POLS625
Introduction to Quantitative Methods

Spring 2023

Instructor:	Daniel Weitzel	**Time:**	F 14:00 – 16:45
Email:	daniel.weitzel@colostate.edu	**Place:**	Clark C347

Objectives:

This class is an introductory course into quantitative methods. You will learn how to collect, clean, analyze, visualize, and report quantitative data and results. We will work with the R programming language, the R Studio integrated development environment (IDE). This is an incredibly powerful open-source statistical programing language used at universities, the industry, government, and nonprofits.

The aim of the course is to equip students with the theoretical and applied skills to successfully implement data driven research projects. The content of the course includes basic descriptive and inferential statistics, as well as the graphic representation of results. The core focus of this course will be hands-on and practical. By the end of the course, students should be able to describe and transform a dataset and conduct basic inferential analysis using R in R in R Studio. The examination will focus on different statistical concepts covered in class and will include basic data analysis using the programming language R. Detailed instructions about the homework assignments, midterm, and the final assignment will be posted on Canvas in due time.

The class will be a mix of lectures, seminar style discussions, and in-class labs in which you will code. Students are expected to be prepared for class and bring their laptop for active participation in exercises.

Office Hours:

Monday 13:00-16:00 in Clark B 348. You can sign up online here. I am also available after class, or by appointment. During office hours I am available for any and all questions students might have. Please make use of this opportunity. We can discuss your questions about the course material, the class, or your progress so far. Since I am new in town: I'm also happy to hear about your favorite things to do in Fort Collins and Colorado.

Prerequisites: No course prerequisites for this class. Successful completion of the course will require access to a laptop and regular class participation. This involves preparing for class and engaging with the material.

Important Dates:

Homework #1	2023-02-17
Homework #2	2023-03-03
Midterm	2023-03-11
Homework #3	2023-04-07
Homework #4	2023-04-28
Final Project	TBD

Note: Depending on progress of the class these dates are subject to change. Updated deadlines will be announced in class and on Canvas.

Main References: This is a restricted list of various interesting and useful books that will be used during the course. You need to consult them.

- R and the tidyverse
  1. Wickham, Hadley, and Garrett Grolemund. *R for data science: import, tidy, transform, visualize, and model data.*, O'Reilly Media, Inc., 2016. Available as paperback and ebook or for free at https://r4ds.had.co.nz/
  2. Wickham, Hadley. *Advanced R*. CRC press, 2019. Available as paperback and ebook or for free at https://adv-r.hadley.nz/.
- Statistics
  1. Wooldridge, Jeffrey M. Introductory econometrics: A modern approach. Cengage learning, 2015.
  2. Greene, William H. Econometric analysis. Pearson Education, 2003.
- Additional chapters and articles listed in the tentative course schedule will be made available in Canvas.

Grading Policy: Grading is based on five components. In order to complete the course with a positive grade students have to pass all five grading components with a positive assessment. In cases of suspected plagiarism you may be called upon to reasonably demonstrate that any work you have submitted is your own.

- Participation (5%): Participation will be assessed based on participation in several class surveys (50% of the grade) as well as meaningful and substantive participation in class (50% of the grade). I will not take attendance in class but participation requires attendance and repeated unexcused absences will have a negative impact on your grade.
- Quizzes (15%): The class has weekly quizzes that are based on the assigned reading. These quizzes must be completed before the class starts. These quizzes might seem like an annoyance but they will encourage you to continuously learn and engage with the class material. We are covering challenging material that cannot be learned over night.

- Four Homework assignments (20%): The assignments are based on material covered in the course. Students are encouraged to form study groups but assignments must be completed individually. Students must submit their R code and detailed written responses explaining results.
- Midterm (30%): The in-class midterm will concern theoretical questions and/or interpretation of R output. Joint work is *NOT* allowed.
- Final (30%): At the end of the course, you will be required to write a final paper (85% of the grade) and present the your research at a mini-conference (15% of the grade). Your paper should focus mostly on methods with applications in R. Joint work is *NOT* allowed for the final assignment. Deadline for handing in the final assignment: TBD.

Software:

- We will be using R and R Studio in this class. R is a very powerful and capable free and open source programing language for statistical computing. R Studio is an excellent integrated development environment (IDE) for R that makes writing code and analyzing data a lot easier. Please follow the instructions here to install both R and R Studio.

