EPSY 6352.01
Multivariate Analysis

INSTRUCTOR: RALPH CARLSON
TERM: FALL 2018
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OFFICE LOCATION: EEDU 1.208
OFFICE HOURS: MONDAY, TUESDAY, THURSDAY, FRIDAY 1:30~4:30 PM

CLASS TIME AND LOCATION: MONDAY 4:40~7:10 PM EDCC 2.222

Textbook and/or Resource Material
Required Text:

Course Description and Prerequisites
The content of the course will include introduction to exploratory and confirmatory factor analysis; principal component theory; number of factor extracted; multivariate analysis of variance; path analysis, analysis of covariance structures; multiple discriminate analysis; and cluster analysis. Prerequisite: EPSY 6350 and EPSY 6351 or equivalent or consent of instructor.

Methods of Instruction (teaching)
A. Direct (expository) teaching
1. Lecture method of presentation of content (topic or concept):
   gestalt \(\rightarrow\) parts \(\rightarrow\) gestalt \(\rightarrow\)
2. modeling
3. demonstrations
4. guided practice
5. independent practice
6. measurement and evaluation

This syllabus subject to change in order to better meet course objectives per discretion of instructor.
B. Activities
   1. homework (independent practice)
   2. class discussion
   3. review

C. Methods of Learning for Students
   1. mnemonic system(s)
   2. elaboration of meaning
   3. actively thinking about one’s thinking
   4. management of self and information (content or skills to be acquired)

D. Methods of Measurement and Evaluation
   1. grading of homework
   2. tests (there will be one tests during the semester)

*CROSSWALK COURSE*
This course satisfies: Intellectual, professional, and academic development for graduate students, masters and doctoral, and faculty.

**Learning Objectives/Outcomes for the Course**

**Student Learning Outcomes**

After instruction/teaching:

1. Students will be able to utilize and engage rational thought and data.
2. Students will know what some of the criteria might be for knowing/science.
3. Students will know what some of the characteristics are for knowledge/science.
4. Students will know and understand the logic system for hypothesis testing.
5. Students will be able to partition variance and covariance into its various sources and error term(s).
6. Students will understand what statistical significance means and what it does not mean.
7. Students will be able to specify the criteria and conditions for falsifying, debunking, or deleting their most cherished hypotheses, ideas, and theories (Sir Francis Bacon).
8. Students will be able to interpret effect size/practical/functional/substantive significance: partial eta squared and Cohen’s $d$.
9. Students will be able to use exploratory and confirmatory data analysis side by side (Tukey, 1977).

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Course Technology

Tools: SPSS (Statistical Package for the Social Sciences)

Technical Requirements

Computer Hardware
To participate in this course, you should have easy access to a computer less than 5-years old with high-speed internet connection via cable modem, LAN or DSL. To ensure you are using a supported browser and have required plug-ins please refer to Supported Browsers, Plugins & Operating Systems for Blackboard Learn from Blackboards resource page.

Student Technical Skills
You are expected to be proficient with installing and using basic computer applications and have the ability to send and receive email attachments.

Software
Mozilla’s Firefox (latest version; Macintosh or Windows)
Google Chrome (latest version; Macintosh or Windows)
Adobe’s Flash Player & Reader plug-in (latest version)
Apple’s QuickTime plug-in (latest version)

Project Software – Optional

UTRGV University Policies

UTRGV Policy Statements

The UTRGV disability accommodation, mandatory course evaluation statement and sexual harassment statement are required on all syllabi. Additional policy statements are optional, such as those covering attendance, academic integrity, and course drop policies.

STUDENTS WITH DISABILITIES: Required on all syllabi. Do not modify.
If you have a documented disability (physical, psychological, learning, or other disability which affects your academic performance) and would like to receive academic accommodations, please inform your instructor and contact Student Accessibility Services to schedule an appointment to initiate services. It is recommended that you schedule an appointment with Student Accessibility Services before classes start. However, accommodations can be provided at any time.

Brownsville Campus: Student Accessibility Services is located in Cortez Hall Room 129 and

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can be contacted by phone at (956) 882-7374 (Voice) or via email at ability@utrgv.edu.

