I. CATALOG DESCRIPTION:

Advanced univariate and multivariate statistical techniques used in educational research are covered. Students are expected to gain knowledge and experience in the use of packaged statistical software in data analysis.

II. TEXTBOOK:

No one text contains all the material covered in this course. The text below will be supplemented from references in such journals as Psychological Bulletin, Multivariate Behavioral Research, Journal of the American Statistical Association, Educational and Psychological Measurement, the Journal of Experimental Education, and the Journal of Educational Statistics.


For a more thorough introduction to multivariate statistical methods you may use:

III. COURSE OVERVIEW:

This course will emphasize statistical concepts necessary for the production of behavioral science research. Coverage will include multivariate topics and the development of computer skills in relation to an understanding of the utilization of "packaged" statistical application programs. SPSS will be used as an exemplar of packaged applications, although other statistical software will also be used. Students are free, however, to use other statistical packages.

IV. GUIDELINES USED IN DEVELOPING COURSE OBJECTIVES:

- The objectives listed here were developed in line with the principles of measurement and statistics established by the National Council on Measurement in Education, and the American Educational Research Association.

V. EXPECTED OUTCOMES (COURSE OBJECTIVES):

STA 7114: Educational Statistics, Spring 2006

07/31/10
Upon successful completion of this course students will understand the appropriate uses of multivariate and advanced univariate statistics including predictive and explanatory multiple regression, analysis of variance designs through multiple regression, multivariate analysis of variance, discriminant and classification analysis, component and factor analysis, cluster analysis and canonical correlation.

Students will also be expected to be able to independently select, execute, and interpret appropriate statistical techniques for specific data analytic problems in behavioral science research using appropriate computer support.

VI. EVALUATION AND GRADE ASSIGNMENT:

There will be a midterm and a final to be scheduled in accordance with our progress. They will both emphasize understanding statistical concepts and the resulting appropriate application of statistical techniques. Both tests will be "open book," probing your ability to address data problems with appropriate statistical techniques and software.

In addition, you will keep a portfolio of annotated computer runs executed on data selected (with consultation) by you.

<table>
<thead>
<tr>
<th>Two exams</th>
<th>60%</th>
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<tr>
<td>Portfolio of computer runs</td>
<td>40%</td>
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VII. INSTRUCTIONAL METHODS AND MATERIALS

Blackboard

We will use Blackboard (http://blackboard.fau.edu) for parts of this course. By enrollment in the course, you are issued a Blackboard Username and Password. Both the Username and Password are a function of your name and SS#; the specifics are explained on the Blackboard site above. Blackboard also has an email distribution list for all students registered in the course; I will use this distribution list, as well as other Blackboard vehicles to communicate with you. The email address used is your FAU email address (sometimes called your “MYFAU” email address). You must use this address for any communication with me, or for that matter for any official university correspondence; this is university policy. This list, as well as your Usernames and Passwords, are created at the beginning of the term from the Registrar's records. So it is important, and your responsibility, to check (in the first week or so of class as names are uploaded from the Registrar) to make sure that you have a working Blackboard Username and Password, and to check the email address that is entered for you.

Computer Assignments

I will make specific computer assignments to be accomplished using data of your choice. All of these, with complete instructions, as well as example explanations, are on the course Blackboard site. In each case I will demonstrate the execution of a statistical technique with either SPSS or specialty software. However, you may use whatever software you wish to accomplish the computer assignments.

VIII. COURSE COVERAGE

Course Content

Multiple Regression (Kachgan: Chapters 1-4)
Fundamentals (Brief review and extensions)
1. Linear models
2. Variance partitioning
3. Categorical variables
4. Continuous and categorical variables
5. ANOVA/ANCOVA
Variable importance
Subset Contribution

Cross-validation
1. "Adjustment", "Shrinkage", and "What is the parameter?"
2. Formula estimators
3. Traditional and "double"
4. PRESS
5. Bootstrap
6. Distributional assumptions
7. Specialty Software

Special design problems
1. Collinearity and diagnosis (Kachigan: Chapter 5)
2. Validity concentration - Specialty Software
3. Experimental designs with unequal cell frequencies
4. Non-experimental designs with unequal cell frequencies

Variable selection
1. "Stepwise"
2. Nonparametric methods - Specialty Software
3. Model selection

Sundry Issues
1. Non OLS estimators ("biased estimators")
   a. simple equal weighting
   b. component regression
   c. common factor regression
   d. ridge regression
   e. dangers and rewards -- simulation studies
   g. Specialty Software
2. Nonlinearity - as a polynomial and in the parameters
3. Sensitivity analysis -- outliers and leverage points

The multivariate normal distribution
A. As an assumption
B. Tests for

MANOVA/MANCOVA
A. A different question than ANOVA -- appropriate and inappropriate uses.
B. Tests

Repeated Measures Designs
A. Univariate vs Multivariate approaches
B. Assumptions

Discriminant Analysis (Kachigan: Chapter 6)
A. Descriptive
   1. Variable selection
   2. Variable importance
   3. Weights vs. structure
   4. Specialty Software
B. Classification
   1. Cross-validation
      a. two group formula -- McLachlan
      b. "Hold-out"
      c. Lachenbruch "U"
      d. Bootstrap
      e. Specialty Software
   2. Variable selection
      a. "stepwise"
      b. nonparametric
      c. specialty Software
   3. "Biased" weights - Specialty Software
4. Variable set importance - Specialty Software

**Logistic Regression**
A. PDA type questions
B. Comparison with PDA

**Dimensionality Reduction** (Kachigan: Chapter 7)
A. Principal Components analysis
   1. The model
   2. Number of dimensions
   3. Uses
B. Factor analysis
   1. Different models
   2. Methods of determining the number of factors
      a. scree
      b. parallel analysis
      c. uses
      d. specialty software
   3. "Inverted" factor analysis

**Canonical Correlation** (Kachigan: Chapter 3)
A. Uses
B. Weights vs. structure
C. Interpretability
D. Inter-battery or "double common" factor analysis as alternative - Specialty Software
E. Redundancy statistics

**Cluster Analysis** (Kachigan: Chapter 8)
A. Concepts
B. Models
C. Methods

"Causal" Modeling
A. Path analysis/SEM
B. LISREL

**Reliability**
A. Brief introductions to psychometric theory
B. Computer application

**Selected Journal Articles** (These are not assigned reading; rather references for me to cite during lecture)


Attendance Policy
According to Florida Atlantic University policy, “Students are expected to attend all of their scheduled University Classes and to satisfy all academic objectives as outlined by the instructor.” Attendance includes meaningful, active involvement in all class sessions, class discussions, and class activities as well as professional conduct in class.

Every member of this class is an integral part of the group. As such, it is important to attend each class session on time. Students are requested to notify the professor if they will be arriving late to class or missing class. Students missing class are still responsible for all materials covered in that class.

And please, cell phones must be turned off during class.

Accommodation for Disabilities
Reasonable accommodations will be made for students with disabilities. The purpose of the Office for Students with Disabilities “is to provide reasonable accommodations to students with disabilities.”

If you need any disability-related classroom accommodations or support services, please discuss these with me, at your convenience, and in privacy-or anonymity if you like--so that I can help you.

Academic Integrity
Each of us will publicly and privately uphold the ethical standards of our profession. Any evidence of plagiarism submitted in course assignments will be dealt with harshly with a failing grade for the course and a recommendation to university officials for the expulsion of the offender.