STAT 218: Applied Statistics for Life Sciences

Fall 2024

Welcome!

You are an important part of our Cal Poly community and this classroom, no matter your background, identity, or experiences. Our diversity enriches the learning environment, and I'm committed to creating an inclusive and equitable space where all voices are heard and respected. I'm eager to learn from your unique perspectives, just as I hope you will gain valuable insights from this STAT 218 class. I believe you will find many things that resonate with your own interests and the major you pursue. Please read this syllabus carefully, as it serves as a contract between you and me as your professor.

Course Website

This course has a website where you can access essential resources throughout the course.

Meet Your Instructor and Grader

Instructor

Dr. Sinem Demirci (Dr. Deh-meer-jee) (she/her)
Email: sdemirci@calpoly.edu
Office: 025-213

Instructor's office hours:
Mon: 10:15 AM - 12:00 PM *(In-Office)*
Wed: 10:15 AM - 12:00 PM on Zoom

Grader

Grace Elizabeth Percer
gpercer@calpoly.edu

Course Information

Your learning journey begins at Building 186 - Construction Innovations Center. Follow this link to locate the hub of knowledge for your class.

Section 02: MTWR 08:10 AM – 09:00 AM 186-C100
Section 03: MTWR 09:10 AM – 10:00 AM 186-C100

Prerequisite:

Entrance to STAT 218 requires at least one of the following be met:

- Grade of C- or better in MATH 115
- Grade of B or better in MATH 96
- Appropriate placement on the Math Placement Exam.

You should have familiarity with computers and technology (e.g., Internet browsing, word processing, opening/saving files, converting files to PDF format, sending and receiving e-mail, etc.).

Course Description

Life science is complicated. As your professor, I know you already know this, and it's not my intention to teach you that. However, I am committed to giving you a glimpse into some of these complexities by integrating statistical concepts into life science topics. By the end of this course, I hope to increase your awareness of the potential inaccuracies in any data you use which implies that there might not always be a single explanation or prediction for an event, but rather, a range of possible outcomes. In the best-case scenario, I will support you in making sense of uncertainty in the (1) behavior of chemicals, (2) relationships among living organisms & communities of living organisms, and (3) physical processes that sustain most of the living systems through the use of Statistics.

STAT 218 is tailored for life science students who will inevitably engage with Statistics in their future professions.

In this course, we will cover the following concepts, illustrating real-world applications of Statistics in the life sciences: descriptive statistics, confidence intervals, parametric and non-parametric one-and two-sample hypothesis tests, analysis of variance, correlation, simple linear regression, chi-square tests.

At times, we'll utilize the R programming language, a tool favored by *Homo sapiens*, to practically apply the techniques and theories learned. This includes making statistical inferences based on datasets.

Student Learning Outcomes

Upon completion of this course, you will be able to:

1. describe Statistics as a discipline in your own words,
2. explain the interactions between Statistics and life sciences,
3. design a data collection scheme based on simple random sampling or simple experimental designs,
4. distinguish between observational studies and experiments and understand the limitations (practical and consequential) of each,
5. summarize data using graphical techniques,
6. summarize data using numerical techniques,
7. construct and interpret confidence intervals for means and differences between means for independent samples,
8. construct and interpret confidence intervals for means and differences between means for paired samples,
9. conduct parametric two-sample hypothesis tests for means,
10. conduct non-parametric two-sample hypothesis tests for means,
11. construct and interpret a confidence interval for a single proportion,
12. conduct Chi-square goodness-of-fit tests and tests for independence,
13. distinguish between case-control and cohort studies and compute relative-risk and odds in the appropriate settings,
14. perform analysis of variance tests and post-hoc comparisons for completely randomized designs,
15. explain why correlation does not imply causation,
16. use simple linear regression to describe relationships between variables.