**Edinburg Campus**: Student Accessibility Services is located in 108 University Center and can be contacted by phone at (956) 665-7005 (Voice), (956) 665-3840 (Fax), or via email at ability@utrgv.edu.

**MANDATORY COURSE EVALUATION PERIOD:**

Students are required to complete an ONLINE evaluation of this course, accessed through your UTRGV account (http://my.utrgv.edu); you will be contacted through email with further instructions. Students who complete their evaluations will have priority access to their grades. Online evaluations will be available: (3 weeks before the end of the semester).

**ATTENDANCE:**

Students are expected to attend all scheduled classes and may be dropped from the course for excessive absences. UTRGV’s attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service. Students should contact the instructor in advance of the excused absence and arrange to make up missed work or examinations.

**SCHOLASTIC INTEGRITY:** Recommended on all syllabi.

As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism, and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations and UTRGV Academic Integrity Guidelines). All scholastic dishonesty incidents will be reported to the Dean of Students.

**Definitions**

"Plagiarism is a form of cheating. At UTRGV, “plagiarism is the appropriation, buying, receiving as a gift, or obtaining by any means another’s work and the unacknowledged submission or incorporation of it in one’s own academic work offered for credit.”

**Important Note:** Any form of academic dishonesty, including cheating and plagiarism, may be reported to the Office of Student Affairs.

**Course policies are subject to change.** It is the student’s responsibility to check Blackboard for corrections or updates to the syllabus. Any changes will be posted in Blackboard.
SEXUAL HARASSMENT, DISCRIMINATION, and VIOLENCE: Required on all syllabi. Do not modify.
In accordance with UT System regulations, your instructor is a “responsible employee” for reporting purposes under Title IX regulations and so must report any instance, occurring during a student’s time in college, of sexual assault, stalking, dating violence, domestic violence, or sexual harassment about which she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at www.utrgv.edu/equity including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect in an environment free from sexual misconduct and discrimination.

COURSE DROPS: Recommended on all syllabi; may be modified by the instructor as long as it is not inconsistent with UTRGV policy.
According to UTRGV policy, students may drop any class without penalty earning a grade of DR until the official drop date. Following that date, students must be assigned a letter grade and can no longer drop the class. Students considering dropping the class should be aware of the “3-peat rule” and the “6-drop” rule so they can recognize how dropped classes may affect their academic success. The 6-drop rule refers to Texas law that dictates that undergraduate students may not drop more than six courses during their undergraduate career. Courses dropped at other Texas public higher education institutions will count toward the six-course drop limit. The 3-peat rule refers to additional fees charged to students who take the same class for the third time.

STUDENT SERVICES:
Students who demonstrate financial need have a variety of options when it comes to paying for college costs, such as scholarships, grants, loans and work-study. Students should visit the Students Services Center (U Central) for additional information. U Central is located in BMAIN 1.100 (Brownsville) or ESSBL 1.145 (Edinburg) or can be reached by email (ucentral@utrgv.edu) or telephone: (888) 882-4026. In addition to financial aid, U Central can assist students with registration and admissions.

Students seeking academic help in their studies can use university resources in addition to an instructor’s office hours. University Resources include the Learning Center, Writing Center, Advising Center and Career Center. The centers provide services such as tutoring, writing help, critical thinking, study skills, degree planning, and student employment. Locations are:

- **Learning center:** BMSLC 2.118 (Brownsville) 882-8208 or ELCTR 100 (Edinburg) 665-2585
- **Writing center:** BLIBR 3.206 (Brownsville) 882-7065 or ESTAC 3.119 (Edinburg) 665-2538
- **Advising center:** BMAIN 1.400 (Brownsville) 882-7362 or ESWKH 101 (Edinburg)
- **Career center:** BCRTZ 129 (Brownsville) 882-5627 or ESSBL 2.101 (Edinburg) 665-2243

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Course Policies
Attendance Policy (Refer to UTRGV Policy)

