



AMBROSE  
UNIVERSITY COLLEGE

**BHS 410 BASIC MULTIVARIATE STATISTICS**  
**BHS 410L LAB**  
**Instructor:** Don Liteplo

**Fall 2009**

#### **Contacting the Instructor**

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#### **Course Term**

**Dates:** September 9th to December 10th, 2009

**Times:** Lectures: Wed & Fri 9:45 to 11:00 am

Lab Sessions: Mon 9:45 to 11:00 am

**Location:** Lectures: Room A2133

Lab Sessions: Room A2212

#### **Course Description**

This course is designed to acquaint the student with the theory and application of multivariate statistical methods. The focus will be on practical issues such as selecting the appropriate analysis, preparing data for analysis, menu-driven programming, interpreting output, and written presentation of results. Four overlapping aspects of multivariate procedures will be covered:

- (1) Theoretical – The heuristic basis of the various statistical techniques and assumptions underlying their use.
- (2) Practical – The use of *SPSS for Windows* as the statistical package to analyze multivariate data.
- (3) Interpretive – The skills to write accurate and informative results sections based on the techniques used.
- (4) Reflective – A focus on understanding the history, controversies, and limitations in the statistical procedures that we use.

Classroom time will be devoted mainly to explanation and discussion. Lab time will be devoted to explanation and demonstration of statistical software applications by the instructor, and to hands-on practice by the students (as well as completion of assignments). Some lab sessions will be used to finish coverage of materials that couldn't be completed in the lecture classroom and some lab sessions will be devoted to the writing of quizzes. The lab sessions are an integral part of the course – attendance at lab sessions is not optional.

#### **Course Objectives**

Upon completion of this course, students should be able to demonstrate:

- how data is checked to determine if they are suitable for analysis and, if deemed unsuitable, if and how the data can be made suitable for analysis.
- skill in deciding what statistical technique(s) will best answer different research questions.
- ability to input data, run the appropriate statistical technique, and interpret the output, understanding what conclusions can be reached and their limitations.
- ability to cast a critical eye on research literature, especially with respect to the appropriate use and interpretation of some of the more prevalent multivariate analyses.

## Required Text (must be possessed by each student)

Stevens, James P., *Applied Multivariate Statistics for the Social Sciences, Fifth Edition 2009*, Routledge (Taylor & Francis Group).

## Other Materials

The following are on reserve (library):

Girden, E.R., *Evaluating Research Articles from Start to Finish, 2001*, Sage Publications Inc.

Schwartz, K.D., *Basic Multivariate Statistics: Course Reader, 2003*.

Students will find the above reserve materials to be helpful in understanding and handling portions of the course materials, and the reserve materials should be routinely reviewed for assistance and clarification. The instructor may assign specific parts of these reserve materials for reading as the course progresses. The instructor may also provide other handout readings and examples (in hardcopy or as pdf files which can be accessed via MOODLE) as the course progresses.

## Course Schedule

A *Detailed Course Schedule* will be handed out in the first week of the semester. This schedule will set out the topics, dates, and times for the lectures and lab sessions, and will also show the dates and times for assignments, quizzes, and the mid-term examination. The dates and times are subject to change at the instructor's discretion as the course progresses; changes, if any, will be few and will be communicated in advance. The following is a Broad Course Schedule.

TOPIC	READING/LEARNING REFERENCE
Review of Descriptive Statistics (Univariate and Bivariate)	Instructor Lectures Notes/Examples on MOODLE (largely from recent BHS 310 Course)
Review of Inferential Statistics (Univariate and Bivariate)	Instructor Lectures Notes/Examples on MOODLE (largely from recent BHS 310 Course)

The main objective is to expand the students' understanding of major assumptions that underlie the more common statistical tests and procedures as well as some terms/methods that were not covered in depth in the earlier BHS 310 course.

Specific discussion/examples will include:

- assumptions (such as randomization, normality, and homogeneity of variation)
- confidence intervals
- conflict of interest
- confounding variables
- degrees of freedom
- dependent vs independent variables
- effect and effect size
- measurement error

- multicollinearity
- outliers
- parametric vs nonparametric data
- standard deviation vs standard error
- statistical power
- statistical significance vs practical significance
- systematic vs unsystematic variation
- Type I/Type II errors
- validity/reliability

Students will be provided with a hardcopy of the latter list so that they can refer to it frequently as the course progresses and add (in their own words) definitions, explanations, and examples for each item.

Chapter 1 (Introduction) of the Stevens text.

Chapter 1 (Introduction) of the Girden publication on reserve in the Library.

Subsequent discussion will center on examples of:

Regression (Simple Linear)  
 Comparing Several Means  
 Analysis of Covariance  
 Factorial Anova  
 Repeated Measures  
 Mixed Design

Some of the latter examples are from the recent BHS 310 Course and some are new. After discussion, they (and, occasionally, some related handout materials) will be placed (as PDF files) on MOODLE.

Introduction to Multivariate Analysis

Chapter 1 (Overview of Techniques) of the Schwartz publication on reserve in the Library.

Of the many types of multivariate techniques, the BHS 410 Course will be confined rather much to:

Multiple Regression  
 Multivariate Analysis of Variance (and perhaps Covariance)

Chapter 2 (Matrix Algebra – probably only a very basic overview) of the Stevens text.

