APM 635. MULTIVARIATE STATISTICAL METHODS

Instructor : Lianjun Zhang
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Lecture : T.TH. 8:00-9:20 am, Walters Hall Room 210
Office Hours : T.TH. 11:00 am-12:00 pm or by appointment
Textbook : Not required.
Lecture Notes: available for purchase at the ESF Copy Center, Room 04, Bray Hall.

SAS 9.4 Online Docs at http://support.sas.com/documentation/94/index.html

Objective of Course:

APM 635 is a course in APPLIED multivariate statistical analysis. We will focus on: (1) the selection of proper multivariate analysis procedures to meet specific research objectives, (2) the advantages and disadvantages of different procedures, (3) statistical computing, and (4) the interpretation of statistical analysis results. Statistical Analysis System (SAS) will be used throughout the course. Example SAS programs will be provided for each multivariate analysis procedure discussed in the class. The resultant computer output will be interpreted in detail. You are also welcome to use any other statistics software such as SPSS, SYSTAT, MINITAB, S-Plus, R, and etc. You will be expected to provide results similar to what you would have obtained using SAS.

Outline of Course:

1. Introduction and Review of Basic Statistics	**1/15,17,22**
2. Matrix Algebra	**1/24,29,31**
3. Multivariate Normal Distribution	**2/5,7**
4. Multivariate T-Test - Hotelling's T^2	**2/12,14**
5. Univariate Analysis of Variance	**2/19,21**
6. Multivariate Analysis of Variance	**2/26,28 3/5,7**
7. Principal Components Analysis	**3/19,21**
8. Factor Analysis	**3/26,28, 4/2**
9. Discrimination and Classification	**4/4,9,11**
10. Cluster Analysis	**4/16,18**
11. Canonical Correlation Analysis	**4/23,25**
12. Summary	**4/30**

Reference:

Healy. 1986. Matrices for statistics. Oxford.
Neter, Wasserman, and Kutner. 1996. Applied linear regression models. IRWIN. (Chapters 1 and 5).
Manly. 1986. Multivariate statistical methods: A primer. Chapman & Hall.
Johnson & Wichern. 2001. Applied multivariate statistical analysis. 5th Ed. Prentice Hall.
Hair et al. 1998. Multivariate data analysis. 5th Ed. Prentice Hall.

Evaluation:

Your progress will be evaluated by the following weights:

Homework / Projects **100%**

Note:

1. Please **do not** play with iPhone, iPad, iPad Mini, etc. during my lecturing.
2. There are 10 HW assignments. Most assignments will require statistical data analysis, SAS programming, and interpretation of the results. You may work with other students on statistical computing and discussion of potential solutions. You will be expected to submit your own report for the analysis results. **Copying SAS programs and report from each other is NOT acceptable**.
3. **Late project report** will be penalized 10 points for each week passing the due date.
4. HW 3 – 10 will require a project report up to 10 typed pages long (single space). The reports should include (1) introduction, purpose, and description of the study and data sets, (2) step-by-step analysis methods, (3) analysis results and discussion, including necessary tables and graphics, and (4) summary. **Attach your SAS programs as the appendix.** Stacking selected SAS output without sufficient explanation would not be considered a report. An incomplete report that does not follow the reporting requirements will have a 10 points reduction.
5. **I strongly encourage you to learn SAS in this course**. You may use other statistical software, such as SPSS, Stata, Minitab, Excel, R, and etc., to do the HWs and projects. However, you may have to figure out how to use them to obtain the same or similar results as SAS produces.

Grading System: Your final grade will be determined as follows:

95 - 99 = A	80 - 84 = B
90 - 94 = A-	75 - 79 = B-
85 - 89 = B+	< 75 = F

Good Luck!

Statistics Courses Offered at SUNY-ESF:

APM 391 / APM 510 – Introductory Statistics (fall/spring semester)

Descriptive statistics (mean, variance, standard deviation, standard error), Z-test, t-test, F-test, ANOVA, correlation, simple linear regression, and χ^2-test.

APM 620 – Experimental Design and ANOVA (spring semester)

ANOVA, completely randomized design (CR), randomized complete block design (RCB), Latin square design, factorial experiment, split-plot design, mean comparisons, response surface, and linear mixed models.

APM 625 – Sampling Methods (fall semester)

Simple random sampling, systematic sampling, stratified random sampling, two-stage random sampling, ratio and regression estimators, multistage sampling, point sampling, sampling error and sample size.

APM 630 - Regression Analysis (fall semester)

Simple linear regression, multiple linear regression, dummy variables in regression, residual analysis, variable transformation, weighted least squares (WLS), influence and multicollinearity diagnostics, nonlinear regression, and linear mixed models.

APM 635 - Multivariate Statistical Methods (spring semester)

Matrix algebra, multivariate normality, Hotelling T^2, MANOVA, principal components analysis, factor analysis, discrimination and classification, cluster analysis, and canonical correlation analysis.

APM 645 – Nonparametrics and Categorical Data Analysis (fall semester)

Wilcoxon test, sign test, median test, binomial test, χ^2-test and contingency tables (including correspondence analysis), goodness-of-fit tests, nonparametric regression, Robust and Loess regression, generalized linear models (Logistic and Poisson regression), and re-sampling methods (bootstrapping and cross-validation).

APM 730 – Advanced Regression Modeling Methods (spring semester)

Basic regression techniques, generalized linear models (Logistic, Poisson and Beta regression), quantile regression, linear and nonlinear mixed models, variogram and kriging, linear mixed models for spatial data, spatial regression models (spatial lag and spatial error models), local spatial statistics and models (geographically weighted regression), Spline, Loess and GAM.