Required Materials

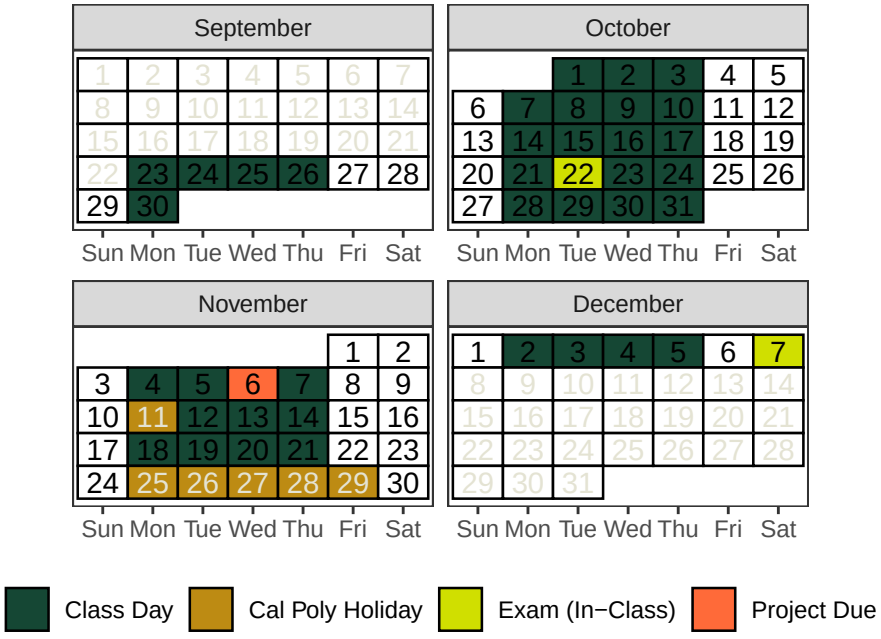
Required Textbooks: We will use two textbooks. The former textbook covers fundamental theories, while the latter textbook delves into practical applications.

- Samuels, M.L., Witmer, J.A., and Schaffner, A. A. (2016). Statistics for the Life Sciences, 5th ed., Pearson Education Limited.
- Diez D. M., Çetinkaya-Rundel, M., & Barr, C. D. (2022). OpenIntro Statistics.

Technology/Tools: Calculator, Laptop/Chromebook/iPad Device

Online Resources: We will use Rossman/Chance Applet Collection 2021 of our very own Professors at Cal Poly, Allan Rossman & Beth Chance

Course Schedule



Grading and Assessment

Assessment	Percentage
Attendance and Participation	5%
Weekly Assignments (Individual)	10%
Midterm	15%
Project Presentation (Group)	15%
Lab + Investigation Assignments (Group)	20%
Final Exam	35%
Total	100%

Letter Grades

Your final grades will be determined based on the total points earned. It's essential to review the letter grades outlined below for a clear understanding of the grading criteria. **Please be aware that I will not "round up" grades at the end of the quarter.**

Letter grade	Points
A	$93 \leq x$
A$^-$	$90 \leq x < 93$
B$^+$	$87 \leq x < 90$
B	$83 \leq x < 87$
B$^-$	$80 \leq x < 83$
C$^+$	$77 \leq x < 80$
C	$73 \leq x < 77$
C$^-$	$70 \leq x < 73$
D$^+$	$67 \leq x < 70$
D	$63 \leq x < 67$
D$^-$	$60 \leq x < 63$
F	$x < 60$

Assessment Types

Our weekly units/topics will follow a pattern and have been designed to give you practice with the concepts. Below you will find brief descriptions of the types of assignments in this course.

Attendance and Participation

Your attendance plays a crucial role in your ability to succeed in every type of assessment conducted in our class, as consistent absences may interrupt your learning and indirectly impact your grades. I will record attendance during every lecture, not only for grading purposes, but also to track your learning progress in this class. In case of recurring absences, I will reach out to understand the reasons and work together to find solutions.

Your active involvement enriches our learning environment and enhances everyone's experience. Active involvement isn't about speaking up every day; it's about actively engaging with the material and activities. I respect that everyone learns differently. Whether you're comfortable sharing your thoughts in class or prefer a more reserved approach or seek clarification when needed, your participation is valued and will be recognized. As long as you provide these indicators, you will get the full credit from your participation.

In brief, you must be present in our classroom (both physically and mentally) unless you have an "Excusable" Reason for Missing Class and participate in classroom activities. Please contact with me in advance if you are not coming and do your best to catch up what we have done in that day. You can also come to my office hours or schedule a virtual appointment if you have questions about the missing class you had.

Midterm and Final Exams

Exams are to be taken without the use of textbooks or notes. It is expected that you will take exams as per the scheduled times. In cases of extraordinary circumstances like illness, a family loss, please inform me before the examination. You won't be required to computer for the exams, but you may see some questions that involve filling in missing information, interpreting provided R outputs, or selecting the appropriate code to complete a task.

