SYLLABUS: STAT 5301
INTERMEDIATE DATA ANALYSIS I
SPRING 2026

Course Overview

Instructor

Name: Dr. Nicole Kelbick
Email: kelbick.1@osu.edu
Office hours: Virtual hours are via Carmen Zoom. Days, times and zoom links will be available in Carmen on the Syllabus page. You are always free to arrange an appointment outside of office hours. Just reach out to the instructor via email to do so.

Grader

Name: Jaehoon Kim
Email: kim.9859@buckeyemail.osu.edu
Office Hours: Virtual hours are via Carmen Zoom. Days, times and zoom links will be available in Carmen on the Syllabus page.

Course Description

Statistics 5301 is the first course in a two-semester non-calculus sequence in data analysis covering descriptive statistics, design of experiments, probability, statistical inference, one-sample t, goodness of fit, the two-sample problem, and one-way ANOVA.

Prerequisites: The sequence is intended for students with ``limited'' formal mathematics background (a solid grounding in high school algebra is beneficial). However, in terms of data analysis and interpretation, the conceptual level of the course is high. While many of the students in the course are graduate students (it is a required course in many programs), it is certainly an appropriate sequence for junior and senior level undergraduates.

Course Learning Outcomes

By the end of this course, students should successfully be able to:

- deal with problems of data-gathering, presentation, and interpretation.
- create graphical and numerical summaries of data
- develop an understanding of problems of measurement
- gain an understanding of the impact of statistical ideas in daily life and specific areas of study
- recognize the uses and misuses of statistics and related quantitative arguments
- understand fundamental concepts of probability and statistics
- utilize the use of computer programs in problems involving data analysis
- summarize data using summary measures and graphical techniques.
- identify an appropriate analysis for data collected in a study
- carry out such an analysis
- examine whether the assumptions behind the analysis are reasonable
- recognize the strengths or weaknesses of the study based on how the data was collected
- understand how the design of a study affects the conclusions that can be made
- write and discuss what conclusions can be drawn from statistical analyses

GE Course Information

This course satisfies the General Education foundation requirement in *Mathematical and Quantitative Reasoning or Data Analysis* which has the following goals and expected learning outcomes:

Goals: Successful students will be able to apply quantitative or logical reasoning and/or mathematical/ statistical methods to understand and solve problems and will be able to communicate their results.

Expected Learning Outcomes (ELOs): Successful students are able to:

1.1 Use logical, mathematical and/or statistical concepts and methods to represent real-world situations.

1.2 Use diverse logical, mathematical and/or statistical approaches, technologies and tools to communicate about data symbolically, visually, numerically and verbally.

1.3 Draw appropriate inferences from data based on quantitative analysis and/or logical reasoning.

1.4 Make and evaluate important assumptions in estimation, modeling, logical argumentation and/or data analysis.

1.5 Evaluate social and ethical implications in mathematical and quantitative reasoning.

This course also satisfies the Legacy General Education requirement in *Data Analysis* which has the following goals and expected learning outcomes:

Goals: Students develop skills in drawing conclusions and critically evaluating results based on data.

Expected Learning Outcomes (ELOs):

1. Students understand basic concepts of statistics and probability.

2. Students comprehend methods needed to analyze and critically evaluate statistical arguments.

3. Students recognize the importance of statistical ideas.

Course Materials

Required Textbook

The textbook for this course is being provided via CarmenBooks. Through CarmenBooks, students obtain publisher materials electronically through CarmenCanvas, saving them up to 80% per title. The fee for this material is included as part of tuition and is listed as *CarmenBooks fee* on your Statement of Account. In addition to cost-savings, materials provided through CarmenBooks are available immediately on or before the first day of class. There is no need to wait for financial aid or scholarship money to purchase your textbook.

Unless you choose to opt-out of the program, you do NOT need to purchase any materials for this course at the bookstore. For more information on the program or information on how to opt out, please visit the CarmenBooks website.

[SS] Ramsey F. and Schafer D. (2012), *The Statistical Sleuth: A Course in Methods of Data Analysis*, 3rd Edition, Cengage Learning • ISBN-13:978-1-133-49067-8

Access this eBook through the CarmenBooks reader link in the course navigation.

Note: *The Statistical Sleuth* is also required for Stat 5302.

