MATH 3330 MULTIVARIATE STATISTICAL METHODS (3 credit hours)

Elmira College

SPRING 2025

Required Text:
1. Wolfgang Karl Härdle, Léopold Simar, *Applied Multivariate Statistical Analysis* (3rd ed.);
2. Richard A. Johnson, Dean W. Wichern, *Applied Multivariate Statistical Analysis* (6th ed.).

Pre-requisites: MATH 2410 Applied Linear Algebra I, MATH 3010 Regression Analysis

Course Description

This module deals with the theories and techniques of multivariate statistical analysis and their applications. It covers matrices, random vectors, Multivariate Normal Distribution, estimation and hypothesis testing, regression models, Principal Components Analysis, Factor Analysis, Cluster Analysis, Discriminant Analysis and other core contents of multivariate statistical analysis. This also includes applications of data set using statistical software.

Course Objectives and Goals

➢ Understand the key concepts, theoretical approaches and assumptions of multivariate problems.
➢ Apply the techniques of discriminant analysis and cluster analysis to classify targeted data sets.
➢ Determine the suitable and efficient method of multivariate statistical analysis to analyze given data sets.
➢ Manipulate and interpret the result of multivariate statistical analysis by using statistical software packages.

Evaluation of Performance

Your grade will be based upon your performance on exams, assignments, and participation.

4 Assignments	20%
2 Group Projects	30%
Midterm Exam	25%
Final Exam	25%
Total	100%

Grades will be assigned as follows:

A 93% and above	B- 80 - 82%	D+ 67 - 69%
A- 90 - 92%	C+ 77 - 79%	D 63 - 66%

| B+ | 87 - 89% | C | 73 - 76% | D- | 60 - 62% |
| B | 83 - 86% | C- | 70 - 72% | F | 59% or below |

Withdrawal Policy: Please see Elmira College Bulletin for information on this policy.

Academic Honesty: Please read the section on Academic Honesty in the **Code of Conduct**. Briefly, academic dishonesty   includes: cheating, fabrication, facilitating academic dishonesty, and plagiarism. Ask if you have any questions on whether something constitutes as academic dishonesty. All work must be original and new. Past assignments from current or other courses will not be accepted. Academic dishonesty will not be tolerated. It will result in zero on the assignment, and a report will be filed with the school. Continued practice will result in failure of the class. Institutional penalties may also apply with repeated acts of academic honesty.

Student Responsibility:
- It is your responsibility to keep track of assignments and due dates.
- You should ask questions concerning assignments and lectures, if you need any clarifications.
- If you are struggling in class, have concerns, and/or unsure about expectations, please stop by during office hours or make an appointment for another time.

Tentative Schedule of Topics

Topic	Materials	Tasks & Evaluations
Matrix Algebra and Random Vectors	Chapter 1	
Multivariate Normal and Sampling Distribution	Chapter 2	Assignment 1
Sample Geometry and Random Sampling	Chapter 3	
The Multivariate Normal Distribution	Chapter 4	Assignment 2
Inference about A Mean Vector	Chapter 5	
Comparisons of Several Multivariate Means	Chapter 6	
Multivariate Linear Regression Models	Chapter 7	Group Project 1
Factor Analysis and Inference for Structured Covariance Matrices	Chapter 8	Midterm Exam
Theory of Estimation	Chapter 9	
Hypothesis Testing	Chapter 10	Assignment 3
Decomposition of Data Matrices by Factors	Chapter 11	
Principal Components Analysis	Chapter 12	
Factor and Cluster Analysis	Chapter 13	Assignment 4
Discriminant and Correspondence Analysis	Chapter 14	
Canonical Correlation Analysis	Chapter 15	Group Project 2
Techniques and Packages	Chapter 16	Final Exam