

# **SPEA Connect V506 – SPRING 2017**

## **Statistical Analysis for Effective Decision-Making**

**Tutorial: Mondays, 8-9:30pm EST via Zoom**

**Class Number: 32879**

**Instructor: Joanna Woronkiewicz**

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Office Hrs: by appointment

**Lab: Tuesdays, 7-8:30pm EST via Zoom**

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Office Hrs: Mon 10am-12pm, Sun 7-9pm EST

### **Course Description and Objectives**

This course provides online, 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, interpreting the results of these statistical analysis tools, and gaining a meaningful understanding of how statistical analysis can be misused or erroneously executed (intentionally or unintentionally). The course will address descriptive statistics, statistical inference, the nature of random variables, sampling distributions, point and interval estimation of parameters, 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 learning outcomes for the course are to enable students to:

- apply statistical tools to problem-solving in the public and non-profit sectors,
- improve decision-making through statistical analysis,
- explain the nature and use of distributions,
- generalize sample data to larger populations,
- explain the properties and limitations of estimators and hypothesis tests,
- measure the nature and strength of relationship between variables,
- transform raw data into useful information, and
- carry out statistical analysis using computer tools.

The course uses a set of modules for delivery of the theoretical content which are based on the class lecture notes, and a weekly Tutorial and Lab. Both the module and lecture notes are available in Canvas. These are supplemented by video lectures, readings from the textbooks, and additional documentation.<sup>1</sup> We will be using Zoom Meeting for a one and a half -hour Tutorial every week on Monday. During this Tutorial, the instructor will be reviewing the primary concepts covered by the modules.

The TAs will be conducting a weekly Lab Session on Tuesday via Zoom. During these lab sessions, the TA's will go over significant aspects of the software and homework assignments, will review critical elements from the Tutorial, and will address any questions you have concerning these or any other elements of the class in a communal fashion.

While we do not require attendance via Zoom for the Tutorial and Lab, we strongly encourage real time attendance. For those of you who have scheduling conflicts for this time slot, or if you want to review elements

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<sup>1</sup>Note that the video lectures were prepared by Professor Ashlyn Nelson and reference the Agresti and Finlay text. Student should refer to the crosswalk table for corresponding pages in the Lind, Marchal, and Wathen textbook.

of the Tutorial or Lab a second time, we will be recording these and making them available via Zoom for streaming. **Students ARE REQUIRED to either attend the Tutorial and Lab or view the recordings.** The Zoom meeting links will be provided via email.

Students will have remote access to SAS via IUanyWARE. This software can be accessed via a Web browser on most Windows or Mac computers wherever a Wi-Fi connection is available. Although there are a few differences, the IUanyWARE SAS software is almost identical to the program running natively in Windows. Use of IUanyWare will be covered in the first Lab.

## Course Requirements and Grading Criteria

There will be two examinations administered during the semester, each equally weighted. These exams are scheduled for a 2.5 hour period during weeks 9 and 16. 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. The exams will be open note and open book, but must be done individually without consultation with any other person or Web resource.

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 six homework exercises during the semester. Unless previously approved by the instructor or a TA, late homework assignments will be accepted with a 10 percent penalty per day late, up to three days. All homework assignments must be submitted as a Microsoft Word file to the Assignments Area of Canvas.

To enhance achievement of the learning outcomes for the class, students are required to work with a partner for the homework assignments. These two-person groups are generally self-selected but the TA's can assist if requested. Given that the first homework exercise is due on January 30th, students should select their partners and notify the TA's of this selection no later than January 22<sup>nd</sup>. The TA's will create the homework groups in canvas and only one student in the group will need to submit the exercise.

Students are also required to be familiar with the use of general computing software, especially word processing and electronic spreadsheets. The class will use Canvas to provide the course modules, video lectures, electronic copies of data sets and other course materials, recordings of the Tutorial and Lab, links to sites that provide assistance in understanding key concepts, and documentation for the SAS software and IUanyWare.

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

The required text for the class is:

Douglas Lind, William Marchal, and Samuel Wathen, *Statistical Techniques in Business and Economics*, 16th ed., (New York: McGraw-Hill/Irwin, 2015).

This text is available to all students as an IU eText therefore students do not need to purchase a hardcopy.

