

Psychology 943: Fundamentals of Multivariate Modeling

Website: <http://wp.me/P3nkOf-ap>

Facebook: <https://www.facebook.com/psyc943fall2013>

Room: 79 Burnett Hall

Time: 12:30-3:20 W

Instructor:

Dr. Jonathan Templin	
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Office:	220 Burnett Hall
Office Hours:	Thursdays 11-1 (Room 230)
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Schedule of Topics and Events:

The online syllabus at the address provided above will always have the most current information.

Course Objectives, Materials, and Pre-Requisites:

This course has two main objectives. First, it will cover modern multivariate analysis using observed variables. Second, it will build a foundation, including the core language, concepts, and software, from which participants can eventually learn more advanced analyses (i.e., involving random effects and latent variables in PSYC 944 and PSYC 948, respectively). Class time will be devoted primarily to lectures and examples. Lecture materials in .pdf format will be available for download at the website above the day prior to class, or else paper copies will be provided in class. Audio/Video recordings of the class lectures in .mp4 format will also be posted online, but are not intended to take the place of class attendance. Selected book chapters and journal articles will be assigned for each specific topic as needed. The initial list of readings is provided below but will likely be updated throughout the semester. Updates to the reading list will be posted in the online syllabus and announced in class and via email. Finally, because the course will make use of statistical software, instructor office hours will be held in the 230 Burnett computer lab, in which participants will have opportunities to work on course assignments and receive immediate software assistance. SAS will be the primary program used, although Mplus will also be used.

Participants should be familiar with the general linear model (analysis of variance, regression) prior to enrolling in this course (i.e., through PSYC 941 and 942). Course assignments will include both essay questions and application of techniques discussed in class, and will use data provided by the instructor.

Academic Honesty:

As a reminder, the University has a policy on academic honesty (see the Graduate Studies Bulletin for further details). All course assignments should be done individually.

Accommodating Persons with Disabilities:

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of UNL to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Prerequisite

Multivariate statistics builds upon the general linear model, which is typically taught in a first year graduate sequence of statistics courses. Within the Department of Psychology at the University of Nebraska-Lincoln, this means having taken and completed PSYC 941 and PSYC 942. The first homework is designed to test your knowledge of the prerequisites.

Statistical Computing

This course will use SAS and Mplus for all statistical analyses. SAS is available to you in three ways:

1. You can purchase your own copy of SAS through the Psychology Department: <http://psychology.unl.edu/sas-distribution-information>. The price is \$25 per year.
2. You can use the computers in rooms 227, 230, and 234 of Burnett Hall
3. You can sign up to use SAS through the Holland Computing Center using secure shell terminal connections (technical and frustrating, but free – see the first lecture)

Mplus, a powerful generalized modeling package, is available to you in two ways:

1. You can purchase your own copy of Mplus through the Muthen & Muthen website: <https://www.statmodel.com/orderonline/categories.php?category=Mplus-Software/Student-Pricing/Click-here-to-order-download-only> (easy but expensive)
2. You can sign up to use Mplus through the Holland Computing Center using secure shell terminal connections (technical and frustrating, but free – see the first lecture)

Because of new software licensing policies, Mplus will likely be unavailable through the Burnett computer labs. Please be advised as each homework assignment will require the use of Mplus.

Course Website/Technology

This course will not use Blackboard. Instead, we will use freely available commercial software for communication and dissemination of course materials.

Audio/Video Recordings of Class

I will be making a flash recording of each class, which will be posted on the website by the end of the day following class.

Class Page on Facebook

In order to facilitate communication, I have created a Facebook page where I will:

1. Post information about the course
2. Hold online office hours (as needed)
3. Answer your questions directly using the wall feature

The Facebook page is designed to facilitate discussion in a manner that is easily accessible by all students and auditors of the course. To be a part of the discussion, please search for PSYC 943 or use the link: <https://www.facebook.com/psyc943fall2013>. To follow us on Facebook, you must “like” the page.

Course Materials Over Dropbox

All course readings will be available over a shared folder on Dropbox, a file repository online (www.dropbox.com). **To gain access to the shared folder, please send me an email.** You do not have to install the Dropbox application as you can download files from any web browser.

