Sociology/Demography 5350
Quantitative Methods I
Fall 2023
University of Pennsylvania

Classroom: McNeil Building 309
Class meeting hours: Wednesdays, 8:30-10:20 am ET
Recitation hours: Tuesdays, 12-1 pm and 1:45-2:45 pm ET

Course instructor:
Prof. Paula Fomby
McNeil 244
pfomby@sas.upenn.edu
(215) 898-7768
Office hours: Mondays, 10:45-11:45 am, Wednesdays, 3:30-4:30 pm, and by appointment.

Teaching assistant:
Katelyn Kim
McNeil 254A
katehj@sas.upenn.edu
Office hours: Wednesdays, 10:45-11:45 am

Course overview: This course is an introduction to the practice of statistics in social and behavioral sciences. This is the first semester of a two-semester sequence. It is open to beginning graduate students and--with the permission of the instructor--advanced undergraduates. Topics covered include the description of social science data, in graphical and non-graphical form; correlation and other forms of association, including cross-tabulation; bivariate regression; an introduction to probability theory; the logic of sampling; the logic of statistical inference; and significance tests. There is a lecture once weekly and a mandatory recitation ("lab").

Course objectives:
By the end of this course, students should be able to achieve the following.
- Describe the properties of quantitative data
- Produce descriptive statistics including measures of central tendency and dispersion by hand and using software for statistical analysis
- Use statistics to describe relationships between variables
- Explain what the sampling distribution is and how it informs inferential statistics
- Interpret statistical significance
- Define Type I and Type II error as threats to inferential statistics
- Develop research hypotheses and perform hypothesis tests with one independent and one dependent variable

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Expectations and guidelines for success:

- There are no prerequisites for this course.
- All class meetings will occur in-person, barring a public health or weather-related emergency. Weekly class meetings will combine lecture, review, and application of methods using both hand calculation and software for statistical analysis. Recitations will reinforce lecture content and application.
- Statistics is a cumulative discipline, meaning that each week's course content builds on the principles established in prior weeks. Your active participation in lecture and recitation is strongly encouraged and contributes 5 percent to your final grade. Active participation includes regular attendance, focused and respectful attention paid to other classroom participants, and active engagement in classroom activities. Frequent absence, attention directed toward personal communications on electronic devices, sleep, and/or disregard or disrespect toward class members will contribute to a lower participation grade.
- Students are expected to spend about 5-6 hours completing assignments and preparing course meetings each week. Complete all assigned reading before the beginning of class so that the concepts covered in lecture are familiar.
- Course policies regarding assignments and late work are designed to accommodate occasional conflicts (see below). Please be familiar with these policies, and use the available flexibility wisely.

Contact information: Email (pfomby@sas.upenn.edu or via the Canvas messaging system) is the best way to reach me outside of class time and office hours. I will respond to all emails within 24 weekday hours. I will not reply on weekends. If you do not receive a reply within 24 weekday hours, feel free to send me a reminder. To help me locate your message in my inbox, please include the course number in the subject heading (SOCI 5350 or DEMG 5350).

Office hours: Scheduled office hours for the instructor and teaching assistant appear at the top of this syllabus. We will be in our respective offices to welcome you during those hours, and we are also available by appointment. We can also arrange to meet virtually if needed. Office hours serve multiple purposes, and I hope you will find at least one occasion to visit during the semester. You can use this time to ask questions about course content, expand on ideas discussed in class, or discuss how course concepts apply to your own research. This is also the time to discuss any problems or concerns you have that you don't wish to discuss in class. Please bring those issues to me early so we can resolve them appropriately and as quickly as possible.

Evaluation

Problem sets: A total of nine problem sets will be assigned. Problem sets will be available via Canvas immediately after lecture (10:30 am ET Wednesdays*). Completed problem sets are due by 11:59 pm on the following Tuesday.* Completed work should be submitted via Canvas. Your lowest grade will be dropped (i.e., you may complete all nine problem sets and drop the lowest grade, or you may choose to skip one problem set without penalty).

Problem sets require a combination of hand calculation and the use of statistical software (described below). Submitted work should include written responses and, where appropriate, the Stata or R code to support the responses. Submit your work in a standard word processing document or as a PDF file (including scanned copies of handwritten responses).

> **Late policy:** You may submit problem sets up to two days after the deadline (i.e., by Thursday, 11:59 pm). 25% credit will be deducted each day an assignment is late, beginning immediately after the deadline. Problem sets submitted more than two days late will be graded and returned in order to provide feedback, but no credit will be given.

