STAT 643:
Advanced Theory of Statistical Inference
Fall 2016

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Lecture: MWF 9:00-9:50 AM, Gillman 0312

Textbook: No single book will serve as the text for this course but the following are relevant references (at difference levels) for course material:

1. *Theory of Statistics* by Schervish (1995, Springer)
2. *Mathematical Statistics* by Shao (1999, Springer)
3. *Theory of Point Estimation* by Lehmann & Casella (1988, Springer)
4. *Testing Statistical Hypotheses* by Lehmann (1997, Springer)
5. *Mathematical Statistics* by Knight (2000, Chapman Hall)
6. *Mathematical Statistics* (Volumes I & II) by Doksum & Bickel (2015, Chapman Hall)

Prerequisites: STAT 543, STAT 642

Student Learning Outcomes: The course is intended to empower students through advanced training in fundamental principles underlying statistical inference. Students will learn, and be able to apply, statistical concepts related to likelihoods and elements of statistical decision theory.

Course Content

The course aims to cover the following topics:

1. Sufficiency and Related Concepts
   (a) Sufficiency and Factorization Theorem
   (b) Minimal Sufficiency
   (c) Ancillary Statistics & Complete Statistics
2. Facts about Common Statistical Models
   (a) Bayes Models
   (b) Exponential Families of Distributions
   (c) Measures of Statistical Information (e.g., Fisher & Kullback-Leibler Information)
3. Statistical Decision Theory
   (a) Basic Framework & Concepts
   (b) Geometry (finite-dimensional) of Decision Theory
   (c) Complete Classes of Decision Rules
   (d) Minimax Decision Rules
4. Asymptotics of Likelihood Inference
   (a) Consistency & Asymptotic Normality of Likelihood-based Estimators
   (b) Asymptotics for Likelihood Ratio-type Test Statistics and Related Confidence Regions
   (c) Asymptotic Shape of the Log-likelihood and Related Bayesian Asymptotics
5. Optimality in Finite Sample Point Estimation
   (a) Unbiasedness & "Information" Inequalities
6. Optimality in Finite Sample Testing

Time-permitting other topics may include generalized estimating functions, empirical processes, and/or resampling.

Course Information

Homework: Homework assignments (4-5 assignments) will be assigned throughout the semester to provide opportunities for practice and application. Both the homework problems and their solutions will be posted on the course website. About one set of homework problems will be assigned about every two weeks.

Exams: There will be one midterm exam, which will most likely be administered at an evening time (e.g., 7-9 PM on a Thursday). You may use a calculator and formula sheets for the exams (more details later with at least a two week notification prior to the exam date announcement).

Grading: Grades will be based on the following criteria:

Component	**Weight**	**Tentative Date**
Homework	30%	
Midterm Exam*	35%	Tentatively, Thursday, October 13th
Final Exam	35%	Monday, Dec 12, 7:30-9:30 A.M.

* Please note that the date for the midterm exam is tentative and may be changed based on the pace of the course. The final exam date/time are set by the university. You will always be given sufficient notice of an exam. Locations of exams are to be announced.

ISU Blackboard: Students can keep track of their grade scores and access all other class material through a Blackboard page for STAT 643. To enter Blackboard, go to "http://www.iastate.edu" and click on "Blackboard". Then enter your ISU username and ISU password (you should have both if you have an ISU email address).

General ISU Policies for this Course

Academic Dishonesty
The class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office.
http://www.dso.iastate.edu/ja/academic/misconduct.html

Disability Accommodation
Iowa State University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please contact Prof. Nordman to set up a meeting within the first two weeks of the semester or as soon as you become aware of your need. Before meeting with Prof. Nordman, you will need to obtain a SAAR form with recommendations for accommodations from the Disability Resources Office, located in Room 1076 on the main floor of the Student Services Building. Their telephone number is 515-294-7220 or email disabilityresources@iastate.edu . Retroactive requests for accommodations will not be honored.

Dead Week (the last week of the semester prior to final exam week)
This class follows the Iowa State University Dead Week policy as noted in section 10.6.4 of the Faculty Handbook
http://www.provost.iastate.edu/resources/faculty-handbook.

Harassment and Discrimination
Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, Student Assistance at 515-294-1020 or email dso-sas@iastate.edu , or the Office of Equal Opportunity and Compliance at 515-294-7612.

Religious Accommodation
If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request. You or your instructor may also seek assistance from the Dean of Students Office or the Office of Equal Opportunity and Compliance.

Contact Information for any Issues Above
If you are experiencing, or have experienced, a problem with any of the above issues, email academicissues@iastate.edu .