If you do not have a Dropbox account, please email me for an invitation.

Course Website

Course lecture slides, lecture examples, flash video files, assignments, and information are available on the website. The website for the course is <http://jonathantemplin.com/fundamentals-multivariate-modeling-fall-2013-unl/>. The website features the ability to post questions and comments about each lecture and homework where everyone can discuss the topic.

Course Structure and Student Evaluation

Student evaluation will be made on the basis of homework grades. **All homework and answers must be your own and not be copied or paraphrased from anyone else's answers.** You are responsible for your own work.

Homework

Homework assignments will be administered in order to give students practice applying techniques discussed in class and will be due at the start of class the following week. Each assignment must be at least 75% complete in order to be accepted for grading. Revisions to homework assignments are accepted on a schedule set once the homework has been graded.

Homework must be submitted electronically (email jtemplin@unl.edu) in the form of Microsoft Word document with the name: 943_FirstLast_HW#.docx.

Late homework will have a penalty of 10% of the total per calendar day (any homework later than 10 days late will not be accepted). Resubmission of late homework is allowed, but the maximum grade cannot exceed the maximum amount allowed by the late penalty.

Do not wait until the last minute to do your homework.

Course Grading System

<u>Percentage of Points</u>	<u>Grade</u>
100-97	A+
96-93	A
92-90	A-
89-87	B+
86-83	B
82-80	B-
79-77	C+
76-73	C
72-70	C-
69-60	D
Below 60	F

Course Style and Content**Lecture Format**

Most lectures will have notes (slides) available digitally, with slides available online by the morning of the day of the lecture. Please check the course website before coming to class if you would like to bring a printout of the slides with you. If nothing is posted, then we will be having lecture without slides. I strongly encourage you to participate in lecture by asking questions whenever anything is unclear.

Reading Assignments

To be fully successful in this course, I **strongly** encourage you to read the assigned papers and/or chapter(s) prior to the coming to class when we will cover the topic. Even if you have difficulty reading the material, exposure to the information prior to lecture will aid in your understanding of the course. Remember, this course is about learning the language of structural equation modeling and multivariate statistics – something that takes immersion in the readings.

How to Succeed in this Course

- Read the assigned papers and chapters (even if it doesn't make sense to you – it will eventually)
- Come to class (and bring your questions about what you just read that week)
- Ask questions when you do not understand
- Come to office hours
- Do the homework (consider it practice on applying statistics)
- Compare your homework with the solutions online before receiving your feedback

Tentative Schedule of Topics:

Week	Day	Date	Topic	Readings
1	Wednesday	8/28/2013	Introduction and Overview; Review of the General Linear Model; Descriptions of Variance; Discussion of SAS	Maxwell & Delaney (2004) Appendix B
	Friday	8/30/2013	HW #1: Tusker/GLM: Due Friday 9/6 at 12:00pm	
2	Wednesday	9/4/2013	Simple, Marginal, and Interaction Effects in GLMs (Introduction to PROC GLM)	Hoffman (in preparation), ch. 2
	Friday	9/6/2013	HW #2: GLMs: Due Friday 9/13 at 12:00pm	
3	Wednesday	9/11/2013	Univariate Normal Distribution, GLM in Univariate Normal, Estimation: Least Squares	Kutner et al. (2005), ch. 1, Appendix A;
	Friday	9/13/2013	HW #3: Distributions and Estimation: Due Friday 9/20 at 12:00pm	
4	Wednesday	9/18/2013	Maximum Likelihood Estimation	Enders (2010), ch. 3
	Friday	9/20/2013	HW #4: Matrix Algebra: Due Friday 9/27 at 12:00pm	
5	Wednesday	9/25/2013	Matrix Algebra and PROC IML; Mean Vectors, Covariance Matrices, and the Multivariate Normal Distribution	Johnson & Wichern (2002), chs. 2, 3, & 4
	Friday	9/27/2013	HW #4 MVN Distributions: Due Friday 10/4 at 12:00pm	
6	Wednesday	10/2/2013	Maximum Likelihood for Multivariate Outcomes (SAS PROC MIXED); Empty Multivariate Models	
	Friday	10/4/2013	HW #5: SAS PROC Mixed and PROC IML: Blending the two: Due Friday, 10/11 at 12:00pm	
7	Wednesday	10/9/2013	Introduction to Path Analysis (part 1); Adding Predictors to Multivariate Models	Kline (2005), chs. 5 & 6
	Friday	10/11/2013	HW #6: Multivariate Analysis: Due Friday 10/25 at 12:00pm	
8	Tuesday	10/15/2013	Office Hours (change from Thursday)	Wright (1998)
	Wednesday	10/16/2013	Comparisons of Multivariate Models with Classical MANOVA	
	Friday	10/18/2013	NO HOMEWORK	

