STAT 730: Advanced Theory of Statistics I - Spring 2019

Instructor: Wen Zhou (Email: riczw@stat.colostate.edu), 216 Statistics Building
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Meeting Place and Time: TR 12:00pm-1:50pm, 223H Weber Building (01/22-05/12)
Office Hours: TWR 10:00-11:00am or by appointment
Webpage: We will use the Canvas system.

Midterm Exams: 02/26; 04/09 (T-in class)
Final Exam: 05/15(W), 6:20-8:20pm

Prerequisites: STAT 530 and STAT 720 (or equivalent courses on measure theory, probability theory and statistical inference).

Objectives: The aim of this course is to provide theoretical foundation for modern statistical inference and estimation. It employs the probabilistic and measure theoretic approach to formulate and solve statistical inference problems. Materials will be covered include projection and/or conditional expectation, U-statistics, sufficiency, exponential family, moment estimation, concentration inequalities and their applications, sub-Gaussian and sub-exponential random variables, maximal inequality and their applications, ULLN, complexity, decision theoretic statistics, asymptotic comparison, likelihood-based inference.

Learning Outcomes and Expectations: The students are able to understand the theory behind various statistical estimation and inference techniques and are capable to provide theoretical justification and understanding of statistical methods in practice. The students are highly recommended to spend at least six hours outside of instructional time on reading, homework, and exam preparation.

Textbook (recommended only)

Asymptotic Statistics, A.W. van der Vaart, Cambridge Series in Statistical and Probabilistic Mathematics, 2000.

Theory of Point Estimation, E.L. Lehmann and George Casella, Springer Texts in Statistics, 2nd edition, 1998.

Testing Statistical Hypotheses, E.L. Lehmann, Springer Texts in Statistics, 1997.

Statistical Decision Theory and Bayesian Analysis, J.O. Berger, Springer Series in Statistics, 1993.

Weak Convergence and Empirical Processes: With Applications to Statistics, A.W. van der Vaart and J. Wellner, Springer Series in Statistics, 2000.

Mathematical Statistics, J. Shao, Springer Texts in Statistics, 2007.

Topics (temporary list)

- Projection, conditional expectation, U-statistics
- Exponential families
- Concentrations, maximal inequalities
- Statistical decision theory: sufficiency, factorization theorem, admissibility, Bayes
- Introduction to ULLN, consistency, entropy arguments
- Unbiasedness: UMVUE, information inequality, shrinkage

- Introduction to the minimax framework under asymptotics
- Theory for likelihood estimation

Course Work

Homework: Homework will be assigned approximately every week (it will be assigned on Thursday in general and due on the following Friday), and each assignment will carries equal weight.

Exams: There will be two midterms (temporarily and subject to change according to the course progress) and a comprehensive final exam.

Grading: Homework (20%), midterms (40%), and final exam (40%). There is no quota or limit to the number of potential A's or any other grade.

Course Policies

1. Late homework: No credit unless a prior permission is granted.

2. Exam conflicts: Requires prior permission *and* prior testing only. *Under no circumstances* (aside from University requirements) will changes to the final exam time be permitted; plan accordingly.

3. Any grading dispute must be submitted in writing to me within one week after the work is returned. No changes will be made after this deadline.

4. **Academic honesty**: It is important that your course work represents only your ideas. I encourage discussion of homework in broad, conceptual terms where one student is trying to educate another without giving away the answer. Copying solutions or computing code from other students or other sources is plagiarism. At a minimum, all students involved will receive a 0 on the assignment in question for any type of academic dishonesty.

5. Resources for Disabled Students: Support and services are offered to student with functional limitations due to visual, hearing, learning, or mobility disabilities as well as to students who have specific chronic health conditions. See the Resources for Disabled Students web page for more information (rds.colostate.edu). If you need specific accommodations due to a disability, please meet with me outside of class to discuss your needs as early in the semester as possible. In accordance with RDS procedures, accomodations must be arranged in advance–no retroactive remedies are allowed.

Disclaimer The instructor reserves the right to make amendments to the syllabus and schedule as the semester develops. It is your responsibility to attend lectures and keep track of the proceedings.