

SPEA V506 – Fall 2012

Statistical Analysis for Effective Decision-Making

TR 1:00-2:15; SPEA 278

Lab: T 7:00-8:30 p.m.; SPEA 278 or McNutt 001B

Instructor: Barry Rubin

Office: SPEA 329

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E-Mail: rubin@indiana.edu

Office Hrs: TR 11:15-12:50, or by appointment

Kyle O'Rourke's Office Hrs: MW 11:00-1:00,

F 10:00-11:30/12:30

Class Number: 20677

TA: Kelly Cook

Office: SPEA 440

Phone: 856-5194/(317) 374-2159

E-Mail: cookka@indiana.edu

Office Hrs: T 5:20-6:50 (TBA),

R 8:15-9:15 am, 2:30-4:00,

F 12:30-1:30/2:30,

or by appointment

Course Description and Objectives

This course provides graduate-level instruction in the application of statistical analysis to issues in public and environmental affairs and related fields. It is designed to assist students in learning the methods by which statistical analysis is carried out, as well as the basic theory that enables and constrains the application of statistics to real world data. The course emphasizes practical aspects of applying such methods, appropriately interpreting the results of these statistical analysis tools, and gaining a meaningful understanding of how statistical analysis can be misused or erroneously executed (either intentionally or unintentionally). As such, the course will address descriptive statistics, statistical inference, the nature of random variables, sampling distributions, point and interval estimation of parameters (mean, standard deviation, etc.), hypothesis testing, analysis of variance, and bivariate and multivariate regression. Although these are traditional topics for an introductory statistics course, the emphasis in V506 will be on appropriately applying these techniques and extracting meaningful information from unstructured data. Use of computer tools for carrying out statistical analysis (primarily SAS) will also be a major emphasis.

The primary goals for the course are to enable students to understand:

- how statistical tools can be applied to problem-solving,
- how decision-making can be improved through statistical analysis,
- the nature and use of distributions,
- how sample data can be used to generalize to larger populations,
- the properties and limitations of estimators and hypothesis tests,
- the nature and strength of relationships between variables,
- how to transform raw data into useful information, and
- how to use computer tools to carry out statistical analysis.

A lecture format with occasional in-class exercises will be used for the Tuesday and Thursday class sessions. There is also a lab session generally scheduled for 7:00-8:30 p.m. on Tuesday, beginning the second week of class. The lab sessions will be used for review of concepts, instruction on use of the SAS software, assistance with homework exercises, and return and explanation of graded homework exercises and the midterm exam. Lab sessions will take place in SPEA 278 or McNutt 001B, depending on the date. Regular attendance at lab sessions is advised for any student who feels they need additional help or assistance with course concepts or homework. However, with the exception of the two SAS computing labs, attendance at the labs is not required. The lab sessions will generally be conducted by the TA.

Students will also have remote access to SAS via IUanyWARE. This software, as well as most of the other applications that are present in the Student Technology Clusters (STCs), can be accessed via a Web browser on most Windows or MAC notebook or desktop computers wherever a Wi-Fi connection is available. Although there are a few minor differences, the IUanyWARE SAS software environment is almost identical to that of the program running in the STCs.

Course Requirements and Grading Criteria

There will be two examinations administered during the semester, each equally weighted. These exams are scheduled for October 18th and December 11th. Each exam will combine multiple choice and problem/essay questions. The exams will be comprehensive, but only to the extent that concepts covered in the first half of the course are required to understand those covered later. Homework exercises will generally include a combination of two types of problems -- those that will need to be analyzed without computer assistance and those that will be addressed via use of computer tools. There will be seven homework exercises during the semester. With the exception of the first homework, you are required to work collaboratively with one and only one other student in the class. A single set of answers for the assignment will be submitted by both students collectively. However, all students should be able to successfully employ, on the exams and in class, the problem-solving approaches used on the homework assignments. Unless previously approved by the instructor or TA, late homework assignments will be accepted with a 10 percent penalty per day late, up to three days.

Students are also required to be familiar with the use of general computing software, especially electronic spreadsheets. The class will also use Oncourse to provide electronic copies of course materials, links to sites that provide assistance in understanding key concepts, and documentation for the SAS software.