Class Policy:

- Regular attendance is essential and expected. Please reach out if you know that you will miss a class. I don't expect you to disclose a reason for missing class but you need to inform me of your absence.
- We will use the statistical programing software R and its graphical user interfaceR Studio in this course. Students must submit their homework as a pdf and always include all their R code. I encourage students to submit quantitative work based on Rmarkdown files. More information about Rmarkdown can be found here.
- All homework and exam submissions must be through Canvas and you must submit your text as well as your written code.
- The material in the class can be challenging and difficult at first. It is hence of utmost importance that you follow the seminar closely, prepare for the class, do the homework, and always contribute to an open and engaging class environment. I strongly encourage students to ask questions. If you don't understand something or are stuck on a problem you are usually not alone.
- The Canvas page has a Forum for students to ask questions, help each other, and interact. I expect professional and courteous behavior that adheres to the rules of academic honesty.

- Due to the Coronavirus I expect that issues will arise over the course of the semester. The course is already designed to give students maximum flexibility. They have one week to submit quizzes and sufficient time will be given for homeworks, midterm, and the final assignment. Please reach out to me as soon as possible (i.e. before the issue arises) if you encounter problems that might put your academic success in this class at risk.
- The goal of this class is the personal and intellectual growth of all students attending. Every student is expected to participate in and the generation of an environment that facilitates this growth. Woolley, Kaitlin, and Ayelet Fishbach. "Motivating personal growth by seeking discomfort." Psychological science 33.4 (2022): 510-523.
- Students are encouraged to combine the final assignment in this class with projects in other classes. However, you need to request approval from all instructors and clearly formulate how assignment submissions are distinct from each other. Under no circumstances can you submit the same assignments in multiple classes.

Academic Honesty: Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Exercises and class papers will be examined from violations of the university's academic honesty policy.

Grading Policy

Grade	Range
A+	100% to 96.67%
A	<96.67% to 93.33%
A-	<93.33% to 90.00%
B+	<90.0% to 86.67%
B	<86.67% to 83.33%
B-	<83.33% to 80.00%
C+	<80.00% to 76.67%
C	<76.67% to 70.00%
D	<70.00% to 60.00%
F	<60.00% to 0%

Tentative Course Outline:

Session 1: Introduction to the course 2023-01-20
Required reading:

1. Agresti and Finlay (2009), Chapter 1, Chapter 2
2. Kellstedt and Whitten (2013), Chapter 1

Additional information:

- Optional: Wackerly et al (2008), Chapter 1
- Quiz 1 due

Session 2: Descriptive statistics 2023-01-27
Required reading:

1. Agresti and Finlay (2009), Chapter 3
2. Kellstedt and Whitten (2013), Chapter 5

Additional information:

- Optional: Monogan (2015), Chapter 4
- Quiz 2 due

Session 3: Hypothesis Testing 2023-02-03
Required reading:

1. Kellstedt and Whitten (2013), Chapter 6
2. Kellstedt and Whitten (2013), Chapter 7

Additional information:

- Optional: Wackerly et al 2008, Chapter 10
- Quiz 3 due

Session 4: Confidence Intervals 2023-02-10
Required reading:

1. Wackerly et al 2008, Chapter 10

Additional information:

- Quiz 4 due

Session 5: Comparing Means 2023-02-17
Required reading:

1. Kellstedt and Whitten (2013), Chapter 7

Additional information:

- Homework 1 due

Session 6: Covariance and Correlation 2023-02-24
Required reading:

1. Agresti and Finlay (2009), Chapter 8

Additional information:

- Quiz 5 due

Session 7: The Logic of Linear Regression 2023-03-03
Required reading:

1. Agresti and Finlay (2009), Chapter 9
2. Wooldridge (2016), Chapter 2

Additional information:

- Greene, Chapter 2
- Homework 2 due

Session 8: Midterm 2023-03-10
Required reading:

1. Exam about the content covered so far. It will have theoretical and applied questions.

Additional information:

- Midterm survey of the class

Session 9: Gauss-Markov Assumptions 2023-03-24
Required reading:

1. Wooldridge (2016), Chapter 3

Additional information:

- Greene Chapter 2
- Quiz 6 due
- Schedule the first meeting to discuss your final project

Session 10: Estimating, Forecasting, Fit, and Inference 2023-03-31
Required reading:

1. Wooldridge (2016), Chapter 2.2-2.6,
2. Wooldridge (2016), Chapter 3.2-3.6,
3. Wooldridge (2016), Chapter 4.6.4, 5

Additional information:

- Quiz 7 due
- Gujarati & Porter (2008), Chapter 3.5, 7.5, 5.2-5.10, 8.1-8.8
- Kmenta (1997), Chapter 7.4.

