Statistical Analysis for Effective Decision-Making (V506)

Spring 2025
Tuesday and Thursday 9:35-10:50am ET (A201)
Lab: Thursday 5:30-7:30pm ET (A221)

Instructor: Joanna Woronkowicz
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Zoom: https://iu.zoom.us/my/jworonko

TA: Sanskar Bhuwania
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Zoom: https://iu.zoom.us/my/sbhuwani

Lab Instructor: Ben Hellerstein
Email: bhellers@iu.edu

Course Description and Objectives

This course provides online, graduate-level instruction in the application of statistical analysis to the social sciences. 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 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 an emphasis.

The primary learning outcomes for the course are to enable students to:

- apply statistical tools to the social sciences,
- 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.

Attendance in class is required. Students will be allowed 2 absences from class. Each additional absence will result in a 1 pp deduction in the Class Attendance grade. There is a required weekly lab session for this course on Thursday from 5:30-7:30 ET taught by a Lab Instructor**.** During these lab sessions, the Lab Instructor will go over significant aspects of the software and Lab Exercises. **Attendance for the lab is required.** Students will be allowed 1 absence from the Labs. Each additional absence will result in a 1 pp deduction in the Lab Exercise grade. 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. 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.

Course Requirements and Grading Criteria

There will be one examination administered during the semester midway during week 8 of the semester. There will be no makeup exams.

There will be four Homework Exercises during the semester. 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 11:59pm ET on the due date. There are five Lab Exercises during the semester. Late Lab Exercises will be accepted with a 20 percent penalty per day late, up to three days. All Lab Exercises must be submitted as R Markdown files to the Assignments area of Canvas no later than 11:59pm ET on the due date. It is expected that Lab Exercises will be completed during the weekly labs. Lab Exercises will be graded based on completion.

Homework and Lab Exercises must be completed in groups of 2 and student groups are due via Canvas no later than Week 2 of the course.

There is a final project for this course that will be distributed in class. This project will entail a statistical analysis on a topic of your choice (approved by the instructor). There are several components of this project, including an initial proposal, revised proposal, technical report, and oral presentation. The Final Project must be completed in groups (assigned by the instructor).

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

Class Attendance	10%
Homework Exercises	25%
Lab Exercises/Lab Attendance	15%
Midterm Exam	25%
Final Project	25%
Initial Proposal	5%
Revised Proposal/Data	5%
Technical Report	19%
Group Dynamic Survey	1%
Oral Presentation/Slides	5%

Getting Help with this Course

Students have multiple methods to get help with this course. Students are highly encouraged to use the Discussion Board as a means to ask questions, gain clarity on course assignments, and help their classmates with the material. **Students who consistently accurately answer their classmates' questions on the Discussion Board will be awarded 1 percentage point extra credit to their final grade in the course.** The instructor and TA are reviewing the Discussion Board content on a daily basis. Either the instructor or the TAs will respond to queries posted on the Discussion Board within 24 hours. Students are encouraged to enable Discussion Board notifications in their email so that they can stay engaged with their classmates throughout the course. The TA holds regular office hours

where they review all assignments and answer student questions. Students are highly encouraged to attend these office hours, especially those that review the HW assignments. There will be a Lab Instructor for the first six weeks of this course; after that time, the TA will be leading the Labs. The Labs are specifically designed to focus on the R Programming content of this course and for students to complete Lab Exercises, therefore do not ask the Lab Instructor or TA questions about other HW assignments during this time. Students who need additional help with the course should speak to the instructor.

Required Textbooks

The required texts for the class are:

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

The recommended text for the class is (we do not use this text in class, but this is a great book for students interested in pursuing higher level statistics courses):

Ethan Bueno de Mesquita & Anthony Fowler, *Thinking Clearly with Data*, (Princeton, 2021).

V506 SCHEDULE – Spring 2025

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.

Module One: Descriptive Statistics and Probability Distributions	
Week 1	**Topics: Introduction & Sampling and Measurement** **Read:** Agresti Chapters 1-2
Week 2	**Topic: Descriptive Statistics** **Read:** Agresti Chapter 3
Week 3	**Topic: Probability Distributions** **Read:** Agresti Chapter 4 **HW Exercise #1 Due**
Week 4	**Topic: Probability Distributions** **Read:** Agresti Chapter 4 **Lab Exercise #1 Due**
Module Two: Statistical Inference	
Week 5	**Topic: Statistical Inference: Estimation** **Read:** Agresti Chapter 5
Week 6	**Topic: Statistical Inference: Significance Tests** **Read:** Agresti Chapter 6 **HW Exercise #2 Due** **Lab Exercise #2 Due**
Week 7	**Topic: Statistical Inference: Comparison of Two Groups** **Read:** Agresti Chapter 7
Week 8	**Topic: Midterm Exam on Thursday during class**
Week 9	**Topic: Data Visualization** **Lab Exercise #3 Due**
Module Three: Identifying Relationships	
Week 10	**Topic: Linear Regression and Correlation** **Read:** Agresti Chapter 9 **HW Exercise #3 Due**

