

CEP934 Multivariate Data Analysis
(A Course in Multivariate Statistical Methods for Social Science Research)
Fall Semester 2016

Monday
5:00pm - 8:50pm
130 Erickson Hall

NOTE: The first class meets Wednesday, August 31, 5:00 – 8:50 pm. There is no class the week of September 5 due to Labor Day and class resumes the regular schedule on Mondays starting September 12.

<https://d2l.msu.edu/>

Instructors :

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Description:

This course focuses on the analysis of data with multiple dependent variables. It explores the conceptual basis of the statistical model, the statistical theories and procedures used in estimating the models, and applications of multivariate data models to various research situations. In addition to the basic mathematical and statistical principles and applications of these multivariate techniques, the course also requires the use of computer and computer programs (SPSS, SAS, Other – your choice) in managing data and performing multivariate data analyses.

Topics include:

- Matrix operations
- Theoretical distributions for multivariate data: multinomial and multivariate normal distributions
- Models such as multivariate multiple regression, multivariate analysis of variance, analysis of covariance, path analysis, longitudinal analysis, Markov chain, and structural equation models
- Data description methods such as principal component analysis, discriminant analysis, canonical correlation analysis, and cluster analysis
- Psychometric applications such as reliability
- Causal inference and propensity score methods,

Objectives:

- Be familiar and comfortable with matrix notations and terminology. Be able to perform elementary matrix operations and understand more advanced matrix operations.
- Be able to summarize a set of data with multiple variables using indices of bivariate relation or association including covariance and correlation matrices.

- Be familiar with the linear model and its application in linear regression analysis, univariate and multivariate analysis of variance, discriminant function analysis and canonical correlation analysis. Be able to estimate and test hypotheses about the parameters in these models.
- Be able to use the estimation and hypothesis testing procedures such that a set of multivariate data can be interpreted in a parsimonious manner.
- Be able to set up and execute a computer program to perform multivariate data analysis using different analytical techniques. Be able to interpret multivariate data analysis outputs
- Be able to select and apply the appropriate procedures to multivariate data sets and present a substantive interpretation of the results.

Prerequisites:

1. Students should have strong background in univariate inferential statistical techniques (including random samples, normal random variable, parameter and interval estimations, hypothesis testing procedures, multiple comparison of means).
2. CEP933 or equivalent. Familiarity with general linear models such as regression, analysis of variance, analysis of covariance and research design issues.
3. Knowledge of SPSS and familiarity with MSU Microlab facilities.

Suggested Textbooks:

Rencher, A. C., & Christensen, W. F. (2012). *Methods of multivariate analysis* (3rd ed.). Hoboken, NJ: John Wiley & Sons, Inc. (ISBN: 9780470178966)

Note: 2nd Edition of the book will work as well.

Also Suggested:

Spicer, J. (2005). *Making sense of multivariate data analysis* (1st ed.). Thousand Oaks, CA: Sage.

Grades and Assignments:

Your grade will be based on your performance on the followings:

1. Final Examination
2. Multiple Assignments
There will be exercises and computer assignments which you are expected to complete and turn in.

Topics:

The following is a tentative list of topics to be covered.

- Matrix Operations
- Multivariate Distributions
- Multiple Regression
- Least Squares Estimation
- Multivariate Regression
- Multivariate Hypothesis Testing
- Design Models: MANOVA
- Multivariate Analysis of Covariance

- Canonical Correlation and Discriminant Analysis
- Structural Models
- Causal Models
- Principal Component Analysis
- Path Analysis
- Structural Equation Models (Introduction Only)
- Multivariate Random Effects Model
- Intraclass Coefficient
- Longitudinal Models
- Logistic Regression (Introduction Only)
- Causal Inference

Other Reference Materials:

1. Grimm, Lawrence G. and Paul R. Yarnold (eds), **Reading and Understanding Multivariate Statistics**. Washington, DC: American Psychological Association, 1995. (ISBN 1-55798-273-2) (QA278.R43 1994)
2. Gilmore, Jodie, **Painless Windows: A Handbook for SAS Users, Second Edition**, Cary, NC: SAS Institute Inc., 1999. 360 pp. (ISBN 1-58035-238-9)
3. Timm, Neil H. and Mieczkowski, Tammy A., **Univariate and Multivariate General Linear Models: Theory and Applications Using SAS Software**, Cary, NC: SAS Institute Inc., 1997. 619 pp. (ISBN 1-55544-987-5)
4. Bock, R. Darrell. **Multivariate Statistical Methods in Behavioral Research**. New York: McGraw-Hill, 1975. (Out of Print)
5. Kirk, Roger E. **Experimental Design: Procedures for the Behavioral Sciences, 2nd Edition**. Monterey, Ca: Brooks/Cole Publishing Company, 1982.
6. Morrison, Donald F. **Multivariate Statistical Methods, 4th Edition**. Cengage Learning, 2005. ISBN-13: 9780534387785.
7. Pedhazur, Elazar J. **Multiple Regression in Behavioral Research: Explanation and Prediction, 2nd Edition**. New York, NY: Holt, Rinehart and Winston, 1982.
8. Delwiche, Lora D. and Susan J. Slaughter, **The Little SAS Book, Second Edition**, Cary, NC: SAS Institute Inc., 1998. 288pp. (ISBN 1-58025-239-7)