STA 293A.01: Asymptotic Statistics and Empirical Processes

Fall 2006

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Time & Place: W&F, 10:05-11:20, Old Chem 025
Office Hours: F, 1:00-3:00, Old Chem 223 B

Summary:
The special topic class is composed of two sections: Asymptotic Statistics and Introduction to Empirical Processes. The first section is from 08/30-10/18 (15 Lectures). The second section is from 10/20-12/01 (11 lectures). You may choose to take one of them or both. No matter how many sections you have taken, the maximum credits you can get are two.

Asymptotic statistics is the study of large sample properties and approximations of statistical tests, estimators and procedures. In general, the goal is to learn how well a statistical procedure will work in a variety of settings much more diverse than what we can even begin to simulate. Hence the most critical goal of asymptotic research is to verify the validity of statistical procedures in useful generality. Topics we will cover include functional delta method, the bootstrap, rates of convergence for nonparametric estimators, M-estimators, Z-estimators, Bayesian procedure, and many other areas.

The goal of second section is to introduce students with a background in mathematical statistics, to empirical processes. These powerful research techniques are surprisingly useful for studying large sample properties of statistical estimates from realistically complex models as well as for developing new and improved approaches to statistical inference. The course will develop in each student the technical skills to enable application of empirical process and semiparametric methods in statistics. Other areas to be covered include stochastic convergence in metric spaces, Brownian motion and Brownian bridges, Gaussian Processes, Glivenko-Cantelli and Donsker theorems and emtropy calculations.

Prerequisites: STA 205, STA 215

Required Text:
van der Vaart (1998), *Asymptotic Statistics*, Cambridge U. Press
van de Geer (2000), *Empirical Processes in M-estimation*, Cambridge U. Press.
Kosorok, M.R. (to appear), *Introduction to Empirical Processes and Semiparametric Inference* (download from www.stat.wisc.edu/~kosorok), Springer, New York.

Recommended Text:
van der Vaart and Wellner, J. A.(1996), *Weak Convergence and Empirical Processes: With Applications to Statistics*, Springer, New York.
Barndorff-Nielsen, O. E. and Cox, D. R., (1994), *Inference and Asymptotics*, Chapman and Hall, London.
Pollard, D. (1990), *Empirical Processes: Theory and Applications.* NSFCBMS Regional Conference Series in Probability and Statistics 2. Institute of Mathematical Statistics and American Statistical Association, Hayward, California.
Hall, P. (1992), *The Bootstrap and Edgeworth Expansion*, Springer, New York.

Assignments:
Section I:
There will be one homework assignment and one project. **You must do all homework problems on your own, although you may discuss the problems with other students. Copying assignments or answer keys is not acceptable and is considered a violation of academic integrity. Assignments must be turned in on time for credit.**

Project
For this project, you need to choose a recent statistical article **(published since 2002)**, which utilizes large sample statistical theory. Make sure that the chosen paper can provide some information about potential research projects. **To get full credit, you must get advance approval from me for the paper you select. Identify 1–3 promising problems and/or research questions which could be of interest to the statistical community and which involve large sample statistical theory.** Write a 2–3 pages summary of your findings and include an evaluation of the potential impact if the proposed research were successful.

Section II:
There will be one homework assignment. **You must do all homework problems on your own, although you may discuss the problems with other students. Copying assignments or answer keys is not acceptable and is considered a violation of academic integrity. Assignments must be turned in on time for credit.**

Course Schedule (Due dates are exact, topics are approximate)

Section I:

Date	Topic	Chapters (V or K)	Due Date
08/30	Introduction	V 1-2	
09/01	The Functional Delta Mehtod	V 3	
09/06	M-estimator and Z-estimator	V 5.1-5.7	
09/08	``		
09/13	``		
09/15	Nonparametric Density Estimation	V 24	
09/20	Efficiency of Estimators	V 8	
09/22	Bayesian Procedures	V 10	
09/27	Projections	V11	
09/29	Quantiles and Order Statistics	V21	
10/04	L-Statistics	V22	
10/06	U-Statistics	V12	HWK-1
10/11	Contiguity	V6	
10/13	Likelihood Ratio Tests	V 16	
10/18	``		PROJECT

Section II:

Date	Topic	Chapters (V or K)	Due Date
10/20	Preliminaries for Empirical Processes	VV 18, VG 1, 2	
10/25	``		
10/27	Stochastic Convergence		
11/01	``		
11/03	Empirical Processes Methods	VV 19, VG 3,4,6, K 2	
11/08	Maximal Inequalities		
11/10	``		
11/15	``		
11/17	``		HWK-2
11/29	``		
12/01	``		