Session 11: Limitations, Issues, and Problems 2023-04-07
Required reading:

1. Wooldridge (2016), Chapter 8.1-8.4
2. Wooldridge (2016), Chapter 9.4
3. Wooldridge (2016), 10.1, 10.3,
4. Wooldridge (2016), 11.2,
5. Wooldridge (2016), 12.1-12.3

Additional information:

- Homework 3

Session 12: Diagnostics and Specification Tests .... 2023-04-14 Required reading:

1. Wooldridge (2016), Chapter 9.1-9.2.

Additional information:

- Quiz 8 due

Session 13: Nonlinear Models 2023-04-21
Required reading:

1. Wooldridge (2016), Chapter 6.2 c- d,
2. Wooldridge (2016), 7.2-7.4

Additional information:

- Quiz 9 due
- Schedule the second meeting to discuss your final project

Session 14: Discrete and Limited Dependent Variables 2023-04-28
Required reading:

1. Wooldridge (2016), Chapter 17

Additional information:

- Homework 4

Session 15: Time Series and Panel Data 2023-05-05
Required reading:

1. Wooldridge (2016), Chapter 10,
2. Wooldridge (2016), 13.3-13.4,
3. Wooldridge (2016), 14.1-14.2

Additional information:

- Quiz 10 due
- End of semester survey of the class

Additional Literature: In case you want to go further.

1. More advanced textbooks about statistics

   - Gujarati, Damodar N. and Dawn C. Porter, *Basic Econometrics* (5th ed.). New York: McGraw-Hill, 2008.
   - Kmenta, Jan, *Elements of Econometrics* (2nd ed.). Ann Arbor, MI: University of Michigan Press, 1997.
   - Imai, Kosuke, *Quantitative Social Science: An Introduction*, Princeton University Press, 2018.
   - Angrist, Joshua D. and Jörn-Steffen Pischke , *Mostly Harmless Econometrics: An Empiricist's Companion.*, Princeton University Press, 2009.
   - Morgan, Stephen L. and Christopher Winship , *Counterfactuals and Causal Inference*, Cambridge University Press, 2007.
   - Wackerly, Denis, William Mendenhall, Richard L. Scheaffer, *Mathematical Statistics with Applications*, Thomson Brooks/Cole, 2008.
   - Casella, George and Roger L. Berger, *Statistical Inference*, Cengage Learning, 2001. *(very advanced!)*
   - Healy, Kieran, *Data Visualization: A Practical Introduction.*, Princeton: Princeton University Press, 2019.
   - James Long and Paul Teetor. *R cookbook* (2nd edition), O'Reilly Media, 2019. Available as paperback and ebook or for free at https://rc2e.com/.

2. Fun reads

   - Mcgrayne, Sharon Bertsch, *The Theory That Would Not Die: How Bayes' Rule Cracked the Enigma Code, Hunted Down Russian Submarines, and Emerged Triumphant from Two Centuries of Controversy*, Yale University Press, 2012.
   - Silver, Nate *The Signal and the Noise: Why So Many Predictions Fail - but Some Don't*, Penguin Books, 2015.
   - Pearl, Judea and Dana Mackenzie, *The Book of Why: The New Science of Cause and Effect*, Basic Books, 2018.
   - Salsburg, David, *The Lady Tasting Tea: How Statistics Revolutionized Science in the Twentieth Century*, Holt Paperbacks, 2002.

3. Movies

   - *Moneyball*, a movie about the role of statistics in baseball.
   - *Behind the curve*, a documentary about the Flat Earth movement that highlights the importance of a rigorous scientific approach with falsifiable hypotheses.