BIOSTATISTICS
SCHOOL OF PUBLIC HEALTH

STAT 581: Advanced Theory of Statistical Inference

Fall 2024

CONTACT INFORMATION

Instructor: Andrea Rotnitzky *(she)*, Professor of Biostatistics, Dep of Biostatistics, UW SPH
Contact: arotnitz@uw.edu
Office hours: Wed 11:00 am -12:00 pm on zoom (https://washington.zoom.us/j/99808773554)

Teaching Assistant

Juejue Wang, juejuw@uw.edu *(she)*,
Office hours: Tuesday and Thursday 11:30 am - 12:30 pm on zoom (Canvas)
Quiz section: Tuesday 10:30am-11:20am at JHN 111. Attending quiz sections is optional

Course times and locations

Lecture: Mo 9:30 – 11:20 JHN 111
Wed 9:30 – 10:20 JHN 111

Lectures will be held in person in Johnson Hall 111. They will also be live-streamed over Zoom, and recordings will be made available on Canvas afterwards.

LAND ACKNOWLEDGEMENT

The University of Washington acknowledges the Coast Salish people of this land, the land which touches the shared waters of all tribes and bands within the Duwamish, Suquamish, Tulalip and Muckleshoot nations.

ILLNESS PROTOCOL

If you feel ill or exhibit respiratory or other symptoms, you should not come to class. Seek medical attention if necessary and notify your instructor as soon as possible by email. UW Environmental Health & Safety recommends that you wear a well fitting mask while you are symptomatic
Additional recommendations include getting your annual flu shot and getting boosted with the updated COVID vaccines (available at clinics and pharmacies, as well as through UW Medicine and local health agencies).

Please check your email and CANVAS announcements daily BEFORE coming to class. If we need to conduct class remotely because the instructor or a guest speaker is unable to attend in person, we will send all registered students an email and/or post a CANVAS announcement with a Zoom link for remote instruction or a plan for making up the class.

COURSE DESCRIPTION

This is the first in a three-course sequence on advanced theory of statistical inference. This course covers the foundations of parametric statistics: elementary decision theory, Bayesian methods, modes of convergence, central limit theorems, delta method, maximum likelihood estimation, regularity, hypothesis testing under fixed and local alternatives, parametric efficiency.

PRE-REQUISITES

Required: STAT 513.

Recommended: mathematical analysis from a course at the level of either MATH 426 or STAT 559

REQUIRED READINGS

Textbook: A W Van der Vaart. *Asymptotic statistics*, volume 3. Cambridge university press, 2000

Class slides and handouts

RECOMMENDED TEXTBOOKS AND RESOURCES

Textbook: Lehmann, E. and Casella, G. Theory of point estimation, 2nd Edition, Springer, 1998

Textbook: T S Ferguson. *A course in large sample theory*. Chapman and Hall, 1996

Jon Wellner's notes: https://www.stat.washington.edu/jaw/COURSES/580s/581/lectnotes.18.html

GRADING

• Midterm: 25%. 1 hour and 50 mins **in class** exam on Mon 10/28 during regular course meeting time
• Final: 35%. 1 hour and 50 mins **in class** exam on Wed 12/11 from 8:30-10:20 a.m.

The midterm and final will be open notes and open book. In particular, while taking each exam, you may make use of: course lecture notes, homeworks, homework solutions and course textbooks during exam. You may not make use of any other references, including the internet.

• Homework: 40%.

Homework 1: Assigned 9/30, Due 10/14
Homework 2: Assigned 10/14, Due 10/23
Homework 3: Assigned 10/30, Due 11/18
Homework 4: Assigned 11/18, Due 11/27
Homework 5: Assigned 11/27, Due 12/4

Homework administration and late assignment policy

Homework assignments can be downloaded on Canvas.
Homework will be due on the start of class on the day that it is due. Assignments should be submitted on Canvas.
Assignments may be written by hand or in LaTeX. If the assignment is written by hand, please ensure that

it is legible and that the scan/photograph of the assignment is as clear as possible. If written in LaTex, please submit the compiled document in pdf.
Students are encouraged to seek help from the instructor, TA, or other students with the written homework problems. However, the work that is handed in should reflect only that student's work. That is, obtaining help from other students in order to learn the methods of solution is allowed, but copying another student's answer is not.
The best time to ask the instructor or the TA for help on the assignment is during office hours. However, if you do ask questions by electronically (either on Canvas Discussions or by email), please note that Andrea and Juejue will not respond to electronic queries about assignments on weekends or within 24 hours of an assignment's due date.