As noted in the Schedule of Classes, I will be teaching this class with IU eTexts. The cost of the textbook has been added to each student's IU Bursar bill. Your copy is available in your Canvas class page. In the menu at the left of the screen, click on "Unizin Engage (IU eTexts)" to open the Engage reading platform. In the top right corner of Engage, click on your icon. Click on the Help link. Click on "Students" to access quick

overviews of how to navigate the platform and all the general studying/learning features – reading, note-taking, highlighting, questioning, printing, bookmarking, searching, and collaborating. Please familiarize yourself with the Engage platform before the first day of class. Engage works best when viewed online, in Firefox or Chrome. Students also have the option of purchasing a printed, B/W, loose leaf copy of text for \$15 directly from Unizin

Required readings from the following supplemental text will be available in Canvas in the Agresti & Finlay folder:

Alan Agresti and Barbara Finlay, *Statistical Methods for the Social Sciences*, 4<sup>th</sup> edition, (Upper Saddle River, NJ: Pearson Prentice Hall, 2009), ISBN 978-0-13-027295-9.

In addition, you will need to download or have access to the following set of class lecture notes from the Canvas site. These notes are contained in five separate Word files.

*SPEA V506: Statistical Analysis for Effective Decision-Making Lecture Notes.*

## **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 CONNECT V506**  
**STATISTICAL ANALYSIS FOR EFFECTIVE DECISION-MAKING**  
**TOPICS, MODULES, AND READING ASSIGNMENTS - SPRING 2016**

<b>Week</b>	<b>Topics, Readings, and Assignments</b>
<b><i>Module One: Descriptive Statistics and Probability Distributions</i></b>	
<b>Week 1a</b> <b>Jan 9-11</b>	<p><b>Topic: Course Introduction and Orientation, SAS Intro, Preliminary Concepts and Frequency Distributions</b></p> <p><b>Module 1, Week 1a</b></p> <p><b>Required Readings:</b>  Agresti &amp; Finlay, Ch. 1, pp. 1-7.  Lind, Ch. 1-2, pp. 1-13, 17-36.  V506 Lecture Notes, pp. 2-6.  Canvas Materials for Box, IUanyWare, and Zoom</p> <p><b>Tutorial:</b> Introduction to the Class  Introduction to Statistics, Sampling, and Measurement  <b>Lab:</b> Introduction to the Labs and Accessing SAS</p>
<b>Week 1b</b> <b>Jan 12-15</b>	<p><b>Topic: Sampling and Measurement</b></p> <p><b>Module 1, Week 1b</b></p> <p><b>Required Readings:</b>  Agresti &amp; Finlay, Ch. 2, pp. 11-25.  V506 Lecture Notes, pp. 28-29.  Canvas Materials for Accessing SAS</p>
<b>Week 2</b> <b>Jan 16-22</b>	<p><b>Topic: Descriptive Statistics</b></p> <p><b>Module 1, Week 2</b></p> <p><b>Required Readings:</b>  Agresti &amp; Finlay, Ch. 3, pp. 31-61.  Lind, Ch. 3-4, pp. 50-80, 93-117, 125-126.  V506 Lecture Notes, pp. 7-14.  Canvas SAS Materials</p> <p><b>Tutorial:</b> Descriptive Statistics – Central Tendency and Variation  <b>Lab:</b> Introduction to SAS Part I</p> <p><b>Homework Exercise 1</b> (due Monday, Jan 30, by midnight)</p>
<b>Week 3</b>	<b>Topic: Probability Distributions and Random Variables: the</b>

