Statistics for Social Sciences

Course Syllabus

Weekly Overview Fall 2024

# Course Description

This course is an introduction to statistics in the social sciences. The course is designed for students who never thought they would become programmers and no prior experience with R is required. Students will learn about reading, manipulating, and analyzing statistical data with R. Students will become proficient in data management and R programming through bi-weekly problem sets, which will be completed in groups (with instructor permission for those who want to work individually).

# Instructor

Professor Name (pronouns)

Contact:

Student Office Hours: via Zoom and by appointment

# **Course Structure**

5 units. The course structure consists of a weekly discussion section, asynchronous course materials (e.g. lecture slides, problem sets), and weekly synchronous meetings. The course will use GitHub as a primary course website. Each week we will focus on a particular topic (e.g., creating variables; writing functions). For each unit, students will complete bi-weekly problem sets. Problem sets will be completed in groups and focus on the practical application of concepts/skills from the topic of the week. Students are also expected to participate in an online discussion by posting a question or interacting with a peer’s question weekly.

**Synchronous meetings**. Synchronous class meetings will be on Zoom. Attendance during the entire period is required, but students may ask instructor/TAs for exceptions due to scheduling conflicts.

# Technology & Reading Requirements

We will be using R and RStudio, which are free online software. We will provide guides to help you get set up. This course requires you to have a laptop. You can borrow one from the library (Equipment Lending) if you need access.

All required readings for this course are free and available online. You are not required to purchase any textbooks.

# Assessment and Grading

The course grade will be based on the following components:

* 4 Bi-weekly Problem Sets (60 percent of total grade)
  + They are due on weeks 2, 4, 6, 8
* Course Participation (class attendance and weekly online discussion; 15 percent of total grade)
* Take-home final (25 percent of total grade)

# Learning Goals

At the end of this course, students will be able to:

1. Learn how to describe data using summary statistics and graphs.
2. Learn fundamental concepts of inferential statistics.
3. Use R to investigate data, summarize and visualize data, and perform hypothesis tests
4. Perform and interpret regression analysis with R and by hand.

# Data X

This course was developed in partnership with [DataX](https://datax.ucla.edu/).

# Weekly Overview

UNIT 1: INTRO TO R

Week 1:

Learning goal - Understand what and how to access R and R studio.

Meeting 1: Course Intro

-What is R?

-What is R studio?

Meeting 2: Basics of R

-Introduce Tidyverse

-Introduce Dplyr functions

-filter() picks cases based on their values.

-select() extracts columns and returns a tibble.

-arrange() changes the ordering of the rows.

-mutate() adds new variables that are functions of existing variables.

-rename() easily changes the name of a column(s)

-pull() extracts a single column as a vector.

Week 2:

Learning goal - Apply basic Dplyr functions in R and produce graphs of continuous and categorical variables.

Meeting 1: Basics of R (continued)

-Practice Dplyr functions

-Pipes %>%

-Create new variables conditionally using if\_else(), recode(), and case\_when()

-Subsetting

-Preview Dplyr functions

Meeting 2: Graphing

-Scatterplot, boxplot

-Graphing one continuous variable, one categorical variable, two continuous variable, two categorical variables

-Load and create data frame of generated variables

-Plot distribution, find mean, standard deviation, median

UNIT2: DESCRIPTIVE STATISTICS AND STATISTICAL INFERENCE

Week 3: Descriptive statistics and distributions

Learning goal - Identify descriptive statistics in order to describe individual variables. Articulate the descriptors of normal distribution and skewness.

Meeting 1: Descriptive statistics

-Descriptive statistics to describe data

- mean, median, percentiles

- standard deviation (most important)

-Describing individual variables using R

-summarise() reduces multiple values down to a single summary.

-Measures of central tendency (Mean, median, mode, etc.)

-Measures of dispersion (Standard deviation)

Meeting 2: distributions

- normal distributions

-Skewness (normal, left-skewed, right-skewed)

- normal distributions and the empirical rule

- standard normal distribution

- z-scores

Week 4

Learning goal - Apply understanding of central limit theorem and sampling distributions towards how to evaluate inferential statistics in R.

