**SPEA Connect V506 - Summer 2018**

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

## **Instructor: Thomas Rabovsky Lab: Sundays, 7-8.30pm EST via Zoom**

## Office: SPEA 451 **TAs: Shelly Stumpf and Stacey Weidemann**

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## Office Hrs: By appointment Office Hrs: 6-8 PM EST Tuesday (Stacey)

7-9 EST Wednesday (Shelly)

## **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, 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 R) 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 text and lab materials. All modules are available in Canvas. The modules include readings from the textbooks, audio PowerPoint slides, and video lectures.[[1]](#footnote-1)

The TAs will hold a weekly lab session on Sunday from 7-8.30pm EST starting on **May 13th**. During these lab sessions, the TA’s will go over significant aspects of the software and assignments. Real-time attendance via Zoom for the lab is voluntary. Labs will be recorded and made available for streaming. **Students ARE REQUIRED to either attend the Lab or view the recordings.** The Zoom meeting links will be provided via email.

The statistics software for this class is R. R is an open-source, free to use program that has been widely adopted for statistical analysis in government and public affairs in the last few years. R has many advantages, but also some quirks and learning curves, which we will help you work through during the course of the semester. Fortunately, there are also numerous resources available, both in this course and for free on the internet, to help users learn the R platform. In this course, we will be using R Studio, which is another free program that adds some useful functionality that makes R more user-friendly. Please use the links below to download and install R onto your own computer (note that you will need to download and install R before installing R Studio).

R: <https://ftp.ussg.iu.edu/CRAN/> (click on whichever link is appropriate for your operating system).

R Studio: <https://www.rstudio.com/products/rstudio/download/#download> (click whichever link is appropriate)

A brief overview of both R and R Studio can be accessed below (we will also cover these basics during the lab at the beginning of the semester). <https://www.youtube.com/watch?v=lVKMsaWju8w>

**Course Requirements and Grading Criteria**

There will be two examinations administered during the semester, each equally weighted. These exams are scheduled during weeks 8 and 12. There will be no makeup exams. 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 four homework exercises during the semester. Unless previously approved by the instructor or a TA, late homework assignments will be accepted with a 20 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 no later than 10 pm EST on the Sunday during the week that the exercise is due. Homework assignments must be completed independently.

There will be four in-class exercises, each that will take place at various times throughout the semester. The instructor will announce the availability of an in-class exercise on the Announcements page in Canvas and will provide a timeframe for each student to complete the exercise. In-class exercises are opportunities to practically apply the skills learned throughout the course. There will be no makeup in-class exercises.

Participation will be gauged by online activity in Canvas.

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 labs, links to sites that provide assistance in understanding key concepts, and documentation for the R 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 25%

In-Class Exercise Participation 10%

Participation 5%

The final grading scheme is as follows:

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| --- | --- | --- |
| A+ | 100.0% | 97.0% |
| A | < 97.0 % | to 93.0% |
| A- | < 93.0 % | to 90.0% |
| B+ | < 90.0 % | to 87.0% |
| B | < 87.0 % | to 83.0% |
| B- | < 83.0 % | to 80.0% |
| C+ | < 80.0 % | to 77.0% |
| C | < 77.0 % | to 73.0% |
| C- | < 73.0 % | to 70.0% |
| D+ | < 70.0 % | to 67.0% |
| D | < 67.0 % | to 63.0% |
| D- | < 63.0 % | to 60.0% |
| F | < 60.0 % | to 0.0% |

**Required Textbook**

The required text for the class is:

Alan Agresti, *Statistical Methods for the Social Sciences*, 5th ed., (Boston: Pearson, 2018).

**Academic Integrity**

Just as students have rights, they also have responsibilities. Indiana University recognizes its responsibility to support and uphold the basic freedoms and citizenship rights of all students, and it expects students to be responsible for the following:

1. Uphold and follow all codes of conduct, including this Code, relevant codes and bulletins of respective schools, professional programs or professional societies, and all rules applicable to conduct in class environments or university-sponsored activities, including off-campus clinical, field, internships, or in-service experiences.
2. Obey all applicable university policies and procedures and all local, state, and federal laws.
3. Facilitate the learning environment and the process of learning, including attending class regularly, completing class assignments, and coming to class prepared.
4. Plan a program of study appropriate to the student’s educational goals. This may include selecting a major field of study, choosing an appropriate degree program within the discipline, planning class schedules, and meeting the requirements for the degree.
5. Use university property and facilities in support of their education while being mindful of the rights of others to use university property and facilities.
6. Maintain and regularly monitor their university accounts including e-mail and bursar accounts.
7. Uphold and maintain academic and professional honesty and integrity.
8. Be responsible for their behavior, and respect the rights and dignity of others both within and outside of the university community.

In addition to these on-campus responsibilities, the university may discipline a student for acts of personal misconduct or criminal acts that are not committed on university property.

More information on Indiana University’s Code of Student Rights, Responsibilities, & Conduct can be found at http://studentcode.iu.edu/

**SPEA Honor Code**

SPEA takes matter of honesty and integrity seriously because SPEA is the training ground for future leaders in government, civic organizations, health organizations, and other institutions charged with providing resources for the public, and for members of society who are vulnerable and who are lacking in power and status. Precisely because SPEA graduates tend to rise to positions of power and responsibility, it is critical that the lessons of honesty and integrity are learned early.

