Intro to Statistics for Behavioral Scientists

PSYC UN1610 (4 points)
Tentative Syllabus for Fall 2024

Lecture Information

Tuesdays & Thursdays, 11:40-12:55pm (200b Schermerhorn)

Lab Information

You must register for **both** UN1610 and one of the three sections of UN1611.

Section 001: Thursdays 4:10-6pm (200b Schermerhorn)

Section 002: Thursdays 6:10-8pm (200b Schermerhorn)

Section 003: Fridays 12:10-2pm (200b Schermerhorn)

Instructor Information

Katherine Fox-Glassman
Office: 314 Schermerhorn
Fall drop-in hours: TBD
email: kjt2111@columbia.edu
pronouns in use: she/her/hers

TA Information

For almost everyone, **learning statistics is not something that is most successfully approached alone!** You are welcome and encouraged to attend any office hours (any of the TAs', and/or the instructor's), regardless of your section assignment, and to request appointments with any of us outside of office hours if you cannot make the scheduled times.

Our TAs for Fall 2024 will be Sophie Charles, Jacob Edwards, and Izzy Goldberg. Please check our Canvas homepage for their contact info, along with the most updated list of TA office hours and their locations.

Role in the Psychology Curriculum

For the Psychology major and concentration, and for the Psychology Post-Bac certificate program, this course can count either toward the statistics requirement or as an elective. For the Neuroscience & Behavior major, this course counts toward the P3 (statistics/research methods) requirement.

Description of the Fall 2024 Course

This course provides an introductory overview to the basic statistical concepts and procedures used in experimental research. The focus is on becoming familiar with how to interpret and perform statistical tests, in order to design experiments and interpret their results. It is not a course on mathematical theory; we will not delve into any of the calculus underpinnings of statistics, and in fact no mathematical skills beyond basic algebra are required. The course is instead intended to provide a basic degree of scientific literacy, with an emphasis on the psychological sciences.

In addition to the lectures, students will participate in a required laboratory section that meets once a week. Lab activities will consist primarily of hands-on data analysis using the statistical software R to apply the concepts introduced in lecture. No prior knowledge of R is expected.

Course Requirements

I. Participation

Your presence is expected at every lecture. For a subject like statistics, most of each student's learning comes via putting in the time to work through examples—we'll do this first in lecture together as a group, and then you'll practice in a guided way in lab assignments and on your own in homework problems. Because each lecture's concepts build on previous ones, regular attendance is crucial to building and maintaining an understanding of the material.

You will earn your participation grade (5% of your overall grade) by actively attending class. Active attendance means showing up, but also remaining awake, paying attention, and **asking questions** when something isn't clear. There will be *at least* one time in every lecture when something doesn't quite make sense to you—this is normal! Often, it is intentional. One of the reasons I'm making you show up to every class is so that you can get these questions answered in real time.

Each student will start out with the full 5% for participation, and will have two free absences to use for any reason. Beyond this, you may lose part of your participation grade for additional unexcused absences or for regularly being present only physically (e.g., browsing social media instead of paying attention). If you anticipate needing to miss more than two classes due to illness or other unavoidable obligations (e.g., traveling for athletic competitions, grad-school interviews) then that can often be accommodated, but please check in with Prof. Fox-Glassman about your conflicts no later than a week before the lecture you will need to miss so we can make a plan to make sure you won't end up falling behind.

II. Lab Assignments

Active attendance at every lab meeting is another essential component of this course. During each lab, students will complete an assignment with the guidance of a TA. Lab assignments are self-paced, and most are paced such that students will finish during the lab period. (If you finish early, it is fine to leave early.) If you cannot complete a given lab assignment before the end of the period, that's fine! This will be the case for nearly everyone for a couple of the labs. In that case, check in with your TA before you leave to make sure you have an idea of how you will tackle the remaining questions, and submit your completed lab assignment any time before the following week's lab begins for full credit. For students unfamiliar with the analysis software R, the first couple of labs will take longer than the assigned lab period and will need to be finished as homework, but after the first few weeks most students tend to finish their labs during the allotted time.

If you anticipate needing to miss a lab meeting, you must contact Prof. Fox-Glassman and your TA at least 1 week in advance in order for that absence to be excused. If you need to miss lab unexpectedly due to illness or emergency, your absence may be excused with a doctor's or dean's note. For excused absences, you may make up your lab assignment for full credit, on a timeline as arranged with your TA and instructor. Any lab assignments missed due to an unexcused absence may be made up for partial credit within one week of the missed lab meeting.