Quizzes: A total of four quizzes will be assigned. Quizzes will be available Wednesday mornings by 8:00 am and will be completed in Canvas. Quizzes assess your learning on the content covered in the two prior problem sets. Quizzes are open-book and open-note. *Quizzes must be completed by Sunday, 11:59 pm.* The **exception** is for Quiz 4, which will be assigned the week of Thanksgiving. That quiz is due on *Monday,* November 27. Note that quizzes are available for less time than the problem sets. Your lowest grade will be dropped (i.e., you may complete all four quizzes and drop the lowest grade, or you may choose to skip one quiz without penalty).

> **Late policy:** Late quizzes will *not* be accepted.

Final exam: The final exam is comprehensive (i.e., covers all course content). It is a take-home exam and is open-book and open-note. Completed exams should be submitted via Canvas. You will have one week to complete the exam.

Class participation: Participation includes regular attendance and informed, attentive, and constructive contribution to classroom activity. Participation will be scored at the end of week 8 and at the end of the course.

Components of your grade:

Problem sets (9 assigned, lowest score dropped)	40%
Quizzes (4 assigned, lowest score dropped)	30%
Final exam	25%
Class participation	5%
Total	**100%**

Grading scale:

You will receive a final letter grade at the end of the term based on the scale below. I will not round grades up or down. For example, 92.99% will receive an A-.

A+	97-100%	B+	87-89%	C+	77-79%	D+	67-69%
A	93-96%	B	83-86%	C	73-76%	D	63-66%
A-	90-92%	B-	80-82%	C-	70-72%	D-	60-62%
						F	<=59%

Required textbook:

Moore, David S., George P. McCabe, and Bruce Craig (2021). *Introduction to the Practice of Statistics.* WH Freeman/Macmillan, 10th edition. ISBN-13 (print edition): 978-1319244446. (Referred to as *MMC* below)

The textbook is available to purchase or rent in print or digital format. You may prefer to obtain an earlier edition of the book (e.g., the 8th or 9th edition). These editions will be substantively similar in the content they cover, although specific examples, problem sets, and page numbers may differ. There is a print copy of the current edition available at the Van Pelt Library reserves desk.

Software:

This course uses Stata for statistical analysis. Stata is a widely used software package in the social sciences and related fields, and it provides a sophisticated set of tools for data management, data description, and statistical inference. Lectures and recitations will illustrate the application of statistical analysis in Stata, and some problem set and quiz items will require the use of Stata.

For students with sustained interests in statistical analysis, purchasing a Stata license may make sense (see https://www.stata.com/order/new/edu/profplus/student-pricing/). Stata BE (Basic Edition) is sufficient for this course. A 6-month license is $48 and a 12-month license is $94. The current version is Stata 18, but prior versions (at least back to Stata 13) will work well.

In addition, Stata is available through the Penn Libraries Virtual Computer Lab (https://guides.library.upenn.edu/vlab). Students who do not have their own Stata license can complete all course requirements using Stata through this virtual lab.

Limited support for the R statistical analysis package is provided during the course, and students familiar with R may submit responses to problem sets, quizzes, and/or exams using syntax and output generated in R.

Course material:

All slides, problem sets, quizzes, exams, data sets, and examples of Stata syntax will be available on Canvas.

Course Policies

Electronic devices: Electronic devices are permitted in class in order to access course content. Please limit your electronic device use to classroom-focused activities. There is substantial research-based evidence that web surfing, etc. during class time compromises the learning experience and creates a distraction for others.

Masking: Infectious disease rates associated with COVID-19, RSV, flu, and other viruses continue to fluctuate. At the outset of the Fall 2024 semester, I do not require face masks in the classroom. This policy is subject to change in response to public health and university guidance. I support your choice to wear a mask if you wish. If you have any concerns about this policy, please speak with me.

Attendance: As noted above, your regular attendance is critical to succeed in this class. Please arrive on time prepared to discuss course content. Late arrivals will be noted, and arriving late routinely or missing multiple classes will affect your participation grade. Should you experience an unexpected event such as extended illness or an accident, please contact me as soon as possible to discuss accommodations.

Please note that the class meeting scheduled for November 22 will be asynchronous and virtual. I will record the class "lecture" to accommodate travel around the Thanksgiving holiday. The recording will be available at the usual class meeting time. Plan to complete assigned reading and watch the lecture prior to the next recitation session (November 28).

With this exception, we will meet in-person except when circumstances such as a major storm or a public health emergency pose a threat to public safety. In that case, we will meet on Zoom or another virtual meeting platform.