Meeting 1: Sampling Distribution

-Central limit theorem (this why the sampling distribution)

-Sampling distributions

Meeting 2: Fundamentals of inferential statistics

- The idea of population parameters, sample estimates, and using sample estimates to make inferences about population parameters

-Infer package (basic hypothesis testing)

-specify() allows you to specify the variable, or relationship between variables, that you’re interested in.

-hypothesize() allows you to declare the null hypothesis.

-generate() allows you to generate data reflecting the null hypothesis.

-calculate() allows you to calculate a distribution of statistics from the generated data to form the null distribution.

Week 5

Learning goal - Formulate hypothesis testing both by hand and with infer commands for a single population mean.

Meeting 1: Inferential statistics, about single variable

-Hypothesis testing about a (single) population mean

-doing full example by hand

- overview and Steps in hypothesis testing

- hypothesis

- test statistic

- p-value

- rejection region

- assumptions and conclusion

Meeting 2: Inferential statistics, about single variable

-Hypothesis testing about a (single) population mean

- doing full example using infer commands

- overview and Steps in hypothesis testing

- hypothesis

- test statistic

- p-value

- rejection region

- assumptions and conclusion

Week 6: Comparing two groups

Learning goal - Evaluate two groups with hypothesis testing and comparing population means.

Meeting 1: Comparing Two Groups

-Hypothesis testing about groups

Meeting 2: Comparing Two Groups (continued)

-Fundamental concepts in causal inference

-Hypothesis testing comparing population means of two groups

UNIT 3: REGRESSION

Week 7: Introduction to bivariate regression and estimation

Learning goal - Demonstrate estimation and prediction of bivariate regression analysis in R.

Meeting 1: Introduction to Bivariate Regression

-Scatterplot, Covariance, Correlation

-Population linear regression model

Meeting 2: Introduction to Bivariate Regression

-Estimation

-Population mean

-Regression

-Writing out models

-Regression in R

- introducing tidymodels

- understanding object created by regression

- Prediction

Week 8: bivariate regression, part II

Learning goal - Apply understanding of bivariate regression to do hypothesis testing for continuous variables.

Meeting 1: Bivariate Regression

Meeting 2: Bivariate Regression

-Model Fit

-R^2, the coefficient of determination

-Standard Error of the of the Regression (SER)

Meeting 2: Hypothesis testing

-Regression with continuous variables

-Hypothesis testing about B1

-Factor Variables

Week 9: interpretation of categorical variables, confidence intervals, assumptions

Learning goal - Acquire understanding of beta hat with categorical variables, confidence intervals, and assumptions.

Meeting 1: Interpretation of Beta hat with categorical variables

-Regression with categorical variables

- introduce factors

- introduce reference groups

- interpretation of estimate on categorical X

- hypothesis testing

Meeting 2: confidence intervals and assumptions

-Confidence Intervals

-Calculating confidence intervals

- OLS assumptions

-Bias and efficiency

-OLS (Ordinary Least Squares) Assumptions

Week 10: introduction to multiple regression

Learning goal - Test multivariate regression and interpret findings to estimate causal effects.

Meeting 1: Multivariate Regression

* Multivariate regression model
* Interpretation

Meeting 2: Multivariate Regression (continued)

* Linear probability model
* Using multiple regression to estimate causal effects
  + Conditional independence assumption
  + Omitted variable bias

# Academic Policies

**Academic Accommodations —** [**Center for Accessible Education (CAE)**](https://cae.ucla.edu)

Students needing academic accommodations based on a disability should contact the Center for Accessible Education (CAE) at (310) 825-1501 or in person at Murphy Hall A255. In order to ensure accommodations, students need to contact the CAE within the first two weeks of the term. Students requiring additional accommodations with the Center for Accessible Education (CAE), please request your Letter of Accommodation on the Student Portal. If you are seeking registration with the CAE, please submit your request for accommodations via the CAE website. Please note that the CAE does not send accommodation letters to instructors – you must request that I view the letter in the online Faculty Portal.

**Students requiring academic accommodations should notify the professor and the Center for Accessible Education (CAE) of their needs within the first two weeks of the course. CAE contact information is provided at the end of the document.**

Students requiring accommodations for exams will take their exams through CAE’s testing center.