9	Wednesday	10/23/2013	Examples of Multivariate Regression and Difference Score Models	
	Friday	10/25/2013	HW #7: Difference Score Models: Due Friday 11/1 at 12:00pm	
10	Wednesday	10/30/2013	Introduction to Path Analysis #2: Simultaneous Regression Models	
	Friday	11/1/2013	HW #8: Path Analysis: Due Friday 11/8 at 12:00pm	
11	Wednesday	11/6/2013	Mediation Models	MacKinnon (2008), ch. 6
	Friday	11/8/2013	HW #9: Mediation Models: Due Friday 11/15 at 12:00pm	
12	Wednesday	11/13/2013	Introduction to Bayesian and MCMC Estimation	Enders (2010), ch. 6
	Friday	11/15/2013	HW #10: Bayesian and MCMC: Due Friday 11/22 at 12:00pm	
13	Wednesday	11/20/2013	Missing Data; Handling Missing Data via Maximum Likelihood and Multiple Imputation	Enders (2010), chs. 4, 7, 8, 9
	Friday	11/22/2013	HW #11: Multiple Imputation: Due Friday 12/6 at 12:00pm	
14	Wednesday	11/27/2013	NO CLASS - THANKSGIVING BREAK	
	Friday	11/29/2013	NO HOMEWORK	
15	Wednesday	12/4/2013	Power Analysis for Multivariate Models: Simulation Approaches	Maxwell, Kelley, & Rausch (2008)
	Friday	12/6/2013	HW #12: Power Analysis: Due Friday 12/13 at 12:00pm	
16	Wednesday	12/11/2013	Principal Components Analysis and Exploratory Factor Analysis (from a Mixed Models Perspective)	Johnson & Wichern (2002), ch. 8, 9
	Friday	12/13/2013	HW #13: PCA/EFA: Due Friday 12/20 at 12:00pm	
17	Thursday	12/19/2013	Office Hours	

Books

- Enders, C. K. (2010). *Applied missing data analysis*. New York, NY: Guilford.
- Hoffman, L. (in preparation). *Longitudinal analysis: Modeling within-person fluctuation and change*. New York, NY: Routledge Academic.
- Johnson, R. A. & Wichern, D. W. (2002). *Applied multivariate statistical analysis (5th Ed.)*. Upper Saddle River, N.J.: Prentice-Hall.
- Kline, R. B. (2002). *Principles and practice of structural equation modeling (2nd Ed.)*. New York, NY: Guilford.
- Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). *Applied linear statistical models (5th Ed.)*. New York, NY: McGraw-Hill.
- MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. New York, NY: Routledge Academic.
- Maxwell, S. E., & Delaney, H. D. (2004). *Designing experiments and analyzing data*. Mahwah, NJ: Erlbaum.

Articles

- Maxwell, S. E., Kelley, K., & Rausch, J. R. (2008). Sample size planning for statistical power and accuracy in parameter estimation. *Annual Review of Psychology*, 59, 537-563.
- Wright, S. P. (1998). Multivariate analysis using the mixed procedure. *Proceedings of the Twenty-Third Annual SAS Users Group International Conference*, paper 229. Retrieved from <http://www2.sas.com/proceedings/sugi23/Stats/p229.pdf>.