeper understanding of the topic itself while writing out your e-mail. Please be as detailed and specific as you can in your e-mail, so we know how to frame our response to best suit your needs.

Final Grade Assignment

There are 4 components that will make up your final grade*:

1. Midterm Test (10%)
2. Assignments (20%)
3. Seminar (20%)
4. *Final Exam (50%)

* If your final exam grade is better than your mid-term test grade, your final exam will be worth 60% instead of 50%. The final exam is cumulative over the entire course (including material already covered on the midterm). Assignments and evaluations will consist of multiple choice and short-answer.

Student Seminars

The student seminar component of the course comprises 20% of your final grade, and is an important component of this course. Details of the student seminar, and criteria on which it will be evaluated, will be discussed in class. **The primary criteria is that your seminar be a very strong presentation of a statistical topic.** It is expected that you will begin preparing for the seminar NOW, so that by the time you present, it represents something extremely well-prepared and advanced (and in depth; shallow, surface content will receive no points).

Seminars can be done on topics such as the following:

100	A	1. Bayesian Statistical Analysis (as an alternative to NHST)
99		2. Classical Measurement Theory in Test Construction.
98		3. Experimental vs. Non-Experimental Designs.
97		4. The Matrix Algebra of Multiple Regression Analysis.
96		5. Data Management Using SPSS.
95		6. Missing Data in Statistical Analyses.
94		7. Putting Statistics into Context: The Role of Statistics in Science.
93		8. Mediation Analysis.
92		9. Moderation Analysis.
91		10. An Introduction to R Statistical Software.
90	A -	11. Path Analysis and Structural Equation Models
89		12. Advanced Repeated Measures & Longitudinal Designs
88		13. The Analysis of Categorical and Qualitative Data
87		14. Non-parametric Statistical Methods
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74	B -	
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71	C +	
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68	C	
67		
66		
65	C -	
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62	D +	
61		
60		
59	D	
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56	D -	
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< 50		

In your seminar, you are encouraged to provide handouts, notes, etc., to the class. The instructor may also provide additional handouts on the day of each seminar, though these will form no part of your independent presentation.

Accommodation of Students with Disabilities

In accordance with the University of Montana’s mission to provide equal educational opportunities for all students, the instructor is willing to provide necessary accommodations for students with disabilities. If you require any accommodations, please make these known to the instructor, who will work with the office of Disability Services in adapting this course to meet your needs.

Attendance

Past experience in this course suggests that students who miss classes, usually receive poor grades. This is a reflection of the difficulty of the subject, and the need to stay on pace with the class and course. Attending class lectures usually helps a great deal in understanding material.

Incompletes

Departmental and university policies regarding incompletes do not allow one to change “incomplete” grades after 1 year has passed since the “I” was granted.

Mathematical Arguments Used in Statistics

As was true of Stat I, Stat II will **not** be taught as if it were a mathematics course because statistics is not equal to mathematics. You will not be tested on whether you can prove or justify the equations that make up the discipline of statistics. Most test items, as was true of Stat I, will focus on your understanding and grasp of the material, both through applied questions and theoretical or conceptual questions. However, familiarity with the mathematics of statistics can sometimes (but not always) aid in your understanding of the fundamental concepts. For that reason, lectures, as well as handouts, will sometimes contain mathematical arguments to help in your understanding of statistics. However, as was the case in Stat I, knowing how to “work” a formula or follow a mathematical argument **may or may not** help you in understanding the underlying statistical concept. If you understand the concept however, the math often (but not always) makes much more sense, and may help to fill “gaps” in your conceptual knowledge. As well, learning the math might help you in understanding statistical concepts. It’s generally a two-way street, but guard against knowing the math, without understanding the underlying conceptual meanings. Tests and exams will aim to evaluate your understanding of statistics – the do you “get it” part. In this course, mathematics is simply seen as a way of expressing this understanding. Do not memorize anything, but rather seek to understand it.

A Note on the Use of Statistical Software

SPSS and R will be used in this course and featured in assignments. Although SPSS and R will be featured, it is of **extreme importance** that you do not equate “SPSS and R knowledge” with statistical knowledge. The emphasis in this course will be on first understanding statistics, then applying them on the computer. Learning how to use SPSS and R effectively and efficiently is relatively easy **IF YOU FIRST UNDERSTAND THE STATISTICAL PROCEDURES** which they offer. **It is much easier to know what a multiple regression is first, then learn how to do it on a computer, than to know how to do it on a computer, and be totally clueless as to what it is.** Further, you will rarely be asked at a thesis or dissertation defense to demonstrate your knowledge of SPSS, no more than you would be asked to demonstrate your ability to use your pocket calculator. However, you will likely be asked to defend the statistics you’ve used in your research, and what they mean.

TENTATIVE COURSE SCHEDULE

DATE	TOPIC	READINGS	ASSIGNMENTS
11 Jan.	Course Syllabus, Course Policies Review of Stat I Principles	TBA	
18 Jan.	Analysis of Variance (Fixed Effects)	TBA	#1 Assigned
25 Jan.	Analysis of Variance (Fixed Effects)	TBA	
01 Feb.	Factorial Analysis of Variance	TBA	#1 is DUE #2 Assigned
08 Feb.	Random Effects and Mixed Models ANOVA	TBA	
15 Feb.	Randomized Blocks and Repeated Measures	TBA	#2 is DUE #3 Assigned
22 Feb.	Simple Linear Regression	TBA	
01 Mar.	Multiple Linear Regression I	TBA	#3 is DUE #4 Assigned
08 Mar.	Midterm Test (10%)		
15 Mar.	Multiple Linear Regression II	TBA	
22 Mar.	Multiple Linear Regression III	TBA	
29 Mar.	Spring Break (NO CLASS)		
05 Apr.	Interactions in Regression	TBA	#4 is DUE #5 Assigned
12 Apr.	Logistic Regression and the Generalized Linear Model	TBA	
19 Apr.	Student Seminars TBA		#5 is DUE
26 Apr.	Student Seminars TBA		
03 May. 10:10 – 12:10	Final Exam (50%) – Skaggs 246.	All Course & Seminar Material is Testable	