Calendar of Activities

Calendar of Activities
Include in this section a table or list that provides information for students regarding important dates, assignments or activities. The UTRGV academic calendar can be found at http://my.utrgv.edu at the bottom of the screen, prior to login. Some important dates for Fall 2018 include:

- **August 27**: First day of classes
- **August 30**: Last day to add a course or register for fall 2018
- **September 3**: Labor Day – NO classes
- **November 14**: Last day to drop a course; will count toward the 6-drop rule
- **November 22-24**: Thanksgiving Holiday – NO Classes
- **December 6**: Study Day – NO class
- **December 7-13**: Final Exams
- **December 14-15**: Commencement Exercises

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Outline for EPSY 6352 Multivariate Analysis
Ralph Carlson

I. Review of univariate and bivariate distributions
   a. variance
   b. covariance
   c. bivariate distribution
   d. correlation
   e. regressions analysis and analysis of residuals

II. Introduction to Matrices and Matrix Algebra
   1. element
   2. vectors
   3. rows (i) & columns (j)
   4. dimensions or order of matrix
   5. scalars
   6. a square matrix, which has as many columns as rows
   7. the principal or major diagonal of square matrix that runs from the top left to the bottom right
   8. the trace of a matrix, which is the sum of the elements on the major diagonal of a square matrix
   9. a symmetric matrix, which is a square matrix where the element in the ith row and jth column equals the element in the jth row and ith column, such as a correlation matrix
   10. a variance-covariance matrix, which contains variances along the major diagonal and covariance of the major diagonal
   11. diagonal matrix, which is a matrix whose off-diagonal elements are all zero
   12. an identity matrix, which is a diagonal matrix whose elements are all 1's
   13. a triangular matrix, which is a square matrix whose elements above (or below) the diagonal are all zero
   14. a null matrix, which matrix consist of 0's only
   15. a matrix transpose of order NxM obtained by interchanging the rows and columns of an MxN matrix
   16. matrix equality, which means each and every element in two matrices are numerically equal to one another. (It also implies that the two matrices have the same number of rows and columns.)
   17. matrix operations
   18. matrices in statistical literature
III. Exploratory Data Analysis and Assumptions

1. Outliers
   a. Box-and-whisker plots
   b. Z scores (linear transformations)

2. Normality of distribution $N(0,1)$ (univariate)
   a. stem-and-leaf
   b. goodness of fit chi square; Wilk Shapiro, Kolmogorov one sample case (has the greatest amount of power in detecting non-normality of distribution either skewness or kurtosis at 30 df)

3. Homogeneity of Variance (univariate)
   a. $F$ Max test
   b. Cochran $C$ test
   c. Bartlett’s test
   d. Box’s $M$ test (multivariate)
   e. Analysis of residuals (“goodness” of model fit)

4. Multivariate Analysis Assumptions
   a. Independent random sampling
   b. Repeated Measures MANOVA & common scaling or metric
   c. Multivariate Normal $(\mu, \sigma^2)$
   d. Homogeneity of the variance-covariance matrix
   e. Shericity $S \geq \frac{1}{n - r} \geq 2$

5. Multicollinearity and Singularity

IV. Entry of data
   a. raw data matrix
   b. variance-covariance matrix
   c. intercorrelation matrix
   d. z score matrix

V. Principal components analysis
   a. (variance/variable reduction)
   b. linear combination equation

VI. Factor Analysis (relationship among variables/meaning of data set)
   a. orthogonal rotation factors extraction
   b. nonorthogonal rotation factor extraction
   c. maximum likelihood factor extraction

VII. Multivariate Analysis of Variance (MANOVA)
   a. generalization of the univariate one sample case $T$ test to multivariate one sample case $T^2$ (Hotelling’s $T^2$ )
   b. generalization of the univariate two dependent means (samples) case $T$ test to (Hotelling’s $T^2$ and one-way repeated measures MANOVA)
   c. generalization of the univariate two independent means (samples) case $T$ test to multivariate two independent samples case $T^2$ and one-way MANOVA
   d. generalization of univariate two-way and three-way factorial ANOVA to MANOVA utilizing Wilk’s Lambda and multivariate $F$ tests