EDPSY 594 Advanced Correlational Techniques
Spring, 2003

Robert Abbott
Miller 312
abbottr@u.washington.edu

Texts:
Stevens, J. Applied Multivariate Statistics for the Social Sciences(4th ED) (2002). *[S]*

Course Calendar

March 31	Correlation and regression [S: Chp 1]
April 2	Correlation and regression; [S: Chp 1]
April 7	Multiple regression and correlation; [S: Chp 2, 3]
April 9	Multiple regression and correlation; Matrix Algebra [S: Chp 2, 3]
April 14	Matrix Algebra; [S: Chp 2, 3]
April 16	**Problem Set 1 due**; Multiple correlation; predictor ordering; [S: Chp 3]
April 21	Multiple regression; Logistic regression [S: Chp 3]
April 23	General Linear Model (GLM) [S: Chp 4,5,6]
April 28	Multivariate Analysis; canonical correlations [S: Chp 5, 12]
April 30	**Problem Set 2 due**; Multivariate Analysis; canonical correlations [S: Chp 5, 12]
May 5	Factor analysis; Component analysis [S: Chp 11]
May 7	Factor analysis; Component analysis [S: Chp 11]
May 12	Multivariate General Linear Model (MGLM); MANOVA [S: Chp 6, 7, 8]
May 14	**Problem Set 3 due;** Multivariate Analysis: MANOVA [S: Chp 6, 7, 8]
May 19	Multivariate Analysis: MANOVA [S: Chp 6,7,8,10]
May 21	Multivariate Analysis: Discriminant Analysis [S: Chp 7]
May 28	Multivariate Analysis: MANOVA [S: Chp 8, 9]
June 2	Multivariate Analysis: Log linear Models [S: Chp 14]
June 4	**Problem Set 4 due**; Non-Pearsonian correlations

Unit I: Regression and Correlation

Objectives: The student who understands the material in Unit I is able to:

1. Compute and interpret correlation coefficients.

2. Specify limitations of correlation coefficients and their subsequent interpretations.

3. Identify the assumptions of the least squares, linear regression, and linear correlation models.

4. State the formula for a line, indicating each symbol's interpretation.

5. Compute the slope and intercept of the regression line.

6. Interpret the relationship between the correlation and z scores.

7. Interpret "regression to the mean."

8. Compute and interpret the residual variance and coefficient of determination.

9. State and interpret the relationship between b_y, b_x, and r_{xy}.

10. Within the Linear Regression and Linear Correlation models, state the hypothesis tests.

11. Interpret point biserial, phi, biserial, and tetrachoric correlation coefficients.

12. Distinguish between univariate and multivariate techniques, between experimental and nonexperimental research, among independent, dependent, and control variables, between continuous and discrete measures, between population and sample, and between descriptive and inferential statistics.

13. Use a statistical package to do data analysis.

14. Use and interpret dummy coding, effect coding, and orthogonal coding of categorical measures.

15. Describe linear combinations of variables.

16. Identify and interpret data matrices, correlation matrices, variance/covariance matrices, and sum of squares./cross product matrices.

17. Describe the logic of hypothesis testing including null hypothesis, alternative hypotheses, Type I error, Type II error, power of the test, and sampling distribution.

18. Describe procedures for data screening, handling missing data, dealing with outliers, testing distributional assumptions, and evaluating multicollinearity.

19. Discuss algebraically and verbally the meaning and interpretation of partial and part/semipartial correlations.

20. Calculate partial and part/semipartial correlations.

21. Interpret multiple correlation from a part/semi partial correlation perspective.

22. Describe and identify limitations of several methods for dealing with correlated predictors in multiple regression and correlation.

23. Identify the effects of variable selection on the magnitude of R.

24. Describe strengths and limitations of ways to handle variable selection and ordering.

25. Calculate multiple regression equations and interpret findings in terms of assumptions, results, and limitations.

26. Correctly present results from multiple regression analyses.

Units II and III: Multiple Regression, Foundations of Multivariate Analysis, and Factor Analysis

Objectives: The student who understands the material in Unit II is able to:

1. Interpret research articles which use multiple regression.

2. Specify limitations of categorizing continuous measures.

3. Set-up, analyze, and interpret effects in randomized group designs using multiple regression.

4. Set-up, analyze, and interpret effects in designs which include continuous and categorical independent measures using multiple regression..

