POL 286: Advanced Quantitative Methods for Social Research

Spring 2021 (Syllabus Version: 4/22/2021)

Online: T R 12:30p-1:45p

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Schedule an Office Hours Appointment: https://calendly.com/esareyje/office-hours

Course Objectives and Learning Outcomes

In this course, students will learn to:

1. use data visualization in ggplot2 to answer substantive questions using quantitative data;
2. estimate, diagnose, and interpret regression results and apply these results to answer substantive questions using quantitative data; and
3. understand barriers to causal inference and apply multiple techniques to overcome these problems.

Grading Policies and Assignment Details

Grade Components:

- Discussion Questions: 20%
- Small Group Participation: 10%
- Midterm Exam: 35%
- Final Exam: 35%

Grading Scale:

100%-93%: A	82.9%-80%: B-	69.9%-67%: D+
92.9%-90%: A-	79.9%-77%: C+	66.9%-63%: D
89.9%-87%: B+	76.9%-73%: C	62.9%-60%: D-
86.9%-83%: B	72.9%-70%: C-	>59.5%: F

Attendance: This online-only class will meet on Zoom from 12:30p-1:45p. The class can be joined from this link: https://zoom.us/j/92900393208. A password is required to join; that password will be distributed on Canvas. Class meetings will discuss the readings and discussion questions, including problems involving data analysis with RStudio, during these meetings.

Small Group Discussion: Everyone in class will be randomly assigned to a small group. Each group must meet and discuss the discussion questions (including RStudio analysis problems, where applicable). Grading for this assignment is 100% or 0% based on attendance and active participation in the discussion. The grade will be assessed by your peers; after each meeting, your group will indicate on Canvas who meaningfully participated in the discussion and those who did so will receive full credit. The lowest six grades in the category of Small Group Discussion will be dropped (e.g., if you miss a small group discussion and receive a 0%). The rest will be averaged to form this portion of the grade.

Discussion Responses: Discussion questions will be distributed in advance of each day's readings. For each class meeting, there will be a corresponding Canvas assignment. This assignment will randomly select one discussion question, and students will need to produce a response within fifteen minutes (the response is time-limited). The discussion response is due at 12:30p on the day of class. (The questions will form part of the basis for that day's in-class discussion). You are permitted to use your notes to assist you with these response questions, and I recommend that you use the small group discussion to workshop your ideas for this response. The lowest ten grades in the category of discussion responses will be dropped; the rest will be averaged to form this portion of the grade.

Exams: There will be two exams in this class, a midterm and a final. All exams are cumulative but will focus on material learned since the last exam. Exams will be take home; you will be bound by the honor system when taking the exam. You may take as much time as you like to complete the exam, but you must submit the exam before the due date and time. (The exams are designed to be completed in about 90 minutes.) **Class notes and textbooks may be consulted during an exam, but no other materials may be used. No one except Dr. Esarey may be consulted during an exam, including electronic communications over the internet.**

COURSE POLICIES

Privacy: Online class sessions will be recorded and made available on Canvas. These recordings may only be shared with participants in the course (students, faculty, and teaching assistants). To safeguard the privacy of our students and enable free course discussion, students may not create or share their own recordings of class without the written permission of Dr. Esarey.

Late Work: Assignments are due at the date and time I specify for the assignment. Late exams will be marked off at 5 percentage points for the first hour late, and an additional 10 percentage points for every subsequent hour late. Discussion questions and small group participation cannot be submitted late or made up.

Important note: Students are responsible for submitting working, uncorrupted files for all assignments. If a file is corrupted and needs to be re-sent, and re-sending happens after the assignment deadline, a late penalty will be assessed.

Discussion responses and small group participation may not be submitted late or rescheduled; responses that are not submitted will be included in the grades that are dropped (up to the maximum number of drops). **If you develop a severe illness that you believe will interfere with your ability to complete more than one or two discussion responses or small group discussions, please contact Dr. Esarey immediately.**

Failing to take the exam during the scheduled time window will result in no credit for the exam. Exams may be re-scheduled only under the following three circumstances:

(1) a death in the immediate family (parent, spouse, sibling, or child) within two weeks before the exam due date;
(2) an unforeseeable and significant illness or medical emergency affecting you, your spouse, or your child; or
(3) participation in a Wake Forest-sponsored academic or sporting event.

In the event of (1) or (3), you must give me **at least 24 hours advance notice and preferably more** (via e-mail or a phone call) that you will miss the exam, or it may not be made up. I may require supporting documentation. All penalty waivers are at the discretion of the instructor. Under these circumstances, I will extend your due date and/or schedule you a make-up exam time. **Important note: conflicts with a work schedule, non-academic trip, or vacation are not a valid reason to miss an exam or any other assignment** and cannot be the basis for a penalty waiver.

Honor Code/Academic Misconduct: All forms of academic misconduct will be handled according to the Wake Forest University Honor Code. Details on the Honor Code are available at https://studentconduct.wfu.edu/honor-system-wfu/.

If you ever have any questions about what you should do to stay within the honor code on a particular assignment, **contact me with your question and I can assist you**. I cannot guarantee a timely response unless you contact me at least 24 hours in advance of the time the assignment is due.

Students with Disabilities: If you have a disability and require accommodation in this class, please contact me as soon as possible (within the first two weeks of class) to discuss these accommodations. You will also need to contact the Disability Services Office (telephone extension: 5929) in 118 Reynolda Hall. More information is available at https://lac.wfu.edu/disability-services/.