The weights for the course elements that will be used to calculate the semester grade are:

Midterm Exam	30%
Final Exam	30%
Homework Exercises	35%
Class Discussion/Participation	5%

Required Materials and Reading Assignments

Students will be expected to purchase and bring to class a copy of "SPEA V506: Statistical Analysis for Effective Decision-Making Lecture Notes - Fall 2012." This can be purchased at the IU or TIS Bookstores (it is usually on the shelf next to the textbooks). Each student should also have a USB flash drive with at least 1 Gb capacity for storing class materials and a scientific calculator (simple, non-graphing, \$10-\$15 is best).

The required text for the class is:

Douglas Lind, William Marchal, and Samuel Wathen, *Statistical Techniques in Business and Economics*, 15th ed., (New York: McGraw-Hill/Irwin, 2012).

A supplemental text that may prove useful for learning SAS follows. However, don't purchase this text until after we discuss it in class.

Ronald Cody and Jeffrey Smith, *Applied Statistics and the SAS Programming Language*, 5th ed., (Upper Saddle River, N.J.: Pearson/Prentice Hall, 2006).

Other Issues

All aspects of the IU Student Honor Code apply to this class, particularly those regarding academic dishonesty and plagiarism. If any student will require assistance or accommodations for a disability, please contact the instructor. You must have established your eligibility for disability support services through the Office of Disabled Student Services in 096 Franklin Hall, 855-7578.

This syllabus should be considered a work in progress, and some readings, topics, or dates may be modified by the instructor from time to time.

SPEA V506: STATISTICAL ANALYSIS FOR EFFECTIVE DECISION-MAKING TOPICS AND READING ASSIGNMENTS - FALL 2012

Date Topic and Reading Assignments

Part I Descriptive Statistics

Aug 21 Introduction to the Course
Preliminary Concepts and Frequency Distributions

Readings: Lind, Ch. 1-2, pp. 1-16, 21-44.

Aug 21 Lab: None

Aug 23 Central Tendency and Dispersion

Readings: Lind, Ch. 3-4, pp. 57-94, 102-127, 137-138.

Exercise 1 Assigned (due Friday, Sep 7)

Aug 28 Probability Theory

Readings: Lind, Ch. 5, pp. 144-176.

Aug 28 Lab (required): McNutt 001B - SAS Introductory Workshop, 7:00-9:00 p.m.

Aug 30 Random Variables and Probability Distributions

Readings: Lind, Ch. 6, pp. 186-201.

Sep 4 The Normal Distribution

Readings: Lind, Ch. 7, pp. 222-245, 258-260.

Exercise 2 Assigned (due Friday, Sep 14)

Sep 4 Lab: McNutt 001B - Exercise 1 Help Session

Part II Statistical Inference

Sep 6 Sampling Methods, Sampling Distributions, and the Central Limit Theorem

Readings: Lind, Ch. 8, pp. 265-288.

Sep 7 **Exercise 1 Due by 5:00 p.m.**

Sep 11 The Importance of Sampling Distributions in Statistical Inference
Introduction to Point and Interval Estimation: Means

Readings: None.

- Sep 11 *Lab: McNutt 001B - Exercise 1 Returned*
Exercise 2 Help Session
- Sep 13 Point and Interval Estimation: Means and Proportions
Readings: Lind, Ch. 9, pp. 297-312.
- Sep 14 **Exercise 2 Due by 5:00 p.m.**
- Sep 18 Point and Interval Estimation: Variances/Standard Deviations; Estimating Sample Size, and Introduction to Hypothesis Testing
Readings: Lind, Ch. 9, pp. 313-322, 329-330
Exercise 3 Assigned (due Friday, Sep 28)
- Sep 18 *Lab (required): McNutt 001B - SAS Intermediate Workshop, 7:00-9:00 p.m.*
Exercise 2 Returned
- Sep 20 Hypothesis Testing: One-Sample Population Means with Known and Unknown Population Standard Deviation
Readings: Lind, Ch. 10, pp. 333-347.
- Sep 25 Hypothesis Testing: One-Sample Population Means with Unknown Population Standard Deviation, Proportions
Readings: Lind, Ch. 10, pp. 348-352, 356-359.
- Sep 25 *Lab: McNutt 001B - Exercise 3 Help Session*
- Sep 27 Hypothesis Testing: Two-Sample Differences Between Independent Population Means
Readings: Lind, Ch. 11, pp. 371-377, 382-386, 388-391.
- Sep 28 **Exercise 3 Due by 5:00 p.m.**
- Oct 2 Hypothesis Testing: Two-Sample Differences Between Proportions and Two-Sample Differences Between Dependent Population Means
Readings: Lind, Ch. 11, pp. 378-381, 392-397.
Exercise 4 Assigned (due Thursday, Oct 11)
- Oct 2 *Lab: SPEA 278 - Exercise 3 Returned*
- Oct 4 Hypothesis Testing: Standard Deviations/Variances and the F-Statistic
Readings: Lind, Ch. 12, p. 410-415.

