STAT 346/446, PQHS 482: Theoretical Statistics II

Case Western Reserve University, Spring 2025

Time and Place: Tue/Thu 10:00 - 11:15, Olin 306

Instructor: Dr. Jenný Brynjarsdóttir,

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Office hours: TBD

Grader: Grader: Congli Ma, cxm769@case.edu

Prerequisites: STAT 345 or STAT 445 or PQHS 481.

Required Textbook

Statistical Inference (Second Edition), by George Casella and Roger L. Berger.

Another good reference:
Probability and Statistics 4td ed, by DeGroot and Schervish

Course Topics

The objective of this course is to introduce to students the mathematical theory of statistical inference, which is fundamentally important for understanding commonly used statistical concepts and methods. We plan to cover the following topics.

- Large sample theory
  - Convergence concepts, Weak Law of Large Numbers, Central Limit Theorem, Delta method
- Point Estimation
  - Method of Moments, Maximum Likelihood Estimation, Comparing statistical procedures (Risk function, Inadmissibility and admissibility, Mean squared error), Properties of Estimators (Unbiasedness, Consistency, Sufficient Statistics, Minimum Variance Unbiased Estimators, Rao-Blackwell Theorem, Completeness, Cramer-Rao lower bound)
- Interval Estimation
  - Pivotal Method, "best" confidence interval, Large sample confidence intervals
- Hypothesis Testing
  - Loss function and Risk, Critical region, Types of errors, Power function, Randomized tests, Size of a test, Testing simple versus simple hypotheses (Most powerful test, Neyman-Pearson Theorem), Simple versus composite hypotheses, composite versus composite hypotheses (one-sided), Likelihood ratio test

Homework

Homework will be assigned almost every week when there is not a Quiz or Midterm Exam scheduled. See the schedule on Canvas for due dates. The assignments will be turned in via Gradescope. Please type your

assignment or write clearly. You could use this opportunity to learn LaTeX! You have to show all your work; no credit will be given for only writing the final answer.

Schedule

A tentative schedule of reading and homework assignments are on Canvas - updated regularly so check often.

Assignments, Exams, and Grades

Homework	15%	There will be 8 homework assignments over the semester worth a total of 80 points. Your points will be tallied in the end and your score will be out of 70 points. (Similar effect as lowest score does not count towards your grade, which will be the setting on Canvas).
Quizzes	25%	There will be four 30-min in-class quizzes worth a total of 80 points. Your total score will be out of 60 points.
Midterm Exam	30%	There is always hope rule: If your grade on the Final Exam is higher that your grade on your Midterm Exam, your Final Exam grade will override your Midterm grade (but not the other way around, Midterm grade cannot override the Final Exam grade).
Final Exam	30%	

See schedule for dates. Grades will be posted on Canvas.

Tentative grading scale: A $\in [90, 100]$, B $\in [80, 90)$, C $\in [70, 80)$, D $\in [60, 70)$, F $\in [0, 60)$. Please note that due to the way the homework grades will be tallied, the total grade calculated by Canvas may not be completely accurate.

Students registered as STAT 446 or PQHS 482

A higher level of mathematical rigor is expected from graduate students. Homework and exams will include different and/or extra problems.