**Academic Honesty** Neither the University nor I tolerate cheating or plagiarism. If caught, you will face punishment under the guidelines provided by the University of California. I expect you to be familiar with and understand the university’s policies on academic honesty for this course. Please consult the [Student Conduct Code](https://www.deanofstudents.ucla.edu/studentconductcode) for more information.

**BruinLearn** We will use BruinLearn primarily for the submission of assignments. We will use Github for communication. The course website will contain relevant material, datasets, guides, assignments, and modules.

**Basic Needs Security Statement**

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students (<https://www.deanofstudents.ucla.edu/>) for

support. Please notify the teaching team if you feel comfortable doing so. This will enable us to share information about resources (<https://www.financialwellness.ucla.edu/Campus-Resources>) as well.

# Additional Resources for Students

[**All Gender Restrooms**](https://www.uclahealth.org/medical-services/gender-health/patient-resources/all-gender-restrooms)

In accordance with the University’s nondiscrimination policies, All-Gender Restrooms at UCLA are single stall facilities that seek to create an inclusive campus environment and enhance the climate for transgender and gender variant people and many other populations. The standardized signage meets California building code while challenging traditional binary notions of gender.

[**Ashe Student Health and Wellness Center**](http://www.studenthealth.ucla.edu)

Provides high. quality and accessible ambulatory healthcare and education by caring professionals to support the academic success and personal development of all UCLA students.

[**BeWell Bruin**](https://bewellbruin.ucla.edu/)

UCLA is dedicated to creating and sustaining a healthy University community so students can achieve their personal and academic goals. As a Bruin, you have access to a range of health and wellness services, from exceptional medical care and counseling to recreational activities, safety resources, peer advocacy, and more. Through Be Well Bruin, you can learn about resources that support the whole U.

[**Bruin Resource Center**](https://www.brc.ucla.edu/)

The mission of the UCLA Bruin Resource Center (BRC) is to support students’ development, well-being, and academic success and to foster an inclusive and socially just campus community. Their programs include Bruin Guardian Scholars, Bruin Guardian Scholars Academy, Collegiate Recovery Program, Intergroup Relations Program, Students with Dependents Program, Transfer Student Center. Phone number: 310.825.3945.

[**Bruin Shelter**](http://www.bruinshelter.org/)

Provides a safe, supportive environment for fellow college students experiencing homelessness by fostering a collaborative effort between universities, community-based organizations, and service providers.

[**Campus Assault Resources & Education (CARE)**](https://www.careprogram.ucla.edu/)

CARE is committed to the eradication of sexual and gender-based violence through creating and sustaining a safe, healthy, and equitable community for all people. CARE strives to achieve this through provision of comprehensive prevention education, individual support and advocacy, and holistic healing programs for all members of the UCLA community. Phone: 310.206.2465.

[**Campus and Student Resilience**](https://www.resilience.ucla.edu/)

Provides programs to promote resilience and trains students to help support their peers.

[**Community Programs Office (CPO)**](http://uclacommunityprograms.org/)

The UCLA Community Programs Office serves as an umbrella department for the Student Initiated Outreach Center, Student Retention Center, and twenty five student-initiated community service projects. The CPO strives to increase students from underserved communities’ access to higher education, retention in the university, and graduation rates while also serving as a conscious effort in the community, working toward the empowerment of all people. Phone: 310.825.5969.

[**CPO Food Shelter**](http://www.cpo.ucla.edu/cpo/foodcloset/)

Provides free food for any UCLA student who may be experiencing hunger or struggling to attain food due to financial hardships.

[**Counseling and Psychological Services (CAPS)**](https://www.counseling.ucla.edu/)

Provides counseling and other psychological and mental health services to students. Walk-in hours are Monday-Thursday 8am-4:30pm and Friday 9am-4:30pm in John Wooden Center West. Crisis counseling is also available 24 hours/day at (310) 825-0768.

