

## STAT 419 - Applied Multivariate Statistics

Winter 2016

### 1. Catalog Description

#### **STAT 419 Applied Multivariate Statistics (4 units)**

Continuous multivariate statistics. Multivariate linear model, principal components and factor analysis, discriminant analysis, clustering, and classification. Use of statistical software throughout the course. 4 lectures. Prerequisite: IME 326 or STAT 252 or STAT 302 or STAT 312 or STAT 313; and MATH 206 or MATH 244, or graduate standing.

### 2. Required Background and/or Experience

Two courses in statistics and MATH 206 or the consent of the instructor.

### 3. Expected Outcomes

The student should be able to:

- a. recognize the difference between univariate and multivariate statistics;
- b. perform multivariate estimation and hypothesis tests including profile analysis;
- c. solve classification problems using discriminant analysis;
- d. implement hierarchical and non-hierarchical clustering methods to identify groups;
- e. apply variable reduction techniques such as principal components and factor analysis;  
and
- f. use different computer packages for multivariate analyses.

### 4. Text and References

**Text:** Rencher, Alvin, *Methods of Multivariate Analysis*, 3<sup>rd</sup> ed., Wiley, 2012.

### 5. Minimum Student Materials

None.

### 6. Minimum University Facilities

Chalkboards for classroom use, overhead projectors, computer facilities for student use in preparing assignments.

7. **Expanded Description of Content and Method**

<b><u>CONTENT</u></b>	<b><u>LECTURE HOURS</u></b>
<b>A. REVIEW OF UNIVARIATE STATISTICS</b>	4
1. random variables	
2. sampling	
3. estimation and hypothesis testing	
<b>B. MATRIX ALGEBRA AND DATA REPRESENTATION</b>	4
1. review of matrix operations and properties	
2. mean, variance, and covariance matrices, subsets, and linear combinations	
<b>C. MULTIVARIATE DENSITY FUNCTIONS</b>	3
1. joint densities	
2. multivariate normal density	
3. conditional and marginal densities	
<b>D. HOTELLINGS T<sup>2</sup></b>	6
1. one sample and two sample	
3. repeated measures	
4. two-sample profile analysis	
<b>E. MULTIVARIATE ANALYSIS OF VARIANCE</b>	5
1. model and hypothesis	
2. test statistics	
3. multiple comparisons	
4. profile analysis	
<b>F. DISCRIMINANT ANALYSIS</b>	4
1. general discriminant function	
2. linear and quadratic discriminant functions	
3. multiple group classification	
4. error rates	
<b>G. CLUSTER ANALYSIS</b>	6
1. hierarchical: single, complete, average linkage	
2. non-hierarchical: k-means, model-based	
<b>I. VARIABLE REDUCTION AND UNDERLYING FACTORS</b>	6
1. principal components (definition and geometric explanation, interpretation, distribution)	
2. factor analysis (definition and comparison with principal components, rotation of factors)	
	<b>TOTAL:</b> <hr style="display: inline-block; width: 50px; border: 0.5px solid black; vertical-align: middle; margin-left: 5px;"/>
	38

**METHOD**

Material will be presented in a lecture format. Students will be required to use available computer resources.

8. **Method of Evaluating Outcome**

By oral presentations, team and individual projects both written and computing.