

# Psychology 613: Multivariate Statistics

## Spring 2011, LLC-North, T/R 10:00 – 11:20

### Instructor Information

Professor: Elliot Berkman

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### Course overview

The multivariate statistical methods used in psychology and related fields are both broad in range and deep in complexity. A thorough treatment of any one of these could encompass an entire course. However, most advanced multivariate statistical techniques share some core underlying similarities. The purpose of this course is to survey a number of these techniques—those most popular among and useful to psychologists—while emphasizing a conceptual understanding of their underlying structure. This will be accomplished through hands-on application of each technique using software packages (mostly SPSS and MATLAB).

This course has four goals:

1. To survey a range of multivariate statistical methods of interest to empirical psychology
2. To help you develop a strong conceptual understanding of multivariate models
3. To introduce you to computational methods for each technique
4. To give you sufficient understanding of each technique to self-teach for your own research

### Course Organization and Requirements

#### Lectures

The first principal component of the course is lecture. The goals of the lecture for a given statistical technique are **(a)** to teach you the conceptual logic of what the technique does and how it does it, when to use the technique, and what its assumptions are, **(b)** to show you the most common or popular computational method for the technique, and **(c)** to give you the opportunity to ask questions about how and when the technique might be used in your own research.

I strongly encourage discussion and questions. You are encouraged to participate in course discussions and to interrupt me when I lecture in order to ask a question or to share an insight.

Though lecture is not technically required, I strongly recommend that you come to all lectures and obtain detailed notes for those that you are unable to attend.

#### Labs

The second principal component of the course is the computer lab. Each **Friday**, the GTFs will show you how to use the software available at UO to apply the techniques for that week to real data sets. During the labs, you will work through example problems and may begin working on the homework for that week. You are encouraged to work in teams.

#### Problem sets

There will be **five or six problem sets** throughout the quarter. These assignments are intended to elucidate the concepts underpinning each technique, and as such will be more challenging theoretically than computationally. The homeworks will be assigned on Thursday and due the following Tuesday. You may begin working on the homeworks in the computer lab section on Friday. You may work in groups to generate the computer output, but **the final product must be completed individually**.

### Exams

There will be **one midterm** and **one final**. Both will be **take-home**. These will consist of a mix of computational and conceptually-based questions about the materials. There will be no make-up exams and no extensions. The midterm will be distributed on **Thursday, April 28<sup>th</sup>** and due **Thursday, May 5<sup>th</sup> at 5pm**; the final will be distributed on **Thursday, June 2<sup>nd</sup>** and due **Thursday, June 9<sup>th</sup> at 5pm**.

### **Grading**

Midterm	33.3%
Final	33.3%
Problem sets	33.3%

Your scores will be combined and weighted to yield one score out of 100%. I will average the top 10 scores from class, and use that number to determine the cutoff for letter grades. To get an A- you will need to get 90% of the average top score, to get a B- you will need to get 80% of the top score, and so on. This system has the advantage of a curve in that if everyone does poorly on the exams because they are too hard, nobody suffers, but it is also possible for every single person to get an A (since you could all do as well as 90% of the average of the top 10 students).

### **Policies**

Late/missed assignments. Due dates for each assignment are listed in the “Lecture/Assignment Schedule.” All assignments are due at the beginning of class. Late assignments will not be accepted.

Cheating/plagiarism. Don’t do it! This is graduate school; the purpose of the assignments is self-evident.

Students with special needs. The UO works to create inclusive learning environments. If there are aspects of the instruction or design of this course that result in disability-related barriers to your participation, please notify me as soon as possible. You may also wish to contact Disability Services in 164 Oregon Hall at 346-1155 or [disabsrv@uoregon.edu](mailto:disabsrv@uoregon.edu).

### **Texts**

There are no required textbooks for this course. Instead, I will be posting excerpts from the following excellent sources on Blackboard (<http://blackboard.uoregon.edu>).

- Abelson, R.P. (1995). *Statistics as Principled Argument*. Lawrence Erlbaum: Hillsdale, NJ.
- Berkman, E.T., & Reise, S.P. (2011). *A Conceptual Guide to Statistics Using SPSS*. Sage: Thousand Oaks, CA.
- Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction* (2<sup>nd</sup> ed.). Springer: New York, NY.
- Kline, R.B. (2011). *Principles and Practice of Structural Equation Modeling* (3<sup>rd</sup> ed.). Guilford Press: New York, NY.
- Raudenbush, S.W. & Bryk, A.S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods* (2<sup>nd</sup> ed.). Sage: Thousand Oaks, CA.

Tabachnick, B.G. & Fidell, L.S. (2007). *Using Multivariate Statistics* (5<sup>th</sup> ed.). Pearson: Boston, MA.

### Lecture/Assignment Schedule

Month	Day	Topic	Reading	Assignment
March	29	Introduction and overview	Abelson, Pref. & Ch 1 T+F, Ch 1-2	
	31	Introduction to matrix algebra	TBD	PS1: Matrix Algebra
April	5	Matrix algebra in SPSS	B+R, Ch 16	
	7	Programming in MATLAB	TBD	PS 2: Central Limit Theorem
	12	Multilevel linear modeling I	R+B, Ch 2	
	14	Multilevel linear modeling II		
	19	Multilevel linear modeling III	R+B, Ch 4	
	21	Interactions and moderation		PS3: MLM
	26	Psychometrics	B+R, Ch 14	
	28	Multivariate ANOVA	B+R, Ch 10	<b>Midterm out</b>
May	3	Logit analysis		
	5	Logistic regression	T+F, Ch 12	<b>Midterm due at 5pm</b>
	10	Mediation	MacKinnon et al., 2002 (on BB)	
	12	<b>No class</b>		PS4: Mediation
	17	Factor and components analysis I	B+R, Ch 13	
	19	Factor and components analysis II		PS5: FA/CA
	24	Structural equation modeling I	Kline, Ch 2	
	26	Structural equation modeling II	Kline, Ch 5	PS6: SEM
	31	Non-parametric analyses	B+R, Ch 15	
June	2	Prediction, cross-validation, and resampling	H+T+F, Ch 2	<b>Final out</b>
<b>Finals Week</b>	7			
	9	<b>Take-home final due at 5pm</b>		