5. Identify the properties of spherizing transformation and of orthonormalization.

6. Provide a geometric representation for component analysis.

7. Distinguish between common factor analysis and component analysis.

8. State three important ways component analysis can be used in factor analysis.

9. Identify the implications that the assumptions in the component and factor analysis models have for the user..

10. Describe three methods for deciding how many factors are interpretationally relevant.

11. Describe what Thurstone meant by "simple structure."

12. Discuss orthogonal and oblique methods of factor rotations.

13. Describe factor scores and their interpretation and usefulness in research.

14. Given computer output that is well-labeled, be able to read and interpret the results of a factor and component analysis.

15. Identify the purpose of, provide an example of, and interpret the results from a canonical correlation analysis.

Unit IV: Cases of the Multivariate General Linear Model and Non-Pearsonian Correlations

Objectives: The student who understands the material in Unit III is able to:

1. Identify the assumptions of the multivariate general linear model (MGLM).
2. Describe how various analysis techniques are subcases of the MGLM.
3. Identify the purpose of, provide an example of, and interpret the results from a multivariate analysis of variance (MANOVA).
4. Describe follow up tests to multiple df MANOVA and their advantages and disadvantages.
5. Identify the purpose of, provide an example of, and interpret the results from a discriminant function analysis.
6. Identify the purpose of, provide an example of, and interpret the results from a loglinear regression analysis.
7. Identify limitations of the Pearson product moment correlation coefficient and identify alternatives when you have ordinal scales.
8. Identify the purpose of and provide an example of linear structural equation modeling.

Concepts to Know and Use (Part A)

independent, dependent, control variables

experimental, non-experimental research

construct validity, internal validity, statistical conclusion validity, external validity

nominal, ordinal, interval, ratio scales of measurement

continuous variables, discrete variables, categorical variables

mean, median, mode

variance, standard deviation

standard scores, linear transformations of scores, linear composites

population, sample, random sample, probability

descriptive statistics, inferential statistics

least squares model, linear regression model, linear correlation model

sampling distribution of a statistic, standard error of a statistic

probability distributions, normal distribution, t distribution, F distribution

logic of hypothesis testing, Type I error, Type II error, Power

confidence interval of a statistic

covariance, Pearson product-moment correlation coefficient

slope, intercept

homogeneity of variance, homoscedasticity

analysis of variance (anova), mean square between, mean square within

multiple imputation

Concepts to Know and Use (Part B)

regression to the mean

leverage, influence

skewness, kurtosis

error of prediction, residuals, residual variance

coefficient of determination, multiple correlation

point biserial, biserial, phi, tetrachoric correlation coefficients

dummy coding, effect coding, orthogonal coding

partial and part/semipartial correlations

hierarchical ordering, stepwise ordering, forward selection, backward selection

partial regression weights, standardized partial regression weights

Mahalanobis D^2, Durbin-Watson statistic

heteroscedasticity, homoscedasticity

multicollinearlity, singularity

shrinkage, adjusted R^2

suppressor variable; redudancy; complementarity

Concepts to Know and Use (Part C)

matrix addition; matrix multiplication; inverse; orthonormal; trace of matrix

basic structure; basic diagonal; eigenvectors and eigenvalues; latent factors and roots; characteristic vector and roots; singular value decomposition

canonical correlation; canonical variate; redundancy coefficient

multivariate test statistics; Wilks' lambda; gcr test; Pillai's trace;

analysis of covariance (ANCOVA); adjusted means

aptitude x treatment interaction (ATI); areas of significance difference

MANOVA; MGLM;

factor analysis; principal component analysis; communality; principal axis factor analysis;

factor scores; component scores;

orthogonal rotation; oblique rotation; VARIMAX; simple structure

discriminant function; step-down F tests