

Units:	3
Term:	Spring 2016
Time:	Tu, W 5-6:30pm
Location:	USC HSC, Soto Building Room 117
Instructor:	Meredith Franklin
Office:	SSB 202A
Office Hours:	By Appointment
Contact Info:	meredith.franklin@usc.edu 323-442-2703 (office)

Course Description

PM522b follows PM522a with a rigorous introduction to statistical inference. The sequence PM522a-b is required for all the Biostatistics Ph.D. and M.S students, and is suggested for quantitatively oriented students in Epidemiology and other population-based sciences. Topics covered in 522b include the theoretical approaches to point estimation, evaluation of estimators, likelihood methods, numerical solutions to likelihood, hypothesis testing, and theoretical basis behind ANOVA and regression.

Learning Objectives

Through this course, students will become familiar with commonly used inferential techniques. We will cover:

- the basic theoretical foundations of point estimation including method of moments and maximum likelihood
- properties of estimators
- the theory of hypothesis testing
- the theory of interval estimation
- asymptotic theory
- analysis of variance and linear regression

Prerequisite(s): PM522a

Recommended Preparation: courses in linear algebra and calculus

Course Notes

Lecture notes presented in class will be posted on Blackboard.

Technological Proficiency and Hardware/Software Required

There will be some computation using R (downloaded from <http://cran.r-project.org>)

Required Readings and Supplementary Materials

Required text:

- 1) George Casella and Roger L. Berger *Statistical Inference, 2nd edition* (2002), Brooks/Cole.

Description and Assessment of Assignments

Assignments: There will be 6 assignments given throughout the semester, approximately every two weeks. Students may discuss the problems with one another, however, individual solutions must be submitted and copying will not be tolerated. Late assignments will be penalized by 20% for each day past the due date.

Exams: There will be two in-class exams (midterm 2hrs, final 3hrs). A one-page “cheat sheet” will be allowed in both exams.

Participation: We will work through problems in class, and students are expected to participate through in-class discussion and writing solutions on the board.

Grading Breakdown

<u>Assignment</u>	<u>% of Grade</u>
In-class participation	5%
Homework Assignments (7)	25%
Midterm Exam	30%
Final Exam	40%
TOTAL	100%

Assignment Submission Policy

Assignments shall be submitted on Blackboard. Late homework assignments will not be accepted without penalty, except when verifiable extenuating circumstances can be demonstrated.

Course Schedule: A Weekly Breakdown

	Topics/Weekly Activities	Deliverable/ Due Dates
Week 1 January 11	Intro to statistical inference, review of random variables, random samples, order statistics	
Week 2 January 17	Principles of data reduction: statistics, sufficiency principle, likelihood principle	
Week 3 January 24	Principles of data reduction con't: minimum sufficient statistics, exponential family	
Week 4 February 1	Methods for finding point estimators: maximum likelihood estimation	HW1 Due
Week 5 February 8	Methods for finding point estimators: numerical solutions to maximum likelihood estimation, EM algorithm	
Week 6 February 15	Methods for finding point estimators: moment generating functions, method of moments	HW2 Due
Week 7 February 22	Evaluating estimators: bias, mean squared error, best unbiased estimators (MVUE), the Cramer-Rao lower bound	
Week 8 March 1	Evaluating estimators: Cramer-Rao (con't) the Rao-Blackwell & Lehmann-Scheffe Theorems Midterm Review	HW3 Due
Week 9 March 8	Midterm Exam (2 hours)	Midterm Exam
Week 10 Spring Break	No Class	
Week 11 March 22	Hypothesis testing: simple and composite hypotheses, type I & type II error, p-values	
Week 12 March 29	Hypothesis testing: likelihood ratio test, Neyman-Pearson lemma	HW4 Due
Week 13 April 5	Interval estimation: confidence intervals, upper and lower bounds, coverage probabilities	
Week 14 April 12	Asymptotics: point estimators, rates of convergence, consistency, efficiency, asymptotic normality	HW5 Due
Week 15 April 19	Theoretical concepts behind ANOVA and linear regression	
Week 16 April 26	Matrix representation of linear regression Final Review	HW6 Due
FINAL May 10	In class final exam (3 hours)	Final Exam

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu/> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.