Part III Identifying Relationships: Analysis of Variance, Correlation, and Regression

- Oct 9 Hypothesis Testing: Introduction to Analysis of Variance
Readings: Lind, Ch. 12, pp. 416-418.

Oct 9 *Lab: McNutt 001B - Exercise 4 Help Session*

Oct 11 One-Way Analysis of Variance

Readings: Lind, Ch. 12, pp. 418-428.

Midterm Exam Review Questions Distributed

Exercise 4 Due by 5:00 p.m.

Oct 16 Midterm Exam Review

Oct 16 *Lab: SPEA 278 - Midterm Exam Review
Exercise 4 Returned*

Oct 18 **Midterm Exam**

Oct 23 Two-Way Analysis of Variance

Readings: Lind, Ch. 12, pp. 430-440, 455-456.

Exercise 5 Assigned (due Friday, Nov 2)

Oct 23 *Lab: SPEA 278 – Midterm Exam Returned*

Oct 25 Bivariate Regression: Assumptions, Estimation, and the Gauss-Markov Theorem

Readings: Lind, Ch. 13, pp. 461-481.

Oct 30 Bivariate Regression: Correlation, Strength of Relationship, and Hypothesis Testing

Readings: Lind, Ch. 13, pp. 483-494.

Oct 30 *Lab: McNutt 001B - Exercise 5 Help Session*

Nov 1 Bivariate Regression Applications

Readings: Lind, Ch. 13, pp. 495-497.

Exercise 6 Assigned (due Friday, Nov 9)

Nov 2 **Exercise 5 Due by 5:00 p.m.**

Nov 6 Multivariate Regression: Assumptions, Estimation, and the Gauss-Markov Theorem

Readings: Lind, Ch. 14, pp. 512-517, 531-537.

Nov 6 *Lab: McNutt 001B - Exercise 5 Returned
Exercise 6 Help Session*

Nov 8 Multivariate Regression: Strength of Relationship and Hypothesis Testing

Readings: Lind, Ch. 14, pp. 519-531.

Nov 9 **Exercise 6 Due by 5:00 p.m.**

Nov 13 Multivariate Regression: Hypothesis Testing and Application Example

Readings: None.

Exercise 7 Assigned (due Friday, Nov 30)

Nov 13 Lab: SPEA 278 - Exercise 6 Returned

Nov 15 Multivariate Regression: Application Example, Functional Form and Dummy Variables

Readings: Lind, Ch. 14, pp. 537-542, 546-551, 567-568.

Application Article: Mary Donegan, et. al., (2008), "Which Indicators Explain Metropolitan Economic Performance Best? Traditional or Creative Class," *Journal of the American Planning Association*, 74:2, pp. 180-195.

Nov 19- **Thanksgiving Break**

Nov 23

Nov 27 Multivariate Regression: Introduction to Violations of Assumptions

Readings: Lind, Ch. 14, pp. 524-530, 558-559.

Nov 27 Lab: McNutt 001B - Exercise 7 Help Session

Nov 29 Multivariate Regression Research Application Example

Final Exam Review Questions Distributed

Nov 30 **Exercise 7 due by 5:00 p.m.**

Dec 4 Video Case Study of Regression Analysis Application

Dec 4 Lab: SPEA 278 - Exercise 7 Returned
Final Exam Review

Dec 6 Teaching Evaluations
Final Exam Review

Dec 11 **Final Exam, Tuesday, 5:00-7:00 pm, SPEA 278**