See <https://spea.indiana.edu/doc/undergraduate/ugrd_student_honorcode.pdf> for more details.

**Incompletes**

The grade of Incomplete used on the final grade reports indicates that the work is satisfactory as of the end of the semester but has not been completed. The grade of Incomplete may be given only when the completed portion of a student’s work in the course is of passing quality. Instructors may award the grade of Incomplete upon a showing of such hardship to a student as would render it unjust to hold the student to the time limits previously fixed for the completion of his/her work. (<http://policies.iu.edu/policies/categories/academic-faculty-students/academic-student-affairs/incompletes.shtml>)

**Late Withdrawal**

Withdrawal after the automatic withdrawal period requires approval by the instructor and relevant Program Director, and must be based on dire circumstances relating to extended illness or equivalent distress (IU Enrollment and Student Academic Information Bulletin). Requests to drop due to a failing grade will not be approved. You must be passing the course at the time of withdrawal. Contact your advisor or the appropriate Program Director if you want to petition for late withdrawal.

**Disabilities**

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.

**SPEA CONNECT V506**

**STATISTICAL ANALYSIS FOR EFFECTIVE DECISION-MAKING**

**SCHEDULE – Summer 2018**

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.

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| **Week** | **Topics, Readings, and Assignments** |
| ***Module One: Descriptive Statistics and Probability Distributions*** | |
| **Week 1** | **Topic: Course Introduction, Orientation, and Preliminary Concepts**  **Required:**  Read: Agresti Chapter 1  Presentation: Chapter 1  Review: Canvas Materials for Box, IUanyWare, and Zoom  **Lab:** Introduction to Course Technology and Setting up R Studio |
| **Week 2** | **Topic: Sampling and Measurement**  **Required:**  Read: Agresti Chapter 2  Presentations: Chapters 2.1-2.4, Sampling Methods, Cooking with Statistics: Restaurant Tallent  **Lab:** Introduction to the Labs and Basic Intro to RStudio  **Lab Videos:** Introduction to R, Importing Datasets into R, Creating and saving an R code file, Formatting data in Excel |
| **Week 3** | **Topic: Descriptive Statistics**  **Required:**  Read: Agresti Chapter 3  Presentations: Chapters 3.1-3.7, Cooking with Statistics: FARMBloomington, Sampling Distribution  **Lab:** Introduction to R Part I  **Lab Videos:** Graphing in R, Descriptive Statistics in R, Recoding Missing Values in R  **Exercise #1 Due** |
| **Week 4** | **Topic: Probability Distributions**  **Required:**  Read: Agresti Chapter 4  Presentations: Chapters 4.1-4.6  **Lab:** Review Exercise #1  **Lab Videos:** More on Graphing in R, Dataset manipulation in R |
| ***Module Two: Statistical Inference*** | |
| **Week 5** | **Topic: Statistical Inference: Estimation**  **Required:**  Read: Agresti Chapter 5.1-5.4, 5.6  Presentations: Chapters 5.1-5.4  **Lab:** Introduction to R Part II  **Lab Videos:** |
| **Week 6** | **Topic: Statistical Inference: Significance Tests**  **Required:**  Read: Agresti Chapter 6.1-6.5, 6.8  Presentations: Chapters 6.1-6.5  **Lab:** Intro to R Part II  **Lab Videos:** R T-Test, R Confidence Intervals  **Exercise #2 Due** |
| **Week 7** | **Topic: Comparison of Two Groups**  **Required:**  Read: Agresti Chapter 7.1-7.4, 7.8  Presentations: Chapters 7.1-7.4  **Midterm Exam Review**  Midterm Exam Study Guide  **Lab**: Review Exercise #2 and Midterm Exam Review |
| **Week 8** | **Topic: Midterm Exam** |

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| ***Module Three: Identifying Relationships*** | |
| **Week 9** | **Topic: Linear Regression and Correlation**  **Required:**  Read: Agresti Chapter 9  Presentations: Chapters 9.1-9.6  **Lab:** R Code for Regression, R Code and Interpretation for Multivariate Regression  **Lab Videos:** Correlations in R, Bivariate and Multivariate Regression in R  **Exercise #3 Due** |
| **Week 10** | **Topic: Introduction to Multivariate Relationships**  **Required:**  Read: Agresti Chapter 10  Presentations: Chapters 10.1-10.4  **Topic: Multivariate Regression and Correlation**  Required:  Read: Agresti Chapter 11.1-11.6, 11.8, 12.1  Presentations: Chapters 11.1-11.6, 12.1  **Lab**: Review Exercise #3, R Code and Interpretation of Dummy Variables, Interaction Terms, and Variable Transformations    **Exercise #4 Due** |
| **Week 11** | **Topic: Final Exam Review**  **Required:**  Final Exam Study Guide  **Lab:** Exam Review |
| **Week 12** | **Final Exam** |

1. Note that the video lectures were prepared by Professor Ashlyn Nelson. [↑](#footnote-ref-1)