Optional Textbook

There is no required textbook for the first half of the course. You may find the following book useful, but it is optional.

[IPS] *Introduction to the Practice of Statistics* **(5th Edition onwards) by D.S. Moore and G.P. McCabe**

Other useful references will be highlighted as the course progresses.

Course Technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at https://ocio.osu.edu/help, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** http://ocio.osu.edu/selfservice
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Carmen

Technology skills necessary for this specific course

- CarmenZoom

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

Necessary software

- This class requires you to use the statistical software package called R (The R Project for Statistical Computing; https://cran.rstudio.com/). This software package is available as Free Software.

- An in-depth introduction to R is available at http://cran.r-project.org/doc/manuals/R-intro.pdf
- Hands-on tutorials are available in the Swirl system, which you can learn about at http://swirlstats.com/. In particular, "R Programming: The basics of programming in R" is an appropriate first tutorial for students who have never used R.

- A user-friendly interface to R is available in the software package **RStudio** (recently re-branded as Posit). This package is available for Windows, Mac, and Linux and can be downloaded for free from https://posit.co/downloads/. **Note that RStudio requires R to be installed first.**
- More details will be provided on Carmen and during lectures.
- Microsoft Office 365 ProPlus All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Each student can install Office on five PCs or Macs, five tablets (Windows, iPad® and Android™) and five phones.
    - Students are able to access Word, Excel, PowerPoint, Outlook and other programs, depending on platform. Users will also receive 1 TB of OneDrive for Business storage.
    - Office 365 is installed within your BuckeyeMail account. Full instructions for downloading and installation can be found https://ocio.osu.edu/kb04733.

Course Delivery

The course will consist of in-class lectures as well as homework assignments done outside of class. Lecture material and homework assignments will be made available on Carmen. You will be responsible for studying the material that is assigned and reviewed in lecture. Sufficient time will be allotted to complete homework assignments. R statistical software will be used to complete aspects of the assignments. Knowledge of course content and its application will be assessed via three in-class exams, two midterms and a final exam. Your knowledge of R will not be assessed. However, you will be expected to be familiar with and know how to interpret R output reviewed in class and lecture notes. The instructor will hold weekly office hours via CarmenZoom according to the schedule provided.

Grading and Assignments

Grades

Assignment or Category	Percentage
Homework	35
Midterm 1	20
Midterm 2	20
Final Exam	25
Total	100

Grades will be recorded on the class website.

Homework: There will be regular homework assignments (about 10 to 12). Homework must be uploaded to Carmen by the posted deadline. Homework is **not** accepted by email. It is understood that workload from other classes can impede completion of homework assignments by the designated due date. Therefore, late homework will be accepted up to 3 days past the original due date but will receive a 10% penalty for each day late. Afterwards, the homework assignment will receive 60% of the total score for the assignment. You are encouraged to work together on the homework, but do not copy any part of a homework. Each student must produce his/her own homework to be handed in. Homework solutions will be available on the class web site.

Homework preparation rules: Homework may be uploaded to Carmen in PDF or Word format. Your instructor will review how to use R Studio and R statistical software to complete homework assignment. R code and related output for each problem should be included in your answers for each problem, NOT tacked on at the end of the homework. All problems will be graded for completion. A subset of problems will be graded for accuracy.

Exams: There will be three exams: two midterms and a final. All exams are **closed book/closed notes** (except for the sheet of notes described next) and will be **administered in class.** You may use one 8.5x11 inch sheet of paper (both sides), with whatever facts, formulas, or explanations you find helpful, for each exam. Further details, such as content covered by the exam, will be given in advance of each exam. A calculator is allowed but tablets, laptops, cellphones, and other communication devices are not. Statistical tables will be provided as needed.

Makeup Exams: If you absolutely need a makeup exam and have a valid excuse, please see your instructor for the necessary arrangements. However, **you must notify the instructor in advance (ASAP) in such a situation.** A make-up exam should be taken within a week of the missed exam. Exceptions to this policy will be permitted on a case-by-case basis and only in extreme situations.

Faculty Feedback and Response Time

If you have a technical problems, you can call **614-688-HELP** at any time.

Grading and feedback

For large weekly assignments, generally expect feedback within **7-10 days**. Exams are typically returned within 7 days of taking the exam.

E-mail

Emails will be responded to within **24- 48 hours on school days**.