III. Written assignments

Homework. Practicing new knowledge is important in any subject, and is absolutely vital for statistics. Your homework assignments provide you with a chance to test your knowledge, cement concepts before we build on them in further lectures, and make instructive mistakes.

- **Homework assignments must represent your own—and only your own—work.** You should not ask other students for answers or share your answers with a classmate. That said, the homework assignments for this course are designed to test and challenge your understanding of the material, so every student, no matter how strong your math or stats background, is likely to need some help at some point. When that happens, please drop by our office hours, or email a TA or Prof. Fox-Glassman to set up another time to meet and talk through your questions. **You are encouraged to come work with us in office hours** to clarify what each problem is asking, check in on whether your method of solving it is on the right track, and ask for help whenever you're stuck.
- **"Doing your own work" means making at attempt at each problem without the support of AI.** There are lots of tools that can do stats problems for you. You will do best in this course if you use these only for *checking* your work; you will have a very bad time if you regularly replace the process of learning the material with a tendency to let AI tell you the answer. (Plus, AI is *often wrong* in its answers for stats problems.) For both homeworks and projects in this course, we will periodically ask you to walk us through how you solved a problem. If you lean too heavily on outside sources for your homework/project answers, you will fail this oral component of the course and your grade will be seriously affected. Students who appear not to be doing their own work may also be required to complete the remaining projects for the semester in person, in exam conditions, rather than as take-home projects.
- **Show your work!** You will receive most of your points for using a correct method, as opposed to coming to a correct answer. This means that making a silly math error early on—or basing your hypothesis test on a shaky assumption—needn't cause you to lose all points for a question, even if that error makes your final answer wrong. It also means that you will not receive full points for a correct answer if the TAs cannot see how you arrived at it. The first step in showing work for every problem is to **write out the relevant equations by hand**. **All other work must be shown by hand or in R code.** You must be able to explain your R code to a TA if asked.
- **Homework is due at the beginning of class.** Points will be deducted per day past the due date of the assignment, which will always be at 11:40am (when our class starts). If you have not finished your homework before class, the late penalty will be the same if you hand it in during or directly after class as if you turn it in any time before 11:40am the next day. That means that if you haven't been able to finish a homework assignment before class starts, there's no benefit to working on it during class rather than paying attention to the new material—we would rather you gain the full benefit of class, and then finish your homework later in the day when you don't have to rush.
- **Homework is due via Gradescope.** Please make sure you leave time to tag your supporting work each question in Gradescope so that the TAs can find it when grading. Assignments that do not tag the answer/work for each question in Gradescope will lose points. We will help you navigate PDFing your work and entering it into Gradescope for the first couple of assignments.

Projects. Instead of sitting for in-class exams, you will demonstrate your understanding of course concepts by completing a series of data-analysis projects. Think of these projects as take-home exams, and study for them ahead of time just as you would an exam. Some important notes about projects:

- **Projects will be made available 2 days before their due date.** This is a short window, and late projects will lose points, so plan ahead to make sure that you can devote enough time to complete the project before it is due. Extensions will **only** be considered if requested well in advance of the project being assigned, or in cases of unforeseen emergency, as documented

by a doctor's or dean's note. (For any project windows that overlap a major religious holiday, we'll arrange for alternate time windows for students observing that holiday.)

- **You are expected to work alone.** You *may* use any reference resources (lecture notes, your textbook, other readings), but you *may not* receive help of any kind from fellow students, TAs, friends, strangers, internet message boards, AI, or any other outside source. Anyone receiving help on their projects for this class is not presenting their own work, which is equivalent to cheating on an exam; it will result in—at best—a score of 0 for that project and a report to your school's academic misconduct office.
- At the time the project assignment goes live, you will receive a unique dataset that will serve as the basis for your individual analysis. Each student will have different data, which means that each project will have a different set of correct answers. If you do not receive your dataset, let your TA and instructor know immediately.
- After projects are submitted, we will follow up with each student during a subsequent lab period to ask you to explain your reasoning/work for a subset of the problems. **If you are unable to explain work that you submitted, you will receive no points for those problems.** Students who cannot explain their work on early projects may be required to complete the remaining projects for the semester in person, in exam conditions. We realize that this oral component to the projects can be stressful for many students! We're *not* expecting you to have memorized the project or to understand everything perfectly. As long as you did your own work (whether or not your original answers were correct), you will do fine on this component of the projects.
- We will hold one of these follow-up meetings during Finals Week, during which we will ask you to walk us through the work you did on Project 4. This may be done either in person or via Zoom, and there will be slots available across several days during Finals Week—so you don't need to be on campus past the last day of classes, but you should plan on being available at some point during Finals Week for a 20min virtual meeting. Like the in-person follow-ups for the earlier projects, this oral component is pass/fail, and if you did all of your own work, you will pass it!
- Note that the first couple of projects are weighted less strongly toward your final grade than the latter two. If you don't do as well as you would have liked on the first project, make sure to meet with your TA or the instructor to go over what you did wrong (but also what you're doing right!), so that you can improve your grade as the projects increase in value.