Jan 23-29	<p align="center"><b>Binomial and Normal Distributions</b></p> <p><b>Module 1, Week 3</b></p> <p><b>Required Readings:</b>  Lind, Marchal, and Wathan, Ch.5, pp. 131-165; Ch. 6, pp. 173-199.  V506 Lecture Notes, pp. 15-24.  Canvas SAS materials</p> <p><b>Tutorial:</b> Probability Theory, Binomial Distribution  <b>Lab:</b> Introduction to SAS Part II</p>
<p align="center"><b><i>Module Two: Statistical Inference</i></b></p>	
<p><b>Week 4</b>  <b>Jan 30-Feb 5</b></p>	<p><b>Topic: Sampling Distributions and the Central Limit Theorem</b></p> <p><b>Module 2, Week 4</b></p> <p><b>Required Readings:</b>  Lind, Marchal, and Wathan, Ch. 7, pp. 206-230; Ch. 8, pp. 247-273.  V506 Lecture Notes, pp. 25-32.</p> <p><b>Tutorial:</b> Normal Distribution; Sampling Distributions and the Central Limit Theorem  <b>Lab:</b> SAS Elements for Exercise 2, Exercise 1 Answers Reviewed</p> <p><b>Homework Exercise 2</b> (due Monday, Feb 6, by midnight)</p>
<p><b>Week 5</b>  <b>Feb 6-12</b></p>	<p><b>Topic: Statistical Inference - Estimation</b></p> <p><b>Module 2, Week 5</b></p> <p><b>Required Readings:</b>  Lind, Ch. 9, pp. 279-306, 312.  V506 Lecture Notes, pp. 33-37.</p> <p><b>Tutorial:</b> Point and Confidence Interval Estimates for Means  <b>Lab:</b> Intro to SAS Part III</p> <p><b>Homework Exercise 3</b> (Due Monday, Feb 20, by midnight)</p>

<b>Week 6</b> <b>Feb 13-19</b>	<b>Topic: Statistical Inference – Single Sample Hypothesis Testing</b>  <b>Module 2, Week 6</b>  <b>Required Readings:</b> Lind, Ch. 10, pp. 313-336, 338-342. V506 Lecture Notes, pp. 38-45.  <b>Tutorial:</b> Single Sample Hypothesis Tests <b>Lab:</b> SAS Elements for Exercise 3, Exercise 2 Answers Reviewed
<b>Week 7</b> <b>Feb 20-26</b>	<b>Topic: Statistical Inference – Two-Sample Differences Between Parameters</b>  <b>Module 2, Week 7</b>  <b>Required Readings:</b> Lind, Ch. 11, pp. 348-364. V506 Lecture Notes, pp. 46-50.  <b>Tutorial:</b> Two-Sample Hypothesis Tests <b>Lab:</b> SAS Elements for Exercise 4  <b>Homework Exercise 4</b> (Due Monday, Mar 6, by Midnight)
<b>Week 8</b> <b>Feb 27-Mar 5</b>	<b>Topic: Midterm Exam Review</b>  <b>Required Readings:</b> <b>Midterm Exam Study Guide</b>  <b>Lab:</b> Exam Review
<b>Week 9</b> <b>Mar 6-12</b>	<b>Topic: Midterm Exam</b>  <b>Required Readings:</b> None.  <b>Lab:</b> Midterm Exam Review  <b>Midterm Exam: 2.5 Hrs Thursday, Friday, or Saturday</b>
<b>March 13-19</b>	<b>Spring Break – No Tutorial or Lab</b>
<b><i>Module Three: Identifying Relationships - Correlation, and Regression</i></b>	

<p><b>Week 10</b> <b>Mar 20-26</b></p>	<p><b>Topic: The Chi-Square Distribution, Contingency Table Analysis, and the F-Distribution</b></p> <p><b>Module 3, Week 10</b></p> <p><b>Required Readings:</b> Lind, Ch. 12, pp. 380-385, Ch. 15, pp. 543-554, 558-562 V506 Lecture Notes, pp. 53-58</p> <p><b>Tutorial:</b> Chi-square distribution, contingency table analysis, and F-tests <b>Lab:</b> SAS Code for Chi-square tests and F-tests, Midterm Exam Answers Reviewed</p> <p><b>Homework Exercise 5</b> (Due Monday, Apr 17, by midnight)</p>
<p><b>Week 11</b> <b>Mar 27-Apr 2</b></p>	<p><b>Topic: Bivariate Linear Regression and Correlation</b></p> <p><b>Module 3, Week 11</b></p> <p><b>Required Readings:</b> Lind, Ch. 13, pp. 426-443; 448-462. V506 Lecture Notes, pp. 76-89.</p> <p><b>Tutorial:</b> Bivariate Regression and Correlation <b>Lab:</b> Exercise 4 Answers Reviewed, SAS Code for Regression</p> <p><b>Homework Exercise 6</b> (Due Monday, Apr 24, by midnight)</p>
<p><b>Week 12</b> <b>Apr 3-9</b></p>	<p><b>Topic: Multivariate Regression –Assumptions, Estimation, Strength of Relationship, and Inference</b></p> <p><b>Module 3, Week 12</b></p> <p><b>Required Readings:</b> Lind, Ch. 14, pp. 476-493. V506 Lecture Notes, pp. 90-99.</p> <p><b>Tutorial:</b> Multivariate Regression Assumptions, Estimation, Strength of Relationship, and Inference <b>Lab:</b> SAS Code and Interpretation for Multivariate Regression</p>
<p><b>Week 13</b> <b>Apr 10-16</b></p>	<p><b>Topic: Multivariate Regression – Dummy Variables, Interaction Terms, and Variable Transformations</b></p> <p><b>Module 3, Week 13</b></p>