Late policy: *While the official late policy might differ, please note that I will be flexible regarding deadlines for students who are experiencing illness. Please contact me (Juejue) on or before the due date if you think you may not be able to complete an assignment or take an exam on the designated schedule due to illness.*

You may use up to three `grace days' during the quarter. For each grace day used, a 24-hour extension will be given on an assignment without any deduction for lateness (Note: this may result in an electronic copy of your assignment being due at 9:30 am on a weekend). Multiple grace days may be used on one assignment. If you use grace days, clearly indicate this at the top of your assignment. Once you have used all of your grace days, late assignments will receive no credit.

TENTATIVE COURSE SESSION SCHEDULE

Date	Day of Week	Topic	Homework Assigned	Homework Due
25-Sep	Wed	Elementary decision theory and Bayes methods		
30-Sep	Mon	Elementary decision theory and Bayes methods	HW1	
2-Oct	Wed	Elementary decision theory and Bayes methods		
7-Oct	Wed	Elementary decision theory and Bayes methods		
9-Oct	Wed	Basic concepts of large sample theory		
14-Oct	Mon	Basic concepts of large sample theory	HW2	HW1
16-Oct	Wed	Basic concepts of large sample theory		
21-Oct	Mon	Maximum likelihood estimation & related tests		
23-Oct	Wed	Maximum likelihood estimation & related tests		HW2
28-Oct	Mon	**MIDTERM**		
30-Oct	Wed	Maximum likelihood estimation & related tests	HW3	
4-Nov	Mon	Maximum likelihood estimation & related tests		
6-Nov	Wed	Maximum likelihood estimation & related tests		
11-Nov	Mon	HOLIDAY		
13-Nov	Wed	Maximum likelihood estimation & related tests		
18-Nov	Mon	Maximum likelihood estimation & related tests	HW4	HW3
20-Nov	Wed	Introduction to lower bounds for estimation		
25-Nov	Mon	Introduction to lower bounds for estimation		
27-Nov	Wed	Introduction to lower bounds for estimation	HW5	HW4
2-Dec	Mon	Introduction to lower bounds for estimation		
4-Dec	Wed	**REVIEW**		HW5

11-Dec Wed **FINAL EXAM**

IMPORTANT POLICIES & RESOURCES

Academic Integrity

Students at the University of Washington (UW) are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity.
The UW School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, unauthorized use of artificial intelligence (AI) tools, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-121). We expect you to know and follow the university's policies on cheating and plagiarism, and the SPH Academic Integrity Policy. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct.

Use of Generative Artificial Intelligence in Coursework

Artificial Intelligence (AI) content generators, such as ChatGPT, present opportunities that can contribute to your learning and academic work. However, using these technologies may also violate academic standards of the University. Under the Student Conduct Code, cheating includes the unauthorized use of assistance, including technology, in completing assignments or exams.

Access and Accommodations

Your experience in this class is important to me. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law. If you have already established accommodations with Disability Resources for Students (DRS), please activate your accommodations via myDRS so we can discuss how they will be implemented in this course.
If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), contact DRS directly to set up an Access Plan. DRS facilitates the interactive process that establishes reasonable accommodations. Contact DRS at disability.uw.edu.

Religious Accommodations

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at **Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/)**. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/).

Inclusion & Diversity

Diverse backgrounds, embodiments and experiences are essential to the critical thinking endeavor at the heart of University education. In SPH, we are expected:

1. To respect individual differences, which may include, but are not limited to, age, cultural background, disability, ethnicity, family status, gender, immigration status, national origin, race, religion, sex, sexual orientation, socioeconomic status and veteran status.