Grading

I don't grade on a curve in this class, so your grade will be determined only by your own work, not by how well you do relative to the other students. There is no pre-determined proportion of students who will receive As, Bs, Cs, etc.—if every student shows A-level understanding of our concepts, then everyone will receive an A in the course. **It is very difficult to fail this course if you complete all of the work and submit it on time; on the flipside, it is difficult to do well in the course if you haven't completed all of the work**. If you're falling behind, talk to Prof. Fox-Glassman to make a catch-up plan.

Your course grade is based on the following categories:

Participation:	5%
Lab Assignments:	10%
Homework:	20%
Project 1:	10%
Project 2:	15%
Project 3:	20%
Project 4:	20%

The minimum points cutoffs for each letter grade are as follows. Grades are not rounded: your points must meet or exceed a cutoff in order to earn that letter grade.

99% = A+	83% = B	70% = C-
93% = A	80% = B-	60% = D
90% = A-	77% = C+	<60% =
87% = B+	73% = C	

Course Policies

Academic Integrity

Academic honesty includes presenting only your own work in your assignments. Taking credit for work that you did not personally complete is a serious violation within the academic community in any course; in a stats course, copying someone else's work means that you're not actually participating in the learning process yourself. The assignments in this course are designed to provide you with learning opportunities, so if you are not engaging in them in good faith, you will receive a score of 0 on the assignment(s) in question and the incident will be reported to your school and dean.

In this course, academic dishonesty includes receiving unauthorized help on your projects or homework assignments, copying another student's work, sharing your own work with classmates, copying answers from online sources including AI, sharing your own work with classmates or on online forums or homework-help sites, or collaborating with other students on the projects. Detailed definitions and examples of academic dishonesty (and a rundown of the consequences) are available in Columbia's Guide to Academic Integrity (http://www.college.columbia.edu/academics/integrity). Ignorance of the rules is not a valid defense, so make sure you've read them.

If you are tempted to have someone or something other than you complete your work in this course: don't. The purpose of those assignments is to help you figure out which concepts you need some extra guidance with. You are *expected* to need help on both homeworks and labs, so please come to any member of the teaching team for that help. Getting outside help on homeworks and labs without also working with us will leave you under-prepared for the projects. Getting outside help of any kind on a project is equivalent to cheating on an exam, and will result in a score of 0 on that project and a referral to the Dean's Discipline process.

If you find yourself in a position where it feels like getting answers from another person or an AI tool is your best or only option, *please* reach out to Prof. Fox-Glassman and/or your TA before turning elsewhere. It's always preferable to deal with any issues before they get so bad that they become overwhelming, and there are many resources we can point you to that will help you master the material. Please come to us if you're feeling stressed out about the class workload or if there's a concept you're just not understanding. The best time to get help is before a homework assignment is due, and before a project is assigned, but it's never too late to reach out. If you have an issue that you'd rather not talk about with us, you may contact your academic advisor or dean; or a Psychology Program Advisor (DUS); or the counselors at Columbia's CPS (http://health.columbia.edu/services/cps).

AI-use policy for this course: In academia, it is common—and time-saving!—to use code that you have borrowed or adapted from a book, from a colleague's analysis, or from a helpful internet stranger. Using code that an AI has written for you is in some ways no different than that.

However, as a researcher—and as a student in this course—it is critical that you *understand how your code works*. It's not enough to be able to copy code and get it to successfully create some output: you need to be able to follow what that code is doing, and which variables it is doing it to. And you need to be able to tell whether the thing the code is doing actually answers your question.

The labs in this course will teach you how R code works. We'll give you lots of examples (which you may, and should, copy and adapt for your own use, homeworks and projects included!) and lots of opportunities to ask us questions about how it all works. We will ask you to walk us through your work for some of your homework assignments and project problems throughout the semester. **If you are unable to explain the work/code you submitted as yours, you will lose points on that**

assignment. The goal is not to trick or trip you up: If you are engaging with the labs and homeworks and putting in the time to understand how your code (wherever it comes from) works, then you will have no trouble explaining it to us. We do not expect you to have a perfect memory for all of the work/code you produce, but we will look for you to have a level of familiarity with it that a person who did that work would be expected to have.