Here are the due dates of exams:

Mon, Oct 22: Midterm Exam

Sat, Dec 7: Final Exam

> ❗ Important
>
> If you miss one of the key assessments (midterm, group project presentation, and/or final exam) and do not contact your instructor or complete a make-up exam within one week of the deadline for these assessments, your final letter grade will initially be recorded as **"Incomplete"**.
> An incomplete grade indicates that you have not finished all the required coursework. Please contact your instructor with me in advance if you miss any of these key assessments and complete the make-up exam to avoid your incomplete grade turning into an F.

Project Presentation (Group)

The overarching goal of the project in this course is to empower students to become independent learners. This involves actively engaging with the learning process and taking ownership of your academic journey. You will have the opportunity to present a scientific article related to your major and include the following dimensions: (1) summarize the study, (2) identify its research question(s) and statistical procedures used, and (3) evaluate whether the study effectively communicated its findings. This approach not only enhances your understanding of how Statistics is utilized in your field but also fosters a proactive and self-directed approach to learning. Detailed rubric will be provided as a template on your Canvas page.

Wed, Nov 06: Group Presentations (will be uploaded online)

> ❗ Important
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> Your project grade is composed of following components:
> **Project Slides:** 40 points
> **Project Oral Presentation:** 35 points
> **Project Peer Evaluation:** 25 points

Weekly Assignments (Individual)

You will have assignments every week, typically consisting of daily assignments per week. Please upload them collectively, using a format like 'Week X Assignment Name Lastname'.

These assignments are individual assignments to track your learning progress. You can do these assignments either using your PC/Laptop/iPad/Chromebook or solve them to your notebook. Either way, you should upload them to Canvas. All weekly assignments are due **Sundays at 11.59 pm**.

Investigation & Lab Assignments (Group)

Investigation Assignments

There will be 8 investigation assignments, given every Tuesday, to be completed in this course. These assignments will focus on a key statistical concept. You are encouraged to work in groups of ***up to 3 people*** and submit one write-up with all group members' names. ***If your partner is absent on a given day, feel free to join another group.*** All investigation assignments are due **Thursdays by 11:59 p.m.**

Lab Assignments

There will be 8 labs to complete in this course. Most labs should be finished during class time. Make sure to follow the lab write-up instructions carefully.

Lab sessions will be conducted in groups, and lab assignments will also be group assignments. Each group will consist of 2-3 students, who will work together to complete the labs both during and after class. ***If your partner is absent on a given day, feel free to join another group.*** All lab assignments are **due Sundays at 11:59 p.m.**

Important: Please only include the names of group members who actively participated. If a group member is absent, they must either complete the assignment individually or coordinate with their group to finish it together. Feel free to shuffle groups if your partner is absent.

Late Submission Policies

I am using Dr Robinson's late work policy for this class. I do not want class deadlines to cause you extreme stress or anxiety. I offer 3 "grace days" – days to turn in the assignment late without a penalty.

These can be used **ONLY** on weekly assignments (individual), lab assignments and investigation assignments (a single group member must be willing to use one of their grace days for the entire group), but **NOT** exams or the group project. These "grace days" can be used all at once on a single assignment or used on separate assignments throughout the quarter. Simply add a comment on the assignment in Canvas BEFORE THE DEADLINE.

After the expiration of your 'grace days', a 10% grade reduction will be applied for each day that the assignment is overdue. Late submissions **will not be accepted after one week** from the original due date. **Resubmitting assignments is not allowed.**

Accessibility, Diversity and Inclusion

This course was designed to serve students from all diverse backgrounds, places, and perspectives. I view the diversity that participants bring to this classroom as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, religion, country of origin, and culture. Please let me know if there are ways I can improve the effectiveness or experience of this class for you. In addition, if any of the assignment dates conflict with your religious events, please let me know so that we can make arrangements for you.

I have taken numerous steps to ensure that all of the materials presented in this course are accessible to all participants, regardless of physical or learning disabilities. I know that everyone is unique, and I may have unintentionally overlooked something that limits access to some materials or activities. Please let me know if you cannot access any content. If you find you need additional accommodations to complete the required course work, please contact me via email sdemirci@calpoly.edu or come to my office! You can also contact the Disability Resource Center, Building 124, Room 119, at (805) 756-1395.

