

CEP934 Multivariate Data Analysis I

Spring Semester 2005

Monday, Wednesday
4:10pm - 6:00pm
318 Berkey Hall

<http://angel.msu.edu/>

Instructors :

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Description:

This course focuses on the analysis of data with multiple dependent variables. It explores the statistical theories 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 covers the use of computer and computer programs in managing data and performing multivariate data analyses.

Topics include:

- Review of univariate statistical inferences, indices of bivariate relationship and issues of making simultaneous statistical inferences
- Matrix operations, summary and representation of multivariate data
- Theoretical models for multivariate data: multinominal and multivariate normal distributions
- The Linear Models such as multivariate multiple regression, canonical correlation analysis, discriminant analysis and multivariate analysis of variance
- Data description methods such as principal component analysis and cluster analysis
- Psychometric applications such as reliability and factor analysis
- Research Models: Dependence, Interdependence/Data Reduction vs Design Models
- Repeated Measures

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 from a computer program.
- Be able to select and apply the appropriate procedures to multivariate data sets and present substantive interpretation of the results in a report.

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 Windows Operating Systems, SAS and familiarity with MSU Microlab facilities.

Textbooks:

1. Rencher, Alvin C. **Methods of Multivariate Analysis**, New York: John Wiley and Sons Inc., 1995. 627 pp. (ISBN 0-471-57152-0) (QA278.R45 1995)

Grades and Assignments:

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

1. Take Home Examination
2. Multiple Assignments
There will be exercises and computer assignments which you are expected to complete and turn in. **You may work individually or in group (of 2 to 3 persons) on the assignments.**

Topics:

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

<i>Week</i>	<i>Date</i>	<i>Topic</i>
1	01/10/05	Introduction; Statistical Inference; Matrices and Matrix Operations
2	01/17/05	Matrix operations, representation of multivariate data; Indices of bivariate relations
3	01/24/05	Summary of data and theoretical multivariate distributions
4	01/31/05	Multiple Regression Analysis in Matrix Notation
5	02/07/05	Multiple Regression Analysis in Matrix Notation
6	02/14/05	Multivariate Regression Analysis
7	02/21/05	Multivariate Hypothesis Testing
8	02/28/05	Design Models: MANOVA
9	03/07/05	*** ** Spring Break *** **
10	03/14/05	Design Models: MANOVA (continued)
11	03/21/05	Design Models: MANOVA (continued)
12	03/28/05	Multivariate Analysis of Covariance
13	04/04/05	MANOVA with Repeated Measures
14	04/11/05	MANOVA with Repeated Measures(continued)

- 15 04/18/05 Canonical Correlation and Discriminant Analysis
- 16 04/25/05 Principal Component Analysis; Factor Analysis; Missing Data

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, 2nd Edition**. New York, NY: McGraw-Hill Book Company, 1976.
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)