THE UNIVERSITY OF ILLINOIS
Department of Statistics
STATISTICS 510
Mathematical Statistics I
Fall 2016

Instructor information:
Xiaofeng Shao, Ph.D.
Professor
104D Illini Hall
Webpage: publish.illinois.edu/xshao
Office hours: Monday 1:45pm-2.45pm and Thursday 1:30-2.45pm or by appointments

Teaching assistant information:
Runmin, Wang, Ph.D. student, (rwang52@illinois.edu)
Discussion and Office Hours: 1-2.30pm Tuesday, conference room (Illini Hall 122).

Time and Location: MWF: 10:00-10:50am, 161 Noyes Laboratory.

Required Book and Notes:

Casella and Berger (2002) Statistical Inference. 2nd edition.

John Marden's Notes for Mathematical Statistics. Available online.

Supplementary Textbooks:

Lehmann, E. L. and Casella, G. (1998) Theory of Point Estimation. 2nd Edition.

Ferguson, T. S. (1996) A Course in Large Sample Theory.

Mukhopadhyay, N. (2000) Probability and Statistical Inference.

Pre-requisites: STAT410 with a grade of B or above, or equivalent. In particular, students should be familiar with basic undergraduate probability and statistics, including the topics listed below.

1. Basic properties of probabilities, random variables, probability mass/density functions, cumulative distribution functions.
2. Binomial, Beta, geometric, hypergeometric, Poisson, and negative binomial distributions. Gaussian, uniform, and exponential distributions.
3. Joint probability mass/density functions, independence, conditional distribution.
4. Expected values, moments, variance and covariance. Transformations, multivariate normal distribution.
5. Basic matrix algebra.

Equivalent to most of Chapters 1-8 of Marden's notes.

Tentative course content

- Statistical Models, Inference
- Sufficiency, Minimal Sufficiency, Completeness, Ancillarity, Rao-Blackwell Theorem
- Estimation (method of moment, likelihood, least squares, posterior distribution), Unbiased Estimation, UMVUE, Normal one-sample problem, Fisher information and Cramer-Rao bound, Stein's estimator
- Exponential families, location families and shift equivariance, Pitman estimator.
- Bayesian estimation, decision-theoretical approach, risk, admissibility, minimax procedure.
- Asymptotics: convergence in probability, in distribution.
- Consistency and asymptotic normality of MLE, asymptotic (relative) efficiency.

Grading:

1. Weekly/Biweekly Homework. 30% (the homework set with the lowest percentage will be dropped).
2. Midterm exam: on Wednesday, October 26th, in class. 20%
3. Final exam: 1:30-4:30pm, Wednesday, December 14 (50%),
4. A grade of $A+$ will be awarded to the student whose average is at least 98% and has the highest average in the class.

Notes:

1. All exams are cumulative.
2. No special make up exam is given for any of the exams that are missed except for extreme health problems. Proper documentation should be provided (e.g. a doctor's certificate ordering you to stay in the hospital or at home).
3. Problem sets must be handed at the beginning of the lecture on the day that they are due. Late problem sets cannot be accepted.
4. Discussion of homework problems is encouraged, but solutions must be written up individually. Direct copying is not acceptable.

5. If there is an error in the homework or exam grading, you need to contact Runmin or me right after the homework or exam paper is returned. The grade won't be changed if it is beyond one week.

6. If you want to ask questions about this course during my office hour, please knock in. For other time, please send me an email beforehand and make an appointment.

Problem Sets (see course website). I will update the problem set after each class. Due date will be announced at least one week ahead. You are required to do all the listed problems. Show all solutions explicitly.