SensusAccess is a self-service, alternate media solution made available by Kennedy Library to automatically convert files into a range of alternate media including audio books (MP3 and DAISY), e-books (EPUB, EPUB3 and Mobi) and digital Braille. The service can also be used to convert inaccessible files such as image-only PDF files, JPG pictures and Microsoft PowerPoint presentations into more accessible and less tricky formats. This service is available at no charge for all Cal Poly students, faculty, staff and alumni. Also, starting Summer 2021, alternative formats within Canvas have been enabled with Ally. Learn more about Ally's alternative formats.

Disability Accomodations

This course was developed with accessibility in mind; however, if you require accommodations or assistance of any kind, or cannot access materials in the course, or complete an assignment due to a disability, please contact me via email sdemirci@calpoly.edu or come to my office as soon as you can, so I can assist you promptly. If you wish to request disability-related accommodations for this or any other course, please contact the Disability Resource Center. It's important to do this with as much advanced notice as possible, so you have full access to your course materials and activities in a timely manner.

Academic Honesty

Learning thrives in an environment built on trust and respect. The subsequent actions undermine academic integrity, creating obstacles to effective learning:

- Allocating less time than necessary for a satisfactory job.
- Skipping readings or neglecting non-graded activities.
- clicking through course information without thoroughly reviewing resources.

While these behaviors can impact your grade and learning experience, they are personal choices. On the other hand, certain actions go beyond mere 'choices' and breach academic regulations and even legal boundaries. These include:

- Plagiarizing text by directly copying from websites, blogs, other discussions, or published texts.
- Recycling an essay or project previously submitted for another class.
- Engaging in dishonest practices during a test or project.
- Copying directly from another student or source (including AI tools) without proper attribution.
- Purchasing or replicating an essay or project from an online source.

It's crucial to familiarize yourself with the Cal Poly definitions of Cheating and Plagiarism. Take a moment to read this page and understand these concepts. If you're uncertain about citing a source, incorporating a quote, or acknowledging someone in your summaries, I'm here!

On the downside, the college doesn't differentiate between breaking rules intentionally or unintentionally—the consequences remain consistent. In my class, the first instance of misquoting, misrepresentation, or copy/pasting requires a redo of the work and a one-on-one meeting with me. Upon a second occurrence, we meet again, but you won't be allowed to redo the assignment, receiving a zero for that grade. For a third instance, you will not pass the class. Let's take a proactive approach! If you're unsure about citing, don't hesitate to ask!

Artificial Intelligence (AI) Tools Usage Policy

Generative AI tools, which create text, images, code, audio, and other content, are widely available. However, AI tools should not be seen to avoid learning the material, but rather as a tool that can help you master content and produce better results. Keep your academic integrity intact and make sure your own ideas shine through. Always cite AI contributions to maintain academic integrity. AI is allowed for ***certain assignments*** as specified below. ***Otherwise, do not use AI tools.*** If you choose to use generative AI tools, please remember that they may

- be trained on outdated, biased, or copyrighted materials
- result in plagiarism, copyright issues, or inaccuracies

Therefore, you are responsible for ensuring the quality and accuracy of your work, not the AI. When permitted, generative AI use must be properly documented and credited according to APA style. For example:

- OpenAI. (2023). ChatGPT (Mar 14 version) [Large language model]. https://chat.openai.com/chat

Advice:

1. Good prompts lead to better AI results.
2. Always verify AI-generated facts or data.

Assignment Guidelines

Weekly Assignments (Individual) and E: AI use is prohibited.

Midterm and Final Exams: AI use is prohibited.

Project Presentations: You may use AI to understand articles, but your presentation must be original. Attach any AI conversations to your project.

Lab Assignments: You may use AI for coding, but only after attempting the task yourself. Understanding the computer language is essential in this course and you will primarily adjust provided code rather than write from scratch. Attach any AI conversations to your submission.

Investigation Assignments: AI usage is prohibited. I'll be in the classroom and available in my office hours to answer your questions.

Unauthorized use of AI for assignments will be considered a violation of the course's academic integrity policy, and appropriate actions will be taken in accordance with Cal Poly's Academic Dishonesty policy.