Attendance, Participation, and Discussions

Students may miss class, for a variety of reasons related to COVID-19. As much as possible, please stay in contact with the instructor so that we can discuss accommodations should they be needed.

Discussion and Communication Guidelines

The following are expectations for how communication is conducted for this class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. Informality (including an occasional emoticon) is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. (For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.)
- **Backing up your work**: Consider composing your academic posts in a text editor or word processor, where you can save your work, and then copying into the Carmen discussion.

Other Course Policies

Health and Safety

The Ohio State University Wexner Medical Center's Coronavirus Outbreak site (https://wexnermedical.osu.edu/features/coronavirus) includes the latest information about COVID-19 as well as guidance for students, faculty and staff. Guidelines and requirements for campus safety from the University's Reactivation Task Force are published on the Safe and Healthy website (https://safeandhealthy.osu.edu).

Potential Disruptions to Instruction

- As much as possible, students will have access to material online if they are unable to attend class because of positive diagnosis, symptoms, or quarantine required following contact tracing.
- If the instructor is unable to be present in person because of positive diagnosis, symptoms, or quarantine following contact tracing a new instructor will be assigned to the course. Details will be given on the course website.

Student Academic Services

Student academic services offered on the OSU main campus: http://advising.osu.edu/welcome.shtml.

Student Support Services and Resources

Student support services offered on the OSU main campus: https://artsandsciences.osu.edu/academics/current-students/resources.

Academic Integrity Policy

Policies for this course

- **Exams**: You must complete all exams yourself, without any external help or communication.
- **Homework:** Homework may be discussed with classmate or TAs but submitted homework assignments should represent your own efforts.

Ohio State's Academic Integrity Policy

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct https://trustees.osu.edu/bylaws-and-rules/code.

Copyright Disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu

Accessibility Accommodations for Students With Disabilities

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; http://slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of Course Technology

This course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Carmen (Canvas) accessibility
- Streaming audio and video
- Synchronous course tools

Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614- 292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273- TALK or at suicidepreventionlifeline.org

Disclaimer

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular I reserve the right to change due dates or the methods of grading and/or assessment if necessary. Any changes will be communicated to you through official course announcements.

See course schedule on next page.

Course Schedule (tentative)

Week	Topics
1	**Data, Graphical and Numerical Summaries, Normal Distribution, Scatterplots, Correlation** **IPS 1.1-1.4, 2.1-2.2 (IPS = Introduction to the Practice of Statistics)**
2	**Least-Squares Regression, Experimental Design** **IPS 2.3-2.5, 2.7, 3.1-3.3; SS 1**
3	**Sampling Distributions, Randomness, Probability Models,** **Random Variables, Mean and Variance, Central Limit Theorem** **IPS 3.4, 4.1-4.4**
4	**Sampling distribution of a sample mean, $\overline{X}$** **Sampling distribution of a sample proportion, $\widehat{p}$** **IPS 5.1-5.2**
5	**Confidence Intervals, Hypothesis Testing** **Power and Inference as a Decision, Use and Abuse of Tests,** **IPS 6.1-6.4**
6	**One Sample t-tools, The Sign Test, One- and Two-Sided Tests** **IPS 6.1-6.4**
7	**Pooled Two-Sample t-tools, Assumptions of the t-tools, Variable Transformations** **IPS 7.1-7.2; SS 2 and 3**
8	**Non-pooled t-tools, Rank Sum Test, Wilcoxon Signed-Rank Test** **SS 4 (SS = Statistical Sleuth)**
9	**Comparing parametric and nonparametric procedures for analyzing paired data** **SS 4.4**

Week	Topics
10	**Spring Break - Enjoy!**
11	**Inference for a Population Proportion, Comparing Two Proportions** **IPS 8, SS 18.1-18.2**
12	**ANOVA Introduction** **SS 5**
13	**ANOVA Introduction (cont.), Inferences About Linear Combinations of Group Means** **SS 5, 6.1-6.2**
14	**Simultaneous Inferences** **SS 6.3-6.4**
15	**Model Comparison with the F-test, Robustness and Model Checking** **SS 5.3-5.4**
16	**Last day of class; Finish any remaining content/Review** **Final Exam: Thursday, April 30 from 8:00am – 9:45am**

IPS = Introduction to the Practice of Statistics
SS = Statistical Sleuth