Psychology 943 (930 for Fall 2012): Fundamentals of Multivariate Modeling

Website: http://psych.unl.edu/psycrs/943/index.html Room: 79 Burnett Hall Time: 10:30-12:20 W, F

Instructors:

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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 general and generalized 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 or 234 Burnett computer labs, in which participants will have opportunities to work on course assignments and receive immediate software assistance. SAS and Mplus will be the primary programs utilized, although examples using SPSS may also be provided as needed.

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). Participants will need to have access to SAS and Mplus software, available in rooms 234, 227, and 230 Burnett. SAS student licenses can be purchased from the statistics department (around $25; yearly renewal required). Individual student Mplus licenses are expensive (~$200 for the base program), but may be worth the cost if these models are something you're likely to use frequently in the future. Course assignments will include both essay questions and application of techniques discussed in class, and will utilize 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.

Course Requirements: Course performance will be evaluated as follows. Details about each requirement will be presented throughout the semester prior to the due dates.

Homework Assignments (80 possible points): Throughout the semester, 10 online homework assignments will be administered in order to give participants the practice applying techniques discussed in class and will be due as listed on the online syllabus. All homework assignments will be administered and submitted online at http://psych.unl.edu/psycrs/943hw/index.asp . Each assignment will be worth **8 points** and will consist of data analysis, results interpretations, and questions about the topics assigned. There will also be a "homework 0" designed to familiarize participants with the online homework system, that will be worth 3 bonus points.

Take-Home Final Exam (20 possible points): A take-home final exam will be administered in mid-November and will be due the last week of finals. Participants are highly encouraged to submit a first draft of the take-home final exam for feedback in order to make revisions prior to submitting the final draft. The take-home final exam is cumulative and will feature data analysis and interpretation of topics throughout the semester. It should be submitted electronically via email as a Microsoft Word document using this naming convention: **943_FirstnameLastname_Final** (adding an "r" to the end for a revision). Please use the **track changes** function in Microsoft Word when revising the take-home final exam.

Policy on Late Homework Assignments: In order to be able to provide the entire class with prompt feedback, any late homework assignment will incur a **3 point penalty** if submitted at any point past the due date. If extenuating obligations or circumstances will prevent you from completing any course requirements, please contact the instructors at least three weeks advance so that we can create a solution together.

Policy on Late Take-Home Final Exams: In order to give participants as much time as is possible to work on the final exam, the due date for submitting the completed final exam falls shortly before course grades are due. Therefore, late **final drafts will not be accepted**. Participants are not required to submit first drafts of the final exam, but are strongly encouraged to do so, as the take-home final exam factors heavily into the overall course grade.

Final grades will be determined by number of points earned out of 100 possible points:
≥97 = A+ 93-96 = A 90–92 = A- 87-89 = B+ 83-86 = B 80-82 = B- < 80 = C or no pass

Policy on Assigning Incompletes: A grade of "incomplete" will be assigned ONLY in the case of extenuating circumstances that prevent participants from completing course requirements on time (e.g., a health emergency).

Tentative Schedule of Events:

Week	Date	Topics	Readings
1	8/22	Introduction and Overview; Review of General Linear Model; Descriptions of Variability	Maxwell & Delaney (2004) Appendix B
	8/23	**HOMEWORK #0 ADMINISTERED: Due Tuesday 8/28 by 11:59 PM**	
	8/24	Simple, Marginal, and Interaction Effects in GLMs; SAS Introduction and PROC GLM	
2	8/29	More Simple, Marginal, and Interaction Effects in GLMs	Hoffman (in prep) ch. 2
	8/30	**HOMEWORK #1 ADMINISTERED: Due Wednesday 9/5 by 11:59 PM**	
	8/31	**NO CLASS; Extra 234 Lab Hours from 9-11 AM**	
3	9/5	Univariate Normal Distribution; GLM in Univariate Normal; Model for Means/Variances	Kutner et al. (2005) Appendix A and ch. 1 p. 1-15
	9/6	**HOMEWORK #2 ADMINISTERED: Due Tuesday 9/11 by 11:59 PM**	
	9/7	Least Squares Estimation for GLM; Maximum Likelihood Estimation for GLM	Enders (2010) ch. 3 Kutner et al. (2005) ch 1. p. 16-33
4	9/12	Introduction to Generalized Univariate Models; Models for Binary or Ordinal Outcomes (SAS PROC GENMOD)	Azen & Walker (2011) ch. 2 & 6
	9/13	**HOMEWORK #3 ADMINISTERED: Due Tuesday 9/18 by 11:59 PM**	
	9/14	Examples with Binary and Ordinal Outcomes	TBD
5	9/19	Models for Count Data (Single or Mixture Distributions)	Atkins & Gallop (2007)
	9/20	**HOMEWORK #4 ADMINISTERED: Due Tuesday 9/25 by 11:59 PM**	
	9/21	Models for Continuous but Non-Normal Data (Single or Mixture Distributions)	TBD
6	9/26	Matrix Algebra and PROC IML: Theory	Johnson & Wichern (2002) ch. 2
	9/27	**HOMEWORK #5 ADMINISTERED: Due Tuesday 10/2 by 11:59 PM**	
	9/28	Matrix Algebra and PROC IML: Data Description, Covariance, and GLM	Johnson & Wichern (2002) ch. 3
7	10/3	Multivariate Normal Distribution; Introduction to Maximum Likelihood for Multivariate Outcomes (SAS PROC MIXED)	Johnson & Wichern (2002) ch. 4
	10/4	**HOMEWORK #6 ADMINISTERED: Due Tuesday 10/9 by 11:59 PM**	
	10/5	Maximum Likelihood with Multivariate Normal and Multivariate Categorical Distributions; Missing Data via Maximum Likelihood	Enders (2010) ch. 3-4

