Psychology 319

Multilevel Regression Modeling

Fall, 2009

Weeks 1–9

Note: My classes are always paced to try to achieve high mastery levels. Since this is my first attempt at this course, I shall adjust timing as necessary. The reading list below refers to the following books. I will probably add to and modify these readings as I become more familiar with the people in the class.

CCWA Cohen, J., Cohen, P., Aiken, L. S., & West, S. G. (2004). Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.) Mahwah, NJ: Lawrence Erlbaum Associates. .

G&H Gelman, A., & Hill, J. (2007). *Data analysis using regression and multilevel/hierarchical models.* Cambridge: Cambridge University Text.

HG Goldstein, H. (1999). *Multilevel Statistical Models.* Available with data files for free download from http://www.ats.ucla.edu/stat/examples/msm_goldstein/

K&D Kreft, I., & DeLeeuw, J. (1998). *Introducing multilevel modeling.* London:Sage.

R&B Raudenbush, S. W., & Bryk, A.S. (2002). *Hierarchical linear models: Applications and data analysis methods.* London: Sage.

SW05 Weisberg, Sanford (2005). *Applied linear regression (3rd Ed.)* Available in electronic format at www.netlibrary.com. Ebook ISBN: 0471704083. Note: You should also download the ASCII data files and install the R package ALR3. These are available on the author's website at http://www.stat.umn.edu/alr/

GM04 Gelman, A., & Meng, X.L. (2004). *Applied Bayesian modeling and causal inference from incomplete-data perspectives: an essential journey with Donald Rubin's statistical family.* Ebook ISBN 9780470090442 Available at www.netlibrary.com

PX99 Powers, D.A., & Xie, Y. (1999). *Statistical methods for categorical data analysis.* NY: Academic Press.

Week 1

Date	Topic	Reading/Homework Assignment
08/26	Organizational Meeting Meeting Times, Grading Textbook, Software Regression Modeling – A Conceptual Overview Introduction to R Basic Operation Function Definition	

Week 2

08/31	Matrix Algebra – A minimal introduction Matrix Operations in R	Background: Psychology 312 Matrix Algebra Handout
09/02	Review of Statistical Principles Statistical Distributions Normal Multivariate Normal Binomial Normal Approximation Distribution of the sample proportion Poisson Sampling Distributions Standard Errors Normal Theory Confidence Intervals & Wald Tests Simulated Standard Errors and Confidence Intervals Linear Transformation and Linear Combination Theory	**Required: G&H Chapters 1,2** Background: Hays on the binomial and Poisson distributions As Needed: Psychology 310 materials on: Linear Transformation Z-scores Linear Combination

Week 3

09/07	Linear Regression with a Single Predictor	**Required: SW05 Chapters 1-2 (Install the R package ALR3; Download the RSPrimer and R Code from the author's website)** Background: CCWA Chapters 1-2 **NOTE: To get maximum benefit out of Weisberg, after reading each chapter, activate R, open the RSPrimer, and work through it line by line. You will learn a great deal about R programming and linear regression by doing so!**
09/09	Regression Diagnostics and Variable Transformation	**Required: G&H Chapter 3** Followup: SW05 Chapter 7 Followup: Mosteller&Tukey, Chapters 4–5 Followup: CCWA Chapter 6 Background: Gelman 2008

Week 4

09/14	Linear Regression with Multiple Predictors	**Required: SW05 Chapters 3–4** Background: CCWA Chapter 3
09/16	Model Evaluation, Centering, and Interaction	**Required: G&H Chapter 4** Background CCWA Chapters 4,7

Week 5

09/21	Logistic and Probit Regression	**Required: G&H Chapter 5** Background and examples: SW05 Chapter 12 Background and examples: PX99 Ch. 3
09/23	(ctd)	

Week 6

09/28	Generalized Linear Models Logistic-binomial model Poisson regression with overdispersion Ordered and Unordered Categorical Regression	**Required: G&H Chapter 6**
09/30	Simulation of Probability Models and Statistical Inference	**Required: G&H Chapter 7**

Week 7

10/05	Simulation for Checking Statistical Procedures and Model Fits	**Required: G&H Chapter 8**
10/07	Causal Inference Using Regression on the Treatment Variable	**Required G&H Chapter 9** Followup: GM Chapters 1–4

Week 8

10/12	Causal Inference Using More Advanced Models	**Required G&H Chapter 10** Followup GM Chapters 5–7
10/14	Multilevel Structures	**Required: G&H Chapter 11** **Required: K&D Chapters 1–2**

Week 9

10/19	Multilevel Linear Models: The Basics	**Required G&H Chapter 12** **Required HG Chapters 1–2** **Required R&B Chapters 1–2**
10/21	Multilevel Linear Models: Varying Slopes, Non-Nested Models, and Other Complexities	**Required: G&H Chapter 13** Background: HG Chapters 3–5

10/26		
10/28	Growth Curve Models for Change	**Required: R&B Chapter 5**

11/02	Multilevel Logistic Regression	**Required G&H Chapter 14**
11/04	Multilevel Generalized Linear Models	**Required G&H Chapter 15**

11/09	Multilevel Modeling in Bugs and R: the basics	**Required G&H Chapter 16**
11/11	ctd	

11/16	Fitting Multilevel Linear and Generalized Linear Models in Bugs and R	**Required G&H Chapter 17**
11/18	Likelihood and Bayesian Inference and Computation	**Required G&H Chapter 18**

11/30	Debugging and Speeding Convergence	**Required G&H Chapter 19**
12/02	Sample Size and Power Calculations	**Required G&H Chapter 20**

12/07	Review and Catch-Up	
12/09		

CCWA Cohen, J., Cohen, P., Aiken, L. S., & West, S. G. (2004). Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.) Mahwah, NJ: Lawrence Erlbaum Associates. Available at www.netlibrary.com.

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GM04 Gelman, A., & Meng, X.L. (2004). Applied Bayesian modeling and causal inference from incomplete-data perspectives: an essential journey with Donald Rubin's statistical family. Ebook ISBN 9780470090442 Available at www.netlibrary.com