STA 601-001: Theory of Statistical Inference II   Spring 2007
Course Information and Syllabus Document   Dr. Charnigo

Contact information

<u>Instructor</u>: Dr. Richard Charnigo
<u>Office</u>: 851 Patterson Office Tower   and 203-B College of Public Health
<u>Phone</u>: 859.257.2550   and 859.257.5678 x 82072
<u>E-Mail</u>: richc@ms.uky.edu   and RJCharn2@aol.com
<u>Home Page</u>: (www.ms.uky.edu/~richc)
<u>Office Hours</u>: 2:15 to 3:45 p.m. on Wednesdays in *203-B College of Public Health*,
          beginning Wednesday 17 January. There may be one or two cancellations
          during the semester, of which I will try to inform you in advance.

About this course

<u>Official Catalog Description</u>: Elements of decision theory; properties of estimators; point
and interval estimation; hypothesis-testing; sequential testing; inference from categorical
data; linear regression as conditional expectation; multivariate normal distribution.

<u>Main Objectives</u>:
1. You will enhance your existing knowledge in the following areas: convergence
concepts and problem-solving, especially with Slutsky's theorem and the delta method;
finding minimal sufficient, ancillary, and complete statistics; deriving and evaluating
Bayesian estimators; and, deciding whether unbiased estimators have minimal variance.
2. You will learn about general concepts in hypothesis testing (size, power, unbiasedness)
and how to construct likelihood ratio tests, Bayesian tests, union-intersection tests, and
intersection-union tests. You will also learn what uniformly most powerful tests are and
how to derive them.
3. You will learn about general concepts in interval estimation (confidence coefficient,
probability of false coverage, unbiasedness) and how to construct interval estimates by
inverting test statistics, employing pivotal quantities, pivoting cumulative distribution
functions, and Bayesian modeling. You will also learn what uniformly most accurate
intervals are and how to derive them.
4. You will learn about the asymptotic properties of consistency and efficiency. You will
also learn the standard asymptotic results on maximum likelihood estimators, the
standard asymptotic results on likelihood ratio tests, the Wald approach to large-sample
inference, and the score approach to large-sample inference.

<u>Textbook</u>: Casella and Berger (2002). *Statistical Inference*, second edition. Pacific
Grove, CA: Duxbury.

<u>Prerequisite</u>: STA 532.

Course policies and logistics

Class Meetings: We will meet in CB 307 on Mondays, Wednesdays, and Fridays from 1:00 to 1:50 p.m. except on Monday 15 January, during the week of Monday 12 March, and on Friday 27 April. ***We will meet from 12 Noon to 1:50 p.m. on Friday 20 April for a comprehensive examination "drill" that will count for 15% of your grade. Please note that there is no conflict with STA 624 since Dr. Yoshida relinquished that time.***

E-mail Memoranda and Course Materials: I will send e-mail memoranda to distribute course materials, post grade information, and make announcements. Course materials will also be available from (www.ms.uky.edu/~richc/STA601S07). Please inform me if you are not receiving the memoranda.

Written Assignments: There will be six written assignments for you to prepare outside of class, tentatively due at the end of class on Friday 02 February, Friday 16 February, Friday 02 March, Monday 19 March, Monday 02 April, and Monday 16 April. You are encouraged to work in self-selected groups of two or three, handing in one copy of the assignment for the group; however, you may work individually if you wish. Written assignments are to be submitted in hard copy and to me in person unless you have approval to do otherwise.

Examinations: There will be a take-home midterm examination due on Wednesday 07 March at the end of class and a take-home final examination due on Wednesday 02 May at 1 p.m. Both examinations are to be submitted in hard copy and to me in person or under the door of 851 *Patterson Office Tower* unless you have approval to do otherwise. ***The examinations are strictly individual activities. Collaborations with classmates are not permitted. Moreover, consultations with other faculty members or graduate students are not permitted.***

Comprehensive Examination Drill: There will be a comprehensive examination drill from 12 Noon to 1:50 p.m. on Friday 20 April. The drill will resemble the inference part of the departmental comprehensive examination in basic content, style, and format. The drill will be closed-book and closed-notes unless the department revisits that aspect of the comprehensive examination prior to Friday 20 April.