Week	Date	Topics	Readings
8	10/10	Robust Maximum Likelihood; Review	Enders (2010) ch. 5.7-5.16
	10/11	**NO HOMEWORK**	
	10/12	**NO CLASS**	
9	10/17	Introduction to Bayesian Estimation: Theory	Enders (2010) ch. 6
	10/18	**HOMEWORK #7 ADMINISTERED: Due Tuesday 10/23 by 11:59 PM**	
	10/19	Multiple Imputation with Multivariate Normal Data (PROC MI, MIANALYZE)	Enders (2010) ch. 7-9
10	10/24	Introduction to Mplus; Multiple Imputation in Mplus; Imputation of Non-Normal Data	
	10/25	**HOMEWORK #8 ADMINISTERED: Due Tuesday 10/30 by 11:59 PM**	
	10/26	Bayesian Estimation: Data Analysis (GLM, Generalized via MCMC)	Kruschke (2011) ch. 2, 3, 4, & 23
11	10/31	MANOVA via Maximum Likelihood	Wright (1998)
	11/1	**HOMEWORK #9 ADMINISTERED: Due Tuesday 11/6 by 11:59 PM**	
	11/2	Multivariate Regression and Difference Score Models	TBD
12	11/7	Path Models	Kline (2005) ch. 5, 6 MacKinnon (2008) ch. 6
		Mediation Models	
	11/9	**HOMEWORK #10 ADMINISTERED: Due Friday, 11/16 by 11:59 PM**	
13	11/14	Power Analysis for Multivariate Models via Simulation: Theory	Muthén & Muthén (2002)
	11/16	Power Analysis for Multivariate Models via Simulation: Data Examples	Maxwell, Kelley, & Rausch (2008)
14	11/21	NO CLASS	
	11/23	NO CLASS	
15	11/28	Clustering: Mixture and Latent Class Models	Vermunt & Magidson (2002) McCutcheon (2002)
		Exploratory Factor Analysis	Johnson & Wichern (2002) ch. 8, 9
	11/30	**OPTIONAL DRAFTS OF TAKE-HOME FINAL EXAM Due Friday, 11/30 by 11:59 PM**	
16	12/5	Introduction to Scale Construction via Latent Variable Models	Kline (2005) ch. 7
	12/7	Repeated Measures Analysis of Variance; Introduction to Multilevel Models	Maxwell & Delaney (2004) ch. 12-15
	12/17	**COMPLETED TAKE-HOME FINAL EXAM: Due Monday, 12/17 by 11:59pm**	

All readings will be available via the course documents on UNL Blackboard:

Books

Azen, R. & Walker, C. M. (2011). *Categorical data analysis for the behavioral and social sciences*. New York, NY: Routledge Academic.

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.

Kruschke, J. K. (2011). *Doing Bayesian data analysis: a tutorial with R and Bugs*. Burlington, MA: Academic Press.

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

Atkins, D. C., & Gallop, R. J. (2007). Rethinking how family researchers model infrequent outcomes: A tutorial on count regression and zero-inflated models*. Journal of Family Psychology, 21*, 726-735.

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.

McCutcheon, A. L. (2002). Basic concepts and procedures in single- and multiple-group latent class analysis. In J. A. Hagenaars & A. L. McCutcheon (Eds.), *Applied latent class analysis* (pp. 56-88). Cambridge, United Kingdom: Cambridge University Press.

Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling, 9,* 599-620.

Vermunt, J. K., & Magidson, J. (2002). Latent class cluster analysis. In J. A. Hagenaars & A. L. McCutcheon (Eds.), *Applied latent class analysis* (pp. 56-88). Cambridge, United Kingdom: Cambridge University Press.

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.