Posting of course materials: don't. While you may share your own notes both within and beyond our class, **you may not reproduce, distribute, or display (post/upload) any course materials *anywhere* beyond our Canvas site,** nor may you allow others to do so. "Course materials" includes lectures (slides and recordings), assignments, exams, quizzes, and all other material created by the instructor and/or TAs for this course. Distributing course materials to people not enrolled in the course is a violation of U.S. copyright law and Columbia's academic integrity rules, and posting lecture recordings is a serious violation of privacy. If you have a friend who is interested in the lecture slides/recordings for this course, have them reach out directly to me—I'm almost always happy to share course materials with interested students, but I prefer them to come directly from me rather than floating around the internet.

Diversity & Inclusion

Every learning environment should accommodate the wide range of opinions, backgrounds, and identities that students bring into the room. And as psychologists, we know that groups benefit in many specific and important ways from diversity of all kinds—nationality, sex/gender, sexuality, race, class, religion, ability, and many others. To help me make this course as inclusive as possible, please let me know if any of the following is true:

- You have a name and/or set of pronouns that differ from those that appear in SSOL/on Canvas;
- Something that was said in class made you feel uncomfortable or unwelcome;
- Your ability to take part in our class is being affected by events or experiences outside of our class. Even if I can't help you directly, I can try to connect you with resources or support.

Like most people, I am still in the process of learning about and from diverse perspectives and identities. I'm very open to feedback; this is one of many areas where you can likely teach me as much as, if not more than, I could teach you. And of course, please correct me if I mispronounce your name or mistake your preferred pronouns!

Religious Observance

If you will need to miss more than one class/lab this semester for religious reasons, or if religious observance would prevent you from working during one of the project windows, please come talk with me before the end of the first week of class. You won't lose points for missing class/lab due to religious observances, but since this course moves very quickly through topics, we'll want to make a plan to ensure that you stay caught up. If your usual lab section conflicts with a religious holiday, it's typically fine for you to attend a different section that week, as long as you let the TAs know ahead of time.

Student-Specific Accommodations & Resources

If you require any classroom accommodations, please email me the details of your situation as soon as possible. If you have not already done so, contact the Office of Disability Services (ODS) on the 7th floor of Lerner Hall to register for support services. ODS requires a few weeks to process an application, so please contact them as soon as you can. The procedures for registering with ODS can be found at http://health.columbia.edu/services/ods or by calling (212) 854-2388.

Please note that students who ordinarily receive extra time to complete in-class exams are not generally eligible to receive more time to complete the projects in this course, since the default time windows for projects are already designed with DS accommodations in mind.

Readings

Required Readings

Required reading will consist mainly of chapters from our main text:

- Introductory Statistics for the Behavioral Sciences, 7th Edition, by Joan Welkowitz, Barry H. Cohen, and R. Brooke Lea (2012). ISBN: 978-0-470-90776-4.

You may get your own copy if you learn best by highlighting and writing notes in your text—it will be available at Book Culture, at 536 W 112th St. However, **it's not required that you purchase the book, since the CU library makes the entire textbook available online for free**. This online version offers unlimited online viewing, but it has limits on the number of pages that you can download and print, so if you do opt to use the online version of the text, remember (especially during project windows) that your access to it will be dependent on an internet connection!

Note that chapters are sometimes listed as required reading more than once. This is not a mistake, but rather a cue to re-read those chapters prior to the class in question, either because they are particularly important or because they are particularly challenging.

Not every stats book will resonate with every student—sometimes the best book for *you* is not the one that I've chosen as best overall for the course, but rather one that is written in a way that feels intuitive to the way you think about logic and math. If our main text (Welkowitz) feels like it's not right for you, let me know and I'll recommend you some alternatives.

Recommended Readings

Each lecture will also have an accompanying recommended reading, all of which will be made available as PDF files on Canvas. These are strictly optional and (wherever possible) non-mathematical. These supplementary readings were chosen to help make the problems of the course a bit less abstruse, and many of them are (hopefully) more entertaining than you might expect from a stats reading.

There is no need for you to purchase any of these supplementary readings, but if you are interested in reading beyond the excerpts we use in this class, you will find the sources for most of our recommended readings in this list, sorted by the first author's last name (the same convention by which the readings are listed in the table below, and the files on Canvas are named).