Syllabus Change Policy: All policies of this syllabus may be changed by Prof. Esarey with advance notice.

COURSE MATERIALS

Required Texts:

- Gelman, Andrew, Jennifer Hill, and Aki Vehtari. 2021. *Regression and Other Stories*. Cambridge: Cambridge University Press. (This text will be referred to as GHV in the course outline and assigned readings.)
- Kabacoff, Rob. 2020. *Data Visualization with R*. Available online and free-of-charge at https://rkabacoff.github.io/datavis/.

Software: This course will teach statistical analysis using R. We will be using a server that is specially configured for R. You will need your computer (or a tablet) and a browser. All students must have a valid Wake Forest e-mail address and login (and access to the Canvas website) to participate in this course.

In order to use R you will go to: https://rstudio.justinesarey.com/ In order to use this protected server you will need a user name and password (which will be supplied).

In addition, R is free and available for Windows and Macintosh from http://cran.r-project.org/. RStudio is also free and available for Windows and Macintosh at http://www.rstudio.com.

COURSE OUTLINE AND ASSIGNED READINGS

Date	Topic	Readings
1/28	Introduction and RStudio setup	GHV Appendix A: Computing in R, pp. 475-492
2/2	Overview of statistical modeling	GHV, Chapter 1: Overview, pp. 1-17
2/4	Data visualization I: ggplot2	*Data Visualization with R*, Chapter 2 https://rkabacoff.github.io/datavis/IntroGGPLOT.html
2/9	Data visualization II: Univariate graphs	*Data Visualization with R*, Chapter 3 and 6 https://rkabacoff.github.io/datavis/Univariate.html https://rkabacoff.github.io/datavis/GeoMaps.html
2/11	Data visualization III: Bivariate and multivariate graphs	*Data Visualization with R*, Chapter 4-5 https://rkabacoff.github.io/datavis/Bivariate.html https://rkabacoff.github.io/datavis/Multivariate.html
2/16	Essential mathematics	GHV, Chapter 3: Some basic methods in mathematics and probability, pp. 35-47
2/18	Statistical inference I	GHV, Chapter 4: Statistical inference, Sections 4.1-4.4, pp. 49-60
2/23	Statistical inference II	GHV, Chapter 4: Statistical inference, Sections 4.5-4.7, pp. 60-67
2/25	Computational simulation	GHV, Chapter 5: Simulation, pp. 69-76
3/2	**No Classes**	

3/4	Basic ideas and historical context of linear regression	GHV, Chapter 6: Background on regression modeling, pp. 81-90
3/9	Interpretation and assessment of one-variable linear regression	GHV, Chapter 7: Linear regression with a single predictor, pp. 93-101
3/11	Midterm Exam Distributed	
3/11	Fitting regression models via OLS and MLE; a little Bayes' Rule	GHV, Chapter 8: Fitting regression models, Section 8.1, pp. 103-107
3/16	Uncertainty estimation in regression; impactful outliers	GHV, Chapter 8: Fitting regression models, Sections 8.2-8.4, pp. 107-111
3/18	Interpretation of bivariate regression estimates via simulation	GHV, Chapter 9: Prediction and Bayesian inference, Sections 9.1-9.2, pp. 113-119
3/19	Midterm Exam Due	
3/23	Bayesian inference and prior information for linear models	GHV, Chapter 9: Prediction and Bayesian inference, Sections 9.3-9.5, pp. 119-127
3/25	Linear regression with multiple predictors	GHV, Chapter 10: Linear regression with multiple predictors, Sections 10.1-10.2, pp. 131-134 *Data Visualization with R*, Chapter 8, Sections 8.1-8.2 https://rkabacoff.github.io/datavis/Models.html
3/30	Interaction terms and dummy variables	GHV, Chapter 10: Linear regression with multiple predictors, Sections 10.3-10.5, pp. 134-140
4/1	Interpretation of multivariate regression estimates via simulation	GHV, Chapter 10: Linear regression with multiple predictors, Sections 10.6-10.9, pp. 140-149
4/6	Regression assumptions and diagnostics I	GHV, Chapter 11: Assumptions, diagnostics, and model evaluation, Sections 11.1-11.3, pp. 153-163
4/8	Regression assumptions and diagnostics II	GHV, Chapter 11: Assumptions, diagnostics, and model evaluation, Sections 11.4-11.8, pp. 163-180
4/13	The counterfactual model of causality	GHV, Chapter 18: Causal inference and randomized experiments, Sections 18.1-18.2, pp. 339-345
4/15	Experimental design and causal interpretation	GHV, Chapter 18: Causal inference and randomized experiments, Sections 18.3-18.6, pp. 345-355
4/20	Causal interpretation of regression estimates for experimental data	GHV, Chapter 19: Causal inference using regression on the treatment variable, pp. 363-379
4/22	Confounding and statistical control	GHV, Chapter 20: Observational studies with all confounders assumed to be measured, Sections 20.1-20.5, pp. 383-397
4/27	Estimating causal relationships with instrumental variables	GHV, Chapter 21: Additional topics in causal inference, Sections 21.1-21.2, pp. 421-432
4/29	Estimating causal relationships with regression discontinuities	GHV, Chapter 21: Additional topics in causal inference, Section 21.3, pp. 432-440

5/4	Estimating causal relationships with fixed effects	GHV, Chapter 21: Additional topics in causal inference, Section 21.4, pp. 440-448
5/6	Make-up day for missed material	
5/8	Final Exam Distributed	
5/15	Final Exam Due	