Week 11	**Topic: Linear Regression – Assumptions and Diagnostics** **Read:** Agresti Chapter 9 **Lab Exercise #4 Due** **Final Project Proposal Due**
Week 12	**Topic: Introduction to Multivariate Relationships** **Read:** Agresti Chapters 10-11
Week 13	**Topic: Multivariate Regression – Estimation and Interpretation** **Read:** Agresti Chapters 10-11 **Final Project Revised Proposal and Data Due**
Week 14	**Topic: Multivariate Regression – Interaction Terms and Diagnostics** **Read:** Agresti Chapters 10-11 **HW Exercise #4 Due** **Lab Exercise #5 Due**
Week 15	**Topic: Final Project Presentations** **Final Project (Slides) Due**
Week 16	**Final Project (Report, Survey) Due**

Assignments
All assignments must be submitted via Canvas unless otherwise instructed.

Canvas
Canvas will be used in this course as a communication tool among students, the TA, and the instructor. Important information about the course will be posted on this site, including all assignment, required reading, material to review, and grades. Using Canvas is a requirement for this course so be sure you have logged on during the first week and make it a habit to check your messages at least 2-3 times per week, if not daily.

Use of AI (such as ChatGPT) in this class.
Using AI (such as ChatGPT) to assist in completing assignments in this class is prohibited. If you do use AI, you will be committing plagiarism* and will be subject to penalties in this class and sanctions by Indiana University.

> ***Plagiarism**: Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. *Any ideas or materials taken from another source* for either written or oral use *must be fully acknowledged*, unless the information is common knowledge. What is considered "common knowledge" may differ from course to course. https://studentcode.iu.edu/responsibilities/academic-misconduct.html. (emphasis added)

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Note Selling
Several commercial services have approached students regarding selling class notes/study guides to their classmates. Selling the instructor's notes/study guides in this course is not permitted. Violations of this policy will be reported to the Dean of Students as academic misconduct (violation of course rules). Sanctions for academic misconduct may include a failing grade on the assignment for which the notes/study guides are being sold, a reduction in your final course grade, or a failing grade in the course, among other possibilities. Additionally, you should know that selling a faculty member's notes/study guides individually or on behalf of one of these services using IU email, or via Canvas may also constitute a violation of IU information technology and IU intellectual property policies; additional consequences may result.

Materials

The faculty member teaching this course holds the exclusive right to distribute, modify, post, and reproduce course materials, including all written materials, study guides, lectures, assignments, exercises, and exams. While you are permitted to take notes on the online materials and lectures posted for this course for your personal use, you are not permitted to re-post in another forum, distribute, or reproduce content from this course without the express written permission of the faculty member. Any violation of this course rule will be reported to the appropriate university offices and officials, including to the Dean of Students as academic misconduct.

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:

A. 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 online, off-campus, clinical, field, internships, or in-service experiences.
B. Obey all applicable university policies and procedures and all local, state, and federal laws.
C. Facilitate the learning environment and the process of learning, including attending class regularly, completing class assignments, and coming to class prepared.
D. 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.
E. Use university property and facilities in support of their education while being mindful of the rights of others to use university property and facilities.
F. Maintain and regularly monitor their university accounts including e-mail and bursar accounts.
G. Uphold and maintain academic and professional honesty and integrity.
H. 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 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/

O'Neill School expectations of civility and professional conduct[1]

The O'Neill School takes matters of honesty and integrity seriously because O'Neill 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 O'Neill graduates

[1] These expectations are excerpted from the O'Neill School Honor Code which can be found at: https://oneill.indiana.edu/undergraduate/course-advising/advising/resources.html

tend to rise to positions of power and responsibility, it is critical that the lessons of honesty and integrity are learned early.

O'Neill requires that all members of its community – students, faculty, and staff – treat others with an attitude of mutual respect both in the classroom and during all academic and nonacademic activities outside the classroom. A student is expected to show respect through behavior that promotes conditions in which all students can learn without interruption or distraction. These behaviors foster an appropriate atmosphere inside and outside the classroom:

- Students are expected to attend class regularly and to be prepared for class.
- Students must be punctual in their arrival to class and be present and attentive for the duration of the class. Eating, sleeping, reading the newspaper, doing work for another class, wandering in and out of the classroom, and packing up or leaving class early are not civil or professional behaviors.
- Students must abide by the course policy regarding use of electronic devices in the classroom.
- Students must responsibly participate in class activities and during team meetings.
- Students must address faculty members, other students, and others appropriately and with respect, whether in person, in writing, or in electronic communications.
- Students must show tolerance and respect for diverse nationalities, religions, races, sexual orientations, and physical abilities.
- Students must not destroy or deface classroom property nor leave litter in the classroom.

Accessible Educational Services (formerly Disability Services for Students)
Securing accommodations for a student with disabilities is a responsibility shared by the student, the instructor, and the AES Office. For information about support services or accommodations available to students with disabilities, and for the procedures to be followed by students and instructors: https://studentlife.indiana.edu/student-support/iub-aes/index.html