Student Disabilities Services and accommodations for students with disabilities: The University of Pennsylvania provides reasonable accommodations to students with disabilities who have self-identified and been approved by the office of Student Disabilities Services (SDS): https://weingartencenter.universitylife.upenn.edu/. Please meet with me as soon as possible to discuss your accommodations and needs. If you have not yet contacted SDS and would like to request accommodations or have questions, you can make an appointment by calling (215) 573-9235. The office is located in the Weingarten Learning Resources Center at Hamilton Village, 220 S. 40th St., Suite 260 (M-F, 9 am - 5pm ET). All services are confidential.

Other Accommodations
Student athletes, parents and caregivers, and others whose commitments might affect their ability to attend class or complete assignments on time should also speak with me at the

beginning of the semester about potential conflicts. You should also speak with me as soon as possible if religious holidays that occur during the semester will require you to miss class. If you unexpectedly experience a life event that presents you with academic difficulties, I can refer you to CaseNet to ensure that you get the support you need: https://www.college.upenn.edu/casenet.

Code of academic integrity: Students are expected to abide by the University of Pennsylvania's Code of Academic Integrity (available here: https://catalog.upenn.edu/pennbook/code-of-academic-integrity/). I will impose substantial penalties on any violation of the code. If you have questions about what constitutes academic dishonesty, please do not hesitate to ask me.

Extensions: Contact me as soon as possible - and before an approaching deadline - if an unexpected situation arises that may require an extension. I will consider extensions for situations that are truly unforeseeable and out of your control (a death in the family, illness). I will not consider extensions for foreseeable circumstances such as having many assignments due in the same week.

Graded assignments: Aside from computational or other minor errors on my part, all grades assigned are final.

Weekly schedule and assignments

Week	Lecture Date (Weds.)	Topic and assigned reading *(complete reading before lecture)*	Assessment	Assessment Due Date (11:59 pm via Canvas)
Week 1	Aug. 30	Introduction, Data and variables	None	
Week 2	Sept. 6	Descriptive statistics: visualizing distributions, Measures of central tendency and dispersion *MMC: Chapter 1 Introduction, sections 1.1 and 1.2; section 1.3 pp. 25-29 and 35-38*	Problem set #1	Tuesday, Sept. 12
Week 3	Sept. 13	Statistics to summarize distributions, density functions *MMC: Chapter 1, section 1.3 pp. 30-34 and 39-42, section 1.4*	Problem set #2	Tuesday, Sept. 19
Week 4	Sept. 20	Relationships between two variables: scatterplot and correlation *MMC: Chapter 2, sections 2.1-2.3*	Quiz #1 (covering weeks 1-3)	Sunday, Sept. 24
Week 5	Sept. 27	Relationships between two variables: least squares and contingency tables *MMC: Chapter 2, sections 2.4-2.6*	Problem set #3	Tuesday, Oct. 3
Week 6	Oct. 4	Producing data *MMC: Chapter 3*	Problem set #4	Tuesday, Oct. 10
Week 7	Oct. 11	Probability *MMC: Chapter 4, sections 4.1 and 4.2*	Quiz #2 (covering weeks 4-6)	Sunday, Oct. 15
Week 8	Oct. 18	Random variables *MMC: Chapter 4, sections 4.3, 4.4, and 4.5*	Problem set #5	Tuesday, Oct. 24
Week 9	Oct. 25	The relationship between random variables and the population (sampling distribution)	Problem set #6	Tuesday, Oct. 31

Week	Lecture Date (Weds.)	Topic and assigned reading *(complete reading before lecture)*	Assessment	Assessment Due Date (11:59 pm via Canvas)
		MMC: Chapter 5		
Week 10	Nov. 1	Population inference (confidence intervals, statistical significance, and hypothesis testing) *MMC: Chapter 6, sections 6.1, 6.2, and 6.3*	Quiz #3 (covering weeks 7-9)	Sunday, Nov. 5
Week 11	Nov. 8	Statistical power and type I and type II error *MMC: Chapter 6, section 6.4*	Problem set #7	Tuesday, Nov. 14
Week 12	Nov. 15	Inference applications I (group mean differences) *MMC: Chapter 7*	Problem set #8	Tuesday, Nov. 21
Week 13	Nov. 22	Inference applications II (proportions) **No class meeting. A one-hour lecture will be recorded and available on Canvas.** *MMC: Chapter 8*	Quiz #4 (covering weeks 10-12)	Monday, Nov. 27
Week 14	Nov. 29	Inference applications III (contingency tables) *MMC: Chapter 9*	Problem set #9	Tuesday, Dec. 5
Week 15	Dec. 6	Inference applications IV (Analysis of variance [ANOVA]); Course review *MMC: Chapter 12*	Final exam (cumulative, excluding ANOVA)	Wednesday, Dec. 13