2. To engage respectfully in the discussion of diverse worldviews and ideologies embedded in course readings, presentations and artifacts, including those course materials that are at odds with personal beliefs and values.
3. To encourage students with concerns about classroom climate to talk to their instructor, adviser, a member of the departmental or SPH EDI Committee, the Assistant Dean for EDI, or the program's director.

Classroom Climate

We are co-creators of our learning environment. It is our collective responsibility to develop a supportive learning environment for everyone. Listening with respect and an open mind, striving to understand others' views, and articulating your own point of view will help foster the creation of this environment. We engage our differences with the intent to build community, not to put down the other and distance our self from the other. Being mindful to not monopolize discussion and/or interrupt others will also help foster a dialogic environment.

The following guidelines can add to the richness of our discussion:

- We assume that persons are always doing the best that they can, including the persons in this learning environment.
- We acknowledge that systematic oppression exists based on privileged positions and specific to race, gender, class, religion, sexual orientation, and other social variables and identities.
- We posit that assigning blame to persons in socially marginal positions is counter-productive to our practice. We can learn much about the dominant culture by looking at how it constructs the lives of those on its social margins.
- While we may question or take issue with another class member's ideology, we will not demean, devalue, or attempt to humiliate another person based on her/his experiences, value system, or construction of meaning.
- We have a professional obligation to actively challenge myths and stereotypes about our own groups and other groups so we can break down the walls that prohibit group cooperation and growth. [Adapted from Lynn Weber Cannon (1990). Fostering positive race, class and gender dynamics in the classroom. *Women Studies Quarterly, 1 & 2, 126-134.*]

We are a learning community. As such, we are expected to engage with difference. Part of functioning as a learning community is to engage in dialogue in respectful ways that supports learning for all of us and that holds us accountable to each other. Our learning community asks us to trust and take risks in being vulnerable.

Here are some guidelines that we try to use in our learning process:

- LISTEN WELL and be present to each member of our group and class.
- Assume that I might miss things others see and see things others miss.
- Raise my views in such a way that I encourage others to raise theirs.
- Inquire into others' views while inviting them to inquire into mine.
- Extend the same listening to others I would wish them to extend to me.
- Surface my feelings in such a way that I make it easier for others to surface theirs.
- Regard my views as a perspective onto the world, not the world itself.
- Beware of either-or thinking.
- Beware of my assumptions of others and their motivations.
- Test my assumptions about how and why people say or do things.
- Be authentic in my engagement with all members of our class.

Pronouns

We share our pronouns because we strive to cultivate an inclusive environment where people of all genders feel safe and respected. We cannot assume we know someone's gender just by looking at them. So we invite everyone to share their pronouns.

Bias Concerns

The Office of the Dean has a student concern policy, a faculty concern policy and standard HR procedures for staff concerns. Our 2018 climate survey states that most people in SPH do not report bias incidents because they do not know where to go. Students are encouraged to report any incidents of bias to someone they feel comfortable with, including instructors, advisers or department staff. They can email dcinfo@uw.edu for immediate follow up. Bias concerns can be anonymously and confidentially reported via the online form found here: https://sph.washington.edu/about/diversity/bias-concerns. Data is collected by the Assistant Dean for EDI and the Director of Program Operations for Student and Academic Services and tracked for resolution and areas are identified for further training.

Sexual Harassment

Sexual harassment is a form of harassment based on the recipient's sex that is characterized by:

1. Unwelcome sexual advances, requests for sexual favors, or other verbal or physical conduct of a sexual nature by a person who has authority over the recipient when:
    - Submission to such conduct is an implicit or explicit condition of the individual's employment, academic status, or ability to use University facilities and services, or
    - Submission to or rejection of the conduct affects tangible aspects of the individual's employment, academic status, or use of University facilities.
2. Unwelcome and unsolicited language or conduct that creates an intimidating, hostile, or offensive working or learning environment, or has the purpose or effect of unreasonably interfering with an individual's academic or work performance.

If you believe that you are being harassed, or have observed harassment, you can report it to SPH using the bias concerns link. The University also has designated offices to help you: SafeCampus; Office of the Ombud; Title IX Investigation Office; and University Complaint Investigation and Resolution Office.