

STAT-S 721 - Advanced Statistics I

Instructor:	Daniel McDonald Office: Statistics House 200 Phone: 812-856-7820 email: dajmcdon@indiana.edu
Office Hours:	TBA (Suggest Tuesdays 1:30-2:30), or by appointment
Course Web Page:	http://mypage.iu.edu/~dajmcdon/teaching/2012fall/s721/
Lectures:	TR 11:15–12:30, GY 407
Text:	CASELLA, G. AND BERGER, R. L. (2002), <i>Statistical Inference</i> , Springer, 2 edn.
Prerequisite:	A thorough understanding of calculus

Course Objective:

This course will cover the basics of probability theory necessary for and understanding of statistical inference (no measure theory). It will focus mainly on the material covered in Chapters 1–5 of Casella and Berger — probability distributions, expectations, moment generating functions, characteristic functions, modes of convergence — with additional material to supplement as time permits. This course should prepare you for more advanced courses in the statistics department as well as introduce you to a handful of modern theoretical tools useful for statistical research.

Lectures:

Class time will consist of a combination of lecture, discussion, questions and answers, and problem solving. You are strongly encouraged to attend lectures on a regular basis. Note that the lectures will cover some material that is not covered in the text (or is covered in a slightly different order). Only the combination of class lectures, homework sets, and your own reading will give you full exposure to the material and better understanding and appreciation of it.

Textbook:

The textbook for this class is the standard reference for statistical concepts at this level, and it is very good. I strongly recommend it. Additional material will likely come from the following sources:

- WASSERMAN, L. (2004), *All of Statistics: A Concise Course in Statistical Inference*, Springer.
- DASGUPTA, A. (2008), *Asymptotic Theory of Statistics and Probability*, Springer.

Grading:

30% : Test I (October 11)
20% : Test II (November 15)
10% : Test III (December 11, 10:30am Final Exam)
40% : Homework

Homework:

- There will be homework assignments every week. They will be due on Thursdays. Homeworks are due in class before lecture begins. Late homework is unacceptable unless special arrangements are made.
- Homeworks and their solutions will be available on the course website. Please submit legible, stapled paper copies of your homework. I will not accept electronic copies unless you have cleared it with me in advance.
- Unless otherwise instructed, I encourage you to discuss assignments with other students. The best way to work with others on homework is to do as much as you can on your own before discussing the problems. While I encourage you to work together, the written solutions to homework problems must be your own and not copied from someone else. You must give credit to all collaborators on your assignments.

Exams:

All exams are closed book. It is my intention to cover Chapters 1-4 before the first exam. The second exam and “final” will cover more interesting material. The exams will not be cumulative per se.

Vague Schedule:

Date	Tues.	Thurs.
8/21 & 8/23	Set theory (C&B 1.1)	VC-dimension (extra)
8/28 & 8/30	Probability (C&B 1.2.1-1.2.2, 1.3)	RVs, CDFs, PDFs (C&B 1.4, 1.5)
9/4 & 9/6	Expectations (C&B 2.1, 2.2)	Moments (C&B 2.3)
9/11 & 9/13	Characteristic functions	Families of Distributions (C&B 3.1-3.3)
9/18 & 9/20	Exponential families, location scale families (C&B 3.4-3.5)	
9/25 & 9/27	Multiple random variables (C&B 4.1-4.3)	
10/2 & 10/4	Multiple random variables (C&B 4.4-4.6)	
10/9 & 10/11	Review	Exam 1
10/16 & 10/18	Probability inequalities and identities (C&B 3.6 and 4.7)	
10/23 & 10/25	More probability inequalities (extra)	Convergence (C&B 5.5)
10/30 & 11/1	Asymptotic notation	Concentration of Measure (extra)
11/6 & 11/8	Random samples, etc. (C&B 5.1, 5.2, 5.3 (some), 5.4)	
11/13 & 11/15	Review	Exam 2
11/20 & 11/22	Thanksgiving (no classes)	
11/27 & 11/29	Return to VC-dimension and learning theory	
12/4 & 12/6	Rademacher complexity	Review
12/11	Exam 12:30-2:30	