	<p><b>Required Readings:</b>  <b>Lind, Ch. 14, pp. 494-504; 508-514; 528.</b>  <b>V506 Lecture Notes, p. 98.</b></p> <p><b>Tutorial:</b> Multivariate Regression Using Dummy Variables,  Interaction Terms, and Transformations  <b>Lab:</b> SAS Code and Interpretation of Dummy Variables,  Interaction Terms, and Variable Transformations</p>
<p><b>Week 14</b>  <b>Apr 17-23</b></p>	<p><b>Topic: Multivariate Regression Research Application</b></p> <p><b>Tutorial:</b> Regression Application Example in  Academic Research</p> <p><b>Lab:</b> Exercise 5 Answers Reviewed</p>
<p><b>Week 15</b>  <b>Apr 24-30</b></p>	<p><b>Topic: Exam Review</b>  <b>Required Readings:</b>  <b>Exam Study Guide</b></p> <p><b>Lab:</b> Exam Review, Exercise 6 Answers Reviewed</p>
<p><b>Week 16</b>  <b>May 1-7</b></p>	<p><b>Topic: Final Exam</b></p> <p><b>Final Exam: 2.5 Hrs (starts April 29 ends May 5)</b></p>



**CROSSWALK BETWEEN VIDEO LECTURES IN AGRESTI & FINLAY TEXT  
AND THE LIND, MARCHAL, & WATHEN TEXT**

<b>S.No.</b>	<b>Video Lecture</b>	<b>Page Numbers in Agresti &amp; Finlay Text</b>	<b>Page Numbers in Lind, Marchal, &amp; Wathen Text</b>
1	Chapter 1	1-7	1-6
2	Chapter 2.1	11-14	6-11
3	Chapter 2.2-2.3	15-21	248-253;256-257
4	Chapter 2.4	21-24	252-255
5	Chapter 3.1	31-38	18-36; 94-101; 109-113
6	Chapter 3.2	38-46	51-60
7	Chapter 3.3	46-51	68-80
8	Chapter 3.4	51-55	102-108
9	Chapter 3.5-3.7	55-61	114-118
10	Chapter 4.1	73-75	131-165
11	Chapter 4.2	75-78	173-199
12	Chapter 4.3	78-85	211-225
13	Chapter 4.4	85-89	NA
14	Chapter 4.5	89-95	258-272
15	Chapter 4.6	95-98	272-273
16	Chapter 5.1	107-110	280-281
17	Chapter 5.2	110-116	297-300
18	Chapter 5.3	116-123	281-297
19	Chapter 5.4	124-129	300-306
20	Chapter 6.1	143-147	315-322
21	Chapter 6.2	147-156	322-336; 338-339
22	Chapter 6.3	156-159	322-336; 338-339
23	Chapter 6.4	159-163	339-342
24	Chapter 6.5	163-166	NA
25	Chapter 7.1	183-186	348-359
26	Chapter 7.2	187-191	348-359
27	Chapter 7.3-7.4	191-197	364-372
28	Chapter 12.1	369-376	379-394
29	Chapter 12.2	376-378	395-398
30	Chapter 12.4	382-386	399-410
31	Chapter 9.1	255-259	NA
32	Chapter 9.2	259-265	440-450
33	Chapter 9.3	265-269	450-452
34	Chapter 9.4	269-276	427-439; 450-452

35	Chapter 9.5	276-283	453-463
36	Chapter 9.6	283-288	453-463
37	Chapter 10.1	301-304	NA
38	Chapter 10.2	304-307	NA
39	Chapter 11.1	321-326	476-478
40	Chapter 11.2	326-331	NA
41	Chapter 11.3	331-335	482-486
42	Chapter 11.4	335-340	487-493
43	Chapter 11.5	340-345	502-503