STAT 730: Advanced Theory of Statistics I - Spring 2017

Instructor: Wen Zhou (Email: riczw@stat.colostate.edu), 208 Statistics Building
Meeting Place and Time: TR 11:00am-12:40pm, 223H Weber Building (01/17-05/07)
Office Hours: TR 10:00-11:00am or by appointment
Webpage: `http://www.stat.colostate.edu/~riczw/teach/STAT730_S17/Stat730.html`

Midterm Exams: 02/21 Or 02/22 (T or W); 04/04 Or 04/05 (T or W) (Midterm time are up to change)
Final Exam: 05/11(Th), 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 of statistical inference and estimation. It employs the probabilistic and measure theoretic approach to formulate and solve statistical inference problems. Materials will be (or attempt to be) covered include projection, U-statistics, concentration inequalities, large deviations, empirical processes, ULLN, sufficiency, minimal sufficiency, decision theoretic statistical inference (minimax estimation, Bayes estimation, admissibility, shrinkage, etc.), UMVUE, information theoretic inference, large sample theory, asymptotic properties of maximum-likelihood methods, Neyman-Pearson theory.

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 three 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.

Theory of Statistics, M.J. Schervish, Springer Series in Statistics, 1996.

A Course in Large Sample Theory, T.S. Ferguson, Chapman & Hall, 1996.

Topics (**temporary list**)

- Projection, introduction to nonparamtric statistics
- Exponential families
- Statistical decision theory: sufficiency, factorization theorem, admissibility, minimax, Bayes
- Unbiasedness: UMVU estimators, information inequality, shrinkage

- Large sample theory
- Maximum likelihood estimation
- Minimax framework under asymptotics
- Hypothesis testing: Neyman-Pearson theory, UMP hypothesis testing, unbiasedness tests
- Introduction to empirical processes: ULLN, consistency, Donsker's class (if time allows)

Course Work

Homework: Homework will be assigned approximately every week except the week before exams (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.