# Course Syllabus

## STAT 513: Statistical Inference

## Winter 2024

**Instructor:** Prof. Zaid Harchaoui (zaid@uw.edu; use Canvas to message during quarter)

- Office hour: Thursday 10:30-11:30am via zoom (see Canvas)

**Teaching assistant:** PhD students Medha Agarwal (medhaaga@uw.edu) and Ronak Mehta (ronakdm@uw.edu).

- Monday 05:00pm-06:00pm via zoom (see Canvas)
- Friday 10:00am-11:00am via zoom (see Canvas)

**Course website:** `https://canvas.uw.edu/courses/1698303`

**Class schedule:** There will be two lecture sessions and one quiz session a week:

- (Lecture) TT, 08:30-10:00AM in Dempsey Hall 102
- (Quiz) W, 12:30-01-20pm in Dempsey Hall 102
  - The TAs will review exercises and homeworks during the quiz session.

**Course overview:** This is a 10-week course focused on introducing basic concepts in statistical inference. We start from a touch of data reduction and statistical estimation through sufficient, ancillary, and complete statistics, then move on to the information inequality, MLE, and hypothesis testing, and then move on to an introduction to elementary decision theory.

**Course content:** There are four parts in this course:

- **Principles of data reduction:** sufficient, minimally sufficient, ancillary, complete statistics; Fisher-Neyman Factorization Theorem; Basu Theorem; UMVUE via complete sufficient statistics
- **Elementary inference:** information inequality; the maximum likelihood estimator; consistency and convergence in distribution; nuisance parameter adjustment
- **Elementary hypothesis testing:** Neyman-Pearson Lemma, Neyman-Pearson criterion, likelihood ratio tests, Wald tests, Rao tests
- **Elementary decision theory:** the Bayes estimator, the minimax estimator, admissibility

**Prerequisites:** STAT 512 is a prerequisite for this course. This course requires multivariable calculus (limits, infinite series, partial derivatives, and multiple integrals), linear algebra (vectors, matrices, determinants, inverses, Cauchy-Schwarz inequality, orthogonal and positive definite matrices, eigenvalues), and familiarity with elementary probability theory (MATH/STAT 394-5) and statistical theory (STAT 512) of course.

**Grades:** Your grades come from three parts:

- seven homework assignments (40%)
- a midterm exam (30%)
- a final exam (30%).

University of Washington students are expected to practice high standards of academic and professional honesty and integrity.

**Format of HWs:** There will be 7 homework assignments. Each homework will be out on Thursday and due the next Wednesday before midnight. Homework due date will be explicitly stated on each homework assignment. Homework turned in late will receive 0 point. Each student is allowed 2 deadline extensions total over the quarter. The extension will be 48hrs from the due date. Use these extensions sparingly. You do not need to explicitly request an extension; Canvas will keep track. All homeworks should be submitted via Canvas.

**Format of the exams:** The midterm exam will be held around Weeks 4-5 of the Winter quarter. The final exam will be held around Weeks 10-11 of the Winter quarter.

There will be a midterm and a final exam. They are intended to be take-home and done within 24 hours from their publication. You will need to carefully upload your submissions to canvas. The exams will be open book, though neither access to the internet nor teamwork is allowed for exams; they will be considered as misconduct.

Study groups:

Study groups can be beneficial. Their organization is left to the discretion of students. Support each other and be united in face of conceptual and technical challenges. Write your own answers and submit your own answers. UW students are expected to practice high standards of academic and professional honesty and integrity.

**Course textbook:** This course is built on Professor Michael Perlman's superb lecture notes.

1. M. Perlman, STAT512/STAT513 Course Pack (available on Canvas)

The following book will also be sometimes referenced.

2. G. Casella and R. Berger (CB), Statistical Inference (Second Edition, 2002)

**Teaching modality:** This class was setup by UW as "in-person".

Per UW policy, this class will be conducted in person. Therefore, unless you meet the criteria for an accommodation from Disability Resources for Students (DRS) or a special arrangement approved by a respective office that allows you to take the course remotely, you should only register for this class if you can attend in-person.

- Please contact UW Disability Resources for Students (DRS) directly if you feel you may be eligible for an accommodation based on your status as an immunocompromised individual or based on other diagnosed physical or mental health conditions that might prevent you from being able to take classes in-person.
- If you are a student enrolled in a program in SPH, and you are either living with an individual who is immunocompromised, OR you are unable to obtain a visa to travel to the US, you may be eligible for a "special arrangement" that will allow you to take this course remotely. Requests for special arrangements to take the class remotely should have been submitted to and approved by the Students and Academic Services team in the Office of the Dean before the beginning of the quarter. If you have questions about this type of arrangement, please reach out to Student and Academic Services by email at sphsas@uw.edu.

All UW students are expected to complete their vaccine attestation before arriving on campus and to follow the campus-wide face-covering policy at all times. You are expected to follow state, local, and UW COVID-19 policies and recommendations. If you feel ill or exhibit possible COVID symptoms, you should not come to class. If you need to temporarily quarantine or isolate per CDC guidance and/or campus policy, you are responsible for notifying your instructors as soon as possible by email. If you receive a positive COVID-19 test result, you must report to campus Environmental Health & Safety (EH&S) by emailing covidehc@uw.edu.

**Food is not allowed in the classroom. Drinks may be sipped with lifting or removal of your facemask for a brief moment, and immediate re-masking after drinking.**

**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/)."

**Academic integrity:** The University takes academic integrity very seriously. Behaving with integrity is part of our responsibility to our shared learning community. If you're uncertain about if something is academic misconduct, ask me. I am willing to discuss questions you might have.

Acts of academic misconduct may include but are not limited to:

- Cheating (working collaboratively on quizzes/exams and discussion submissions, sharing answers and previewing quizzes/exams)
- Plagiarism (representing the work of others as your own without giving appropriate credit to the original author(s))

Concerns about these or other behaviors prohibited by the Student Conduct Code will be referred for investigation and adjudication by (include information for specific campus office).

Students found to have engaged in academic misconduct may receive a zero on the assignment (or other possible outcome).

**Course schedule:** The schedule will be kept up to date on the Canvas website

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