Syllabus

STAT 132: Classical and Bayesian Inference
Winter, 2025

Instructor: Dr. Paul Parker
Office Hours: M 10:00-11:00 AM & Tu 10:00-11:00 AM; Engineering 2 Room 541A
E-mail: paulparker@ucsc.edu

Class Times: Tu/Th 8:00-9:35 AM
Location: Natural Sciences Annex 101
Website: Through Canvas

Teaching Assistant: Antonio Aguirre
E-mail: jaguir26@ucsc.edu
Office Hours: TBA

Section A Discussion: M 10:40-11:45 AM; R Carson Acad 242
Section B Discussion: M 12:00-01:05 PM; R Carson Acad 242
Section C Discussion: W 05:20-06:25 PM; Oakes Acad 102

Course Description: This course provides a calculus-based introduction to statistical inference methods, studied from a likelihood-based perspective. Topics include Bayesian inference, maximum likelihood estimation, distributions of estimators, confidence intervals, and hypothesis testing.

Learning Outcomes: After completing this course, successful students will be able to:

1. Understand the process of Bayesian inference and how it differs from classical inference.
2. Construct maximum-likelihood, and Bayesian point estimators.
3. Understand the distributions of classical estimators.
4. Construct interval estimates.
5. Understand the ideas behind hypothesis testing, Type I and II errors, and p-values.

Required Textbook: *Probability and Statistics (4th edition)* DeGroot and Schervish (2018) Pearson.

Prerequisites: STAT 131 or CSE 107.

Assessment:

- **Homework Assignments** - 25% - There will be 5 homework sets due throughout the quarter. Homework will be partially graded on completion and partially graded on correctness. If the entire homework is completed with full effort, you will not earn less than a 70% grade on the assignment.
- **Weekly Canvas Quizzes** - 30% - Most weeks there will be a quiz on Canvas. These will be timed, open book and open note quizzes. Quizzes should be completed by yourself, and no outside resources should be used.
- **Midterm Exams** - 15% each - We will have two in-class midterm exams. These will be in-person and closed book, however you are allowed to bring one single-sided page of handwritten notes/formulas. Electronics such as cell phones, computers, tablets, etc. are not allowed. The midterm exams are tentatively scheduled for Jan. 30 and Feb. 20.
- **Final Exam** - 15% - The final exam will be in-person (Thursday, March 20 from 8:00-10:00am) and closed book, however you are allowed to bring one single-sided page of handwritten notes/formulas. Electronics such as cell phones, computers, tablets, etc. are not allowed.

Grading Policy: You are expected to turn in all assignments and quizzes on time. Extensions will not be given, but I understand that sometimes difficulties happen. To account for this, your lowest quiz score will be dropped. Also, I will allow a 24 hour grace period, where homework assignments/quizzes may still be turned in for full credit. Note that assignments/quizzes will **not be accepted at all** beyond 24 hours past the due date. Finally, if you attend **at least 7 weeks of discussion section**, I will drop an additional quiz.

Attendance: Although no formal attendance will be taken, you are expected to show up to class consistently. There will be regular opportunities for a small amount of extra credit that are only available to students attending lecture for that day.

Grading Scale:

Percentage	Grade
98-100%	A+
93-98%	A
90-93%	A-
88-90%	B+
83-88%	B
80-83%	B-
78-80%	C+
70-78%	C
60-70%	D
<60%	F

Course Expectations: It is critical that you attend the lectures in order to learn the material and demonstrate your knowledge through the in-class quizzes. Students may discuss ideas and strategy for homework problems. Students should never copy solutions from other students or outside sources. For quizzes and exams, students should work by themselves without communicating to other students.

Generative AI: Use of generative AI tools such as ChatGPT or other similar software is not allowed for any reason in this course, and is considered cheating.

Communication: The course webpage (through `Canvas`) will serve as an archive of all materials and announcements. If you email me, I will try to get back to you within 48 business hours. The best way to get in contact with me is either office hours or at the end of class.

Lecture Capture: Lectures will be recorded and uploaded to `Canvas`. Please keep in mind that any questions or comments may be captured in the lecture feed. If you are not comfortable being recorded, please save questions or comments for after class or office hours.

Tentative Schedule:

- Week 1: Understanding inference and the Bayesian approach
- Week 2: Conjugate priors and Bayes estimators
- Week 3: Maximum Likelihood
- Week 4: Sampling distributions
- Week 5: χ^2 distribution and distribution of sample mean/variance
- Week 6: t-distribution and confidence intervals

- Week 7: Unbiased estimators
- Week 8: Hypothesis testing
- Week 9: The t-test and tests for a Normal distribution
- Week 10: Bayesian tests and goodness of fit

Accessibility: UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office hours or by appointment, preferably within the first two weeks of the quarter. At this time, I would also like us to discuss ways we can ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact the DRC by phone at 831-459-2089 or by email at drc@ucsc.edu.

Support for students with other difficulties: While we sincerely hope that you will be able to pursue your studies peacefully and worry-free, we are aware that in some cases difficulties happen that are beyond your control. You should always feel free and comfortable to bring up any problem with the instructor, but if this is not sufficient, or if you prefer professional help, here are several campus resources that you may want to consider contacting:

- UC Care which is a confidential space to discuss issues of dating violence, sexual assault and stalking.
- Slug Support where you can ask for help on many practical issues, including dealing with a financial crisis, problems with your living situation, computers, books, etc.
- CAPS, which provides counseling and psychological services to students.

Academic Integrity: All members of the UCSC community benefit from an environment of trust, honesty, fairness, respect, and responsibility. You are expected to present your own work and acknowledge the work of others in order to preserve the integrity of scholarship. Academic integrity includes:

- Following exam rules
- Using only permitted materials during an exam
- Viewing exam materials only when permitted by your instructor
- Keeping what you know about an exam to yourself
- Incorporating proper citation of all sources of information

- Submitting your own original work

Academic misconduct includes, but is not limited to, the following:

- Disclosing exam content during or after you have taken an exam
- Accessing exam materials without permission
- Copying/purchasing any material from another student, or from another source, that is submitted for grading as your own
- Plagiarism, including use of Internet material without proper citation
- Using cell phones or other electronics to obtain outside information during an exam without explicit permission from the instructor
- Submitting your own work in one class that was completed for another class (self-plagiarism) without prior permission from the instructor.

Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript. For the full policy and disciplinary procedures on academic dishonesty, students and instructors should refer to the Academic Misconduct page at the Division of Undergraduate Education.