- *The Tiger That Isn't: Seeing through a world of numbers*, by Michael Blastland & Andrew Dinot
- *Statistics Without Maths for Psychology*, by Christine Dancey & John Reidy
- *The Essential Guide to Effect Sizes*, by Paul Ellis
- *The Cartoon Guide to Statistics*, by Larry Gonick & Wollcott Smith
- *Doing Bayesian Data Analysis*, by J. K. Kruschke
- *Statistical Rethinking*, by Richard McElreath
- *The Lady Tasting Tea: How statistics revolutionized science in the 20th century,* by David Salsburg
- *Bayes' Rule: A Tutorial Introduction to Bayesian Analysis*, by James Stone
- *The Visual Display of Quantitative Information*, by Edward Tufte

List of Topics & Readings

Chapters listed below are all from Welkowitz, unless otherwise noted.

Date	#	Topic	Readings	Lab	Due
Tues. 9/3/24	1	"Why Am I Here?"	Course Syllabus		
Thurs. 9/5/24	2	Variables & Measurement	Chapter 1 (Blastland Ch. 1)	Lab 1	
Tues. 9/10/24	3	Data Visualization	Chapter 2 (Tufte Ch. 1)		HW 1
Thurs. 9/12/24	4	Central Tendency	Chapter 3 (Blastland Ch. 5)	Lab 2	
Tues. 9/17/24	5	Variability	Chapter 3 (Gonick Ch. 2)		HW 2
Thurs. 9/19/24	6	Distributions	Chapter 4 (Salsburg Ch. 2)	Lab 3	
Tues. 9/24/24	7	Discrete Probability	Chapter 16 (Blastland Ch. 3)		HW 3
Thurs. 9/26/24	8	Probability Density	Chapter 4 (Salsburg Ch. 9)	Lab 4	
Tues. 10/1/24	9	Statistical Inference	Chapter 5 (Salsburg Ch. 11)		HW 4
Thurs. 10/3/24	10	Confidence Intervals	Chapter 5 (Salsburg Ch. 12)	Lab 5	Project 1 Due *(Lecs 1-6, Labs 1-3, HWs 1-3)*
Tues. 10/8/24	11	*Catch-up / Review Day: short lecture + time for questions*	-		HW 5
Thurs. 10/10/24	12	The Small Sample Problem	Chapter 6 (Salsburg Ch. 3)	Lab 6	
Tues. 10/15/24	13	Testing for a Change	Chapter 6 (Gonick Ch. 8)		HW 6
Thurs. 10/17/24	14	Testing for a Difference	Chapter 7 (Gonick Ch. 9)	Lab 7	
Tues. 10/22/24	15	Correlation	Chapter 9 (Blastland Ch. 12)		HW 7
Thurs. 10/24/24	16	Linear Regression	Chapter 10 (Gonick Ch. 11)	Lab 8	Project 2 Due *(Lecs 7-13, Labs 4-7, HWs 4-7)*

Tues. 10/29/24	17	Linear Models	Chapter 10 (Dancey Ch. 12)		
Thurs. 10/31/24	18	Analysis of Variance	Chapter 12 (Salsburg Ch. 5)	Lab 9	HW 8*
Tues. 11/5/24	-	*Election Day Holiday*	-		
Thurs. 11/7/24	19	Multiple Comparisons	Chapter 13 (Dancey Ch. 10)	Lab 10	
Tues. 11/12/24	20	Factorial ANOVA	Chapter 14 (Dancey Ch. 11)		HW 9
Thurs. 11/14/24	21	Nonparametric Tests	Chapter 8 (Salsburg Ch. 10)	Lab 11	
Tues. 11/19/24	22	Nonparametric Tests, Part II	Chapter 17 (Salsburg Ch. 10)		
Thurs. 11/21/24	23	Effect Size	Ellis Ch. 1 (Wainer Ch. 1)	Lab 12	Project 3 Due *(Lecs 14-18, Labs 7-11, HWs 7-9)*
Tues. 11/26/24	24	Power Analysis	Chapter 11 (Ioannidis, 2005)		HW 10
Thurs. 11/28/24	-	*Thanksgiving Holiday*	-		
Tues. 12/3/24	25	Bayes' Rule	Stone Ch. 1 (Salsburg Ch. 13)		HW 11
Thurs. 12/5/24	26	Bayes' Rule, Part II	Goodman, 1999 (Kruschke Ch. 2)	Lab 13	
Tues 12/10/24	X	Analytic Strategy *(optional lecture - no new material but will be useful for tying all our topics together)*	(McElreath Ch. 1) (O.S.C., 2015)		HW12
Thurs. 12/12/24	-	-	-		Project 4 written portion Due
Finals Week	-	In-person/Zoom component of Project 4: a 15min. check-in where you'll talk Prof. F-G through your work on one problem from Project 4. Doesn't matter if your work is wrong or right—all that matters is that you can explain what you did and why.	-		Oral portion of Project 4