[**Dashew Center for International Students & Scholars**](https://www.internationalcenter.ucla.edu/)

UCLA is home for more than 12,000 international students and scholars away from home. The Dashew Center is the place where domestic and international students and scholars meet. We enhance the UCLA experience for international students and scholars with our multicultural programs and services. We assist UCLA academic departments with visa services. We serve as a resource and learning center for the entire UCLA community to promote global connection, international understanding and cultural sensitivity. Phone: 310.825.1681.

[**Data Squad**](https://www.library.ucla.edu/about/programs/ucla-library-datasquad/)

As part of the UCLA Library Data Science Center, the UCLA Library DataSquad is a team of undergraduate students who support data-related projects at UCLA. The DataSquad aims to facilitate data processes for sustainable, replicable, reproducible research, teaching and workflows.

[**Dean of Students Office**](https://www.deanofstudents.ucla.edu/)

The Mission of the Dean of Students Office is to serve as a portal to understanding the UCLA experience, and we are committed to the personal and intellectual growth and development of our students. Whether we are the first office you come to for assistance or the last place you think to call, our staff is here to help you enjoy your UCLA experience. Phone: 310.825.3894.

[**Equity, Diversity and Inclusion**](https://equity.ucla.edu/)

Committed to providing an equal learning, working and living environment at UCLA and supports a range of programs to promote these goals campus-wide.

[**Healthy Campus Initiative (HCI)**](https://healthy.ucla.edu)

Provides links to a wide variety of resources for enhancing physical and psychological well-being, positive social interactions, healthy sleep, healthy eating, healthy physical activity and more.

[**Lactation Rooms**](https://map.ucla.edu/?f=5)

For students who may need the use of lactation rooms, please use the linked map above to find lactation rooms on UCLA campus.

[**LGBT Campus Resource Center**](https://www.lgbt.ucla.edu/)

The UCLA LGBT Campus Resource Center has proudly been serving the UCLA community for 20 years. We provide a comprehensive range of education and advocacy services supporting intersectional identity development as well as fostering unity, wellness, and an open, safe, and inclusive environment for UCLAÕs LGBTQ community. Phone: 310.206.3628.

[**Students with Dependents Program**](https://swd.ucla.edu/)

The Students with Dependents (SwD) Program within the Bruin Resource Center offers support to UCLA undergraduate, graduate, and professional students who have taken on the role of parent, guardian, or caregiver and have continued their academic careers. Through partnerships with parenting student organizations at UCLA, the SwD Program can direct students with dependents to organizations and resources that would support scholars and their families throughout their educational journey.

[**Title IX Resources**](https://sexualharassment.ucla.edu/)

UCLA prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, there are a variety of resources to assist you. You can receive confidential support and advocacy at the CARE Advocacy Office for Sexual and Gender Based Violence, 1st Floor Wooden Center West, CAREadvocate@careprogram.ucla.edu, (310) 206-2465. Counseling and Psychological Services (CAPS) also provides confidential counseling to all students and can be reached 24/7 at (310) 825-0768. Faculty and TAs are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Coordinator should they become aware that you or any other student has experienced sexual violence or sexual harassment. You can also report sexual violence or sexual harassment directly to the University’s Title IX Coordinator, 2241 Murphy Hall, titleix@conet.ucla.edu, (310) 206-3417. Reports to law enforcement can be made to UCPD at (310) 825-1491. These offices may be required to pursue an official investigation.

[**UCLA GRIT**](https://www.grit.ucla.edu/)

Coaching Program GRIT stands for Guidance, Resilience, Integrity and Transformation. In this program, UCLA students receive individualized support from trained peer coaches to manage stress, foster positive social connections, set goals, and navigate campus resources.

[**UCLA Police Department**](https://police.ucla.edu/)

UCLA PD sets a standard of excellence in law enforcement and serves a multicultural, educational environment of over 75,000 faculty, staff and students in Los Angeles. It is a part of the statewide UC Police system of about 410 sworn personnel. We take pride in our cultural and ethnic diversity and strive to employ a broad cross-section of the community. The department employs about 64 sworn officers, 42 civilians and 130 students. Phone: 310.825.1491.

[**UCLA Student Legal Services**](https://www.studentlegal.ucla.edu/)

We provide confidential legal counseling and assistance regarding a wide range of legal issues to all currently registered and enrolled UCLA students. Phone: 310.825.9894.