Ancillary Materials: Written assignments from last year and complete solutions to these assignments are available from (www.ms.uky.edu/~richc/STA601S06). You are advised to treat the exercises on these assignments as practice problems to supplement this year's assignments. Also, I have posted the inference part of last year's departmental comprehensive examination among this year's course materials.

Grading: Your grade for the course will be determined by the written assignments (30%), the midterm examination (25%), the final examination (30%), and the comprehensive examination drill (15%). There may be opportunities to earn bonus points (e.g., for finding mistakes in course materials or for outstanding participation). The cutoff for an "A" will be no higher than 90%, the cutoff for a "B" will be no higher than 75%, and the cutoff for a "C" will be no higher than 60%.

Attendance Policy: I do not have an attendance policy *per se*, although for your own sake you are advised to attend consistently.

Late Policy: Cases involving any of the following will be handled individually: University-excused absences, University-prescribed academic accommodations, recommendations for special consideration from the office of an appropriate Dean or the Ombud. Otherwise, late work will be accepted at 75% credit if submitted within 24 hours. If you are submitting late work, please leave it under the door of 851 *Patterson Office Tower* and send me an e-mail so that I know to check for it.

Accommodations: If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (www.uky.edu/TLC/grants/uk_ed/services/drc.html). If you have not already done so, please register with the Disability Resource Center (Room 2 Alumni Gym, 257-2754, jkarnes@uky.edu) for coordination of campus disability services available to students with disabilities.

Academic Honesty: The Department of Statistics, the College of Arts and Sciences, and the University of Kentucky place a premium on academic honesty. Please refer to the University of Kentucky Student Rights and Responsibilities document (www.uky.edu/StudentAffairs/Code/part2.html).

Unforeseen Contingencies: If an unforeseen contingency requires additional course policies, or if I must correct a genuine error in the statement of course policies or due dates, you will be promptly notified in an e-mail memorandum.

Tentative syllabus

Dates	Topics (Relevant sections of the textbook)
10 January, 12 January	Convergence concepts and problem-solving, especially with Slutsky's theorem and the delta method (5.5)
17 January, 19 January	Finding minimal sufficient, ancillary, and complete statistics (6.2)
22 January, 24 January	Deriving and evaluating Bayesian estimators: conjugate priors, loss and risk functions, Bayes risk, Bayes rules (7.2, 7.3)
26 January, 29 January, 31 January	Deciding whether unbiased estimators have minimal variance: Cramer-Rao lower bound, completeness, correlation with noise (7.3)
02 February, 05 February, 07 February	Introduction to hypothesis testing: basic framework, likelihood ratio tests, Bayesian tests (8.1, 8.2)
09 February, 12 February, 14 February	Other hypothesis tests and important concepts: union-intersection tests, intersection-union tests, size, power, unbiasedness (8.2, 8.3)
16 February, 19 February, 21 February	Deriving uniformly most powerful hypothesis tests: Neyman-Pearson lemma, monotone likelihood ratios, Karlin-Rubin theorem (8.3)
23 February, 26 February	Additional elements of hypothesis testing: p-values, loss and risk functions (8.3)
28 February, 02 March, 05 March	Introduction to interval estimation: basic framework, confidence coefficient, inverting a test statistic, employing pivotal quantities (9.1, 9.2)
07 March, 09 March	Other interval estimates and important concepts: pivoting cumulative distribution functions, Bayesian intervals, probability of false coverage, unbiasedness (9.2, 9.3)
19 March, 21 March	Deriving uniformly most accurate interval estimates (9.3)
23 March, 26 March, 28 March	Additional elements of interval estimation: minimizing the length, highest posterior density regions, loss and risk functions (9.3)
30 March, 02 April	Consistency: definition, role of mean squared error, consistency of maximum likelihood estimators, limiting versus asymptotic variance (10.1)
04 April, 06 April	Efficiency: definition, concept of relative efficiency, efficiency of maximum likelihood estimators (10.1)
09 April, 11 April, 13 April	Asymptotic behavior of the likelihood ratio test statistic and likelihood-based interval estimation (10.3, 10.4)
16 April, 18 April	Wald and score approaches to large-sample inference (10.3, 10.4)
20 April	***Comprehensive Examination Drill from 12 Noon to 1:50 p.m.***
23 April, 25 April	Discussions of weaknesses noted in the Comprehensive Examination Drill