Chapter 3 (Multiple Regression – only up to the end of 3.14.4) of the Stevens text.

Chapter 4 (Two-Group Multiple Analysis of Variance) of the Stevens text.

Chapter 6 (Assumptions in MANOVA)  
of the Stevens text.

Chapter 13 (Repeated Measures Analysis –  
only up to the end of 13.16) of the  
Stevens text.

In the midst of all of the above, there will be a Mid-Term Examination.

At the end of the course, there will be a Final Examination.

### **Course Requirements and Grading**

Student performance will be evaluated in a combination of classroom participation and graded assignments, quizzes, mid-term examination, and final examination. Mark allocation is as follows:

Participation	10%
Three Assignments	18% (6% each)
Three Quizzes	24% (8% each)
Mid-Term Exam	18%
Final Exam	<u>30%</u>
	100%

Students need not receive a passing grade on all components of term work and examinations in order to pass the course. However, failure to submit an assignment or write a quiz/examination, without the prior approval of the instructor, may result in an F grade for the course.

Marks for classroom participation are based on the instructor's impression (cumulative through the semester) of the student's efforts to review and comprehend text material, the student's classroom and lab session attitude, quality of responses to questions asked by the instructor, and quantity/quality of contributions to classroom discussion. Absences from class can negatively impact marks for *participation*.

Students are required to read the above-listed chapters in the textbook and other specifically-assigned reference materials in order to be prepared for the classroom lectures, discussion, and problem-solving.

### **Assignments/Quizzes**

The assignments will be take-home exercises. One of the quizzes may be a take-home exercise. Deadlines for completion and submission of these will be clearly indicated in advance.

Any take-home assignment/quiz submitted after the due date will be penalized by 50%, but if submitted after answer keys have been posted, or after any graded materials have been returned to any students, a grade of 0% will be awarded.

All assignment and quiz papers must include the student's name (printed clearly).

Note that in order for a student to be eligible to write the final examination, he/she must submit all take-home papers by the last day of lectures and must have written all in-class quizzes on the scheduled dates. The mark for an in-class quiz which is *missed with a legitimate reason* (typically illness,

evidenced by a Doctor's note) will normally be spread across (transferred to) the other quizzes and assignments.

### Mid-Term Examination

The mid-term examination will be 1 1/4 hours (75 minutes) in length. It will be written during regular class (or lab) time *per the Detailed Course Schedule* and can cover all materials included in the course up to the date of the exam.

A grade of 0% will be awarded for a mid-term examination missed *without a legitimate reason*. If the mid-term examination is missed *with a legitimate reason*, a make-up mid-term examination will be arranged within one week. If the instructor determines that this arrangement is not practical, the final grade will be reallocated as follows:

Participation	10%
Three Assignments	24% (8% each)
Three Quizzes	30% (10% each)
Final Exam	<u>36%</u>
	100%

### Final Examination

The final examination will be comprehensive (i.e., can cover any materials included in the course during the semester, but emphasis will be on the material covered in the last half of the course). The final examination will have a maximum writing time of three hours (180 minutes). The exact time and date for writing will be posted by the Registrar. The final examination will be written during the final examination period – December 14<sup>th</sup> to 18<sup>th</sup>, 2009 – following the last day of classes. It is the student's responsibility to ensure that he/she does not have any conflicting commitments during the final examination period.

Graded final examinations will be available for supervised review at the request of the student.

Students need not receive a passing grade on all components of term work and examinations in order to pass the course.

### Available Letters for Course Grades

<u>% Grade</u>	<u>Letter Grade</u>	<u>Description</u>
95% to 100%	A+	
90% to 94%	A	Excellent
85% to 89%	A-	
80% to 84%	B+	
76% to 79%	B	Good
72% to 75%	B-	
68% to 71%	C+	
64% to 67%	C	Satisfactory
60% to 63%	C-	
55% to 59%	D+	
50% to 54%	D	Minimal Pass
0% to 49%	F	Failure

## **Important Notes**

A student's final course grade is not based upon the student's attendance record; however, the general expectation is that students will attend all classes and lab sessions in which they are registered. A combination of low academic performance and notable absences from classes or lab sessions may be brought to the attention of the program head.

September 18<sup>th</sup>, 2009, is the last day to enter a course without permission and to withdraw from a course and receive tuition refund.

November 13<sup>th</sup>, 2009, is the last day to voluntarily withdraw from a course or change to audit without academic penalty.

Course withdrawal forms are available from the Registrar. Students who do not follow the proper withdrawal procedures will be recorded as having failed the course.

It is the responsibility of all students to become familiar with and adhere to the academic policies contained in the Student Handbook and Academic Calendar.

Students are reminded that examinations will be actively invigilated. Students may only bring to an examination room items stipulated by the instructor to be required for the completion of the examination. All non-essential items (including, but not limited to, hats, coats, gloves, knapsacks, purses, and electronic devices other than approved calculators) must be left in an area of the examination room designated by the instructor. All cell phones and other unauthorized electrical devices **MUST** be turned off during examinations. Failure to comply may result in a failing grade for the examination.