Course Module
Stephen F. Austin State University
STA 524-001 Applied Multivariate Analysis
Math 214 TR 11AM-12:15PM

Instructor
Robert (Bob) Henderson
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BA in Math & History – Trinity University, San Antonio, TX (1978)
MS in Mathematical Statistics – Southern Methodist University, Dallas, TX (1980)
PhD in Mathematical Statistics – Southern Methodist University, Dallas, TX (1982)
MBA – University of Delaware, Newark, DE (1988)
Worked in industry for 27 years, 6 years with DuPont as internal consultant for a variety of
businesses and staff groups, then 21 years in the semiconductor business, most with a supplier of a
key enabling material for semiconductor production, and later with Samsung working primarily
with engineers in process control efforts. The entire 27 years included many training delivery, as
well as course development activities related to basic statistics, experimental design, and process
control systems. Fall of 2009 was first semester at SFA.

Teaching Hours – 9-10:50AM MWF; 11AM-12:15PM TR
Office Hours – M 2-3:30PM; TW 2-5PM; R 10-11AM, and by appointment

Course Goals
The name of this course is Applied Multivariate Statistics, and the emphasis in this course will be
on the “applied” aspect of the material. Ideally, the student will leave the course with some
experience in the application of a variety of multivariate statistical analyses. In addition, it will be
desirable for the student to be able to identify which types of analyses might be most appropriate for
a given problem.

Text

Computer Access/Skills
It will be helpful to have access to a statistical software package, such as SAS, R, or JMP. Many of
the analyses discussed in the course can be executed using such software. In addition, it will likely
be helpful to have access to Microsoft Office programs – Excel, Word, and Powerpoint. Almost all
workplaces expect some skills in working with these packages, and use them for reporting and/or
presentation purposes.

Prerequisites
STA 520 Statistical Analysis I and MTH 317 Linear Algebra
Course Rationale
With the increasing connectivity and computing power in the world today, there is also an ever-increasing array of multivariate data sets available for evaluation. Ideally, these data sets can be effectively analyzed to extract meaningful and useful information for furthering understanding of the populations from which the data are obtained.

My experience in industry has suggested that a significant challenge in such endeavors will be the ability of the statistician involved to be able to clearly and concisely summarize such evaluations for the relevant decision-makers. Most of these individuals will be very sharp people, but are very likely to not have much patience for the mathematical details behind a specific analysis.

This course ideally will convey to students the ability to identify an appropriate approach (or approaches) to evaluating multivariate data sets, the knowledge of how to execute the identified approach(es), and the skills to communicate the salient results to the decision-maker involved. In addition, some attention will need to be given to the inherent assumptions behind the various analysis approaches, and how these may influence the various alternatives suggested by the relevant evaluation.

Course Overview
Weeks 1-2: Introduction and Multivariate Normal Distribution
Weeks 3-4: Analysis of Mean Vectors
Weeks 5-6: Multivariate Analysis of Variance
Weeks 7: Multivariate Regression
Weeks 8: Principal Components
Weeks 9: Factor Analysis
Weeks 10: Canonical Correlation
Weeks 11-12: Discrimination and Classification
Weeks 13-14: Cluster Analysis

Course Objectives
By completing the assigned work and projects, students will demonstrate their knowledge of and be able to:

1. Use data reduction or structural simplification to represent phenomenon being investigated while minimizing loss in information
2. Create groups of “similar” objects or variables based upon measured characteristics
3. Be aware of techniques for classifying objects into well-defined groups
4. Investigate the nature of dependence among several variables
5. Formulate statistical hypotheses in terms of the parameters of multivariate populations and test them using multivariate test statistics
6. Effectively communicate results of evaluations of multivariate data sets

Grading
Grades will be determined by the following:
Assignments 80%
Project 20%
**SFASU Policy 5.4:** The federal definition of a credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates:

1. Not less than one hour of classroom or direct faculty instruction and a minimum of two hours out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or 10 to 12 weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time, or;
2. At least an equivalent amount of work as outlined in item 1 above for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.

To this end, all students in courses offered by the Department of Mathematics and Statistics that wish to be successful should plan to spend at least two hours outside of class for every credit hour associated with this course. Expected activities to be completed in the time outside of class include reviewing notes from previous class meetings, reading assigned course resources, completing all assigned exercises and projects, and performing periodic assessment preparation.

**About Assignments**
Assignments will generally be homework problems. It is not necessarily a given that all homework assignments will be collected, nor when collected that all problems originally assigned will be scored.

**Attendance**
This is a graduate level class, and I do not expect attendance issues. If you know you are going to have to miss a specific class, there is an assignment due for that period, and I have indicated that it will be collected, then to get credit for it, please bring it by my office prior to the class.

**Academic Integrity**
It is the responsibility of the student to abstain from cheating. Dishonesty of any kind with respect to examinations, written assignments [completed] in or out of class, alteration of records, or illegal possession of current examinations or keys to examinations shall be considered cheating. Courtesy and honesty require that any ideas or materials borrowed from another must be fully acknowledged. Offering the work of another as one’s own is plagiarism. The subject matter of ideas thus taken from another may range from a few sentences or paragraphs to entire articles copied from books, periodicals, or the writing of other students. The offering of materials assembled or collected by others in the form of projects or collections without acknowledgment is also considered plagiarism. Any student who fails to give credit for ideas or materials taken from another is guilty of plagiarism.

**Definition of Academic Dishonesty**
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact,
it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit. (from SFA on-line Student Handbook)

A full description of university procedures and penalties in response to cheating and plagiarism can be found in the on-line Student Handbook in the Academic Integrity section at http://www.sfasu.edu/policies/academic_integrity.asp.

All of the above is the official policy of the school; however, the ultimate defender of academic integrity is each individual student. In this class, it might be helpful to work in small groups on the problems. Sharing ideas and helping each other with approaches to understand and solve the problems is not considered cheating or plagiarism. Copying someone else’s homework results 10 minutes before class is considered to be cheating (be warned that these situations are generally easy to identify, and both parties will be subject to the respective penalties). You are encouraged to discuss the problems with others outside the classroom, but are all considered adults, and until you provide evidence to the contrary, will be relied upon to set appropriate boundaries in how you work with others through the duration of this class.

**Withheld Grades**
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms, the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

**Students with Disabilities**
In accordance with University policy, students with disabilities who need accommodations are expected to initiate a meeting with the professor immediately upon registering with Disability Services to discuss how accommodations included on the Special Accommodation Request form will be provided. Students with disabilities who may have special needs and have not requested support services should seek assistance through Disability Services. The Office of Disability Services (ODS) is located in the Human Services Building, room 325, and can be contacted by phone at 468-3004 / 468-1004 (TDD). Failure to request services in a timely manner may delay appropriate accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

**Acceptable Student Behavior**
Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy D-34.1). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.