Course Data

Number: PHST 762  
Title: Advanced Statistical Inference  
Department: Bioinformatics and Biostatistics  
School: Public Health and Information Sciences  
Status: Approved  
Last taught: N/A  
Next Offered: Fall 2005  
Version: 1  
Data updated: 04/28/05

Course Description and Purpose

This course is a mathematically sophisticated introduction to the theory and methods of statistical inference. Students will learn fundamental technical tools that are essential to carry out methodological research in the field of Biostatistics. Emphasis will be placed on how to correctly propose statistical methods in a general setting including concepts such as asymptotic unbiasedness, robust variance estimation and efficiency.

Course Objectives

Upon successful completion of this course, students will be able to:
1. understand and apply concepts of asymptotic distributions of estimators  
2. apply maximum likelihood and estimating equation methods  
3. understand the concept of efficient estimation  
4. apply optimal statistical tests

Prerequisites

PHST 662 or consent of instructor

Course Instructors

<table>
<thead>
<tr>
<th>Name</th>
<th>Office</th>
<th>Phone</th>
<th>Email</th>
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<tbody>
<tr>
<td>Somnath Datta, Ph.D</td>
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<tr>
<td>Course Director</td>
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The course instructors welcome conversations with students outside of class. Students may correspond with instructors by email or set up appointments by contacting Rachel Cummins at 852-2797 or rachel.cummins@louisville.edu.

Students should also contact Rachel Cummins with questions they might have regarding the mechanics or operation of the course.
**Course Schedule**

*IMPORTANT NOTE: The schedule and topics may change as the course unfolds. Changes will be posted on Blackboard.*

<table>
<thead>
<tr>
<th>Class Session Dates</th>
<th>Topics</th>
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<tbody>
<tr>
<td>Week 1-2</td>
<td>Review of PHDA 662, Intro. to various modes of convergence</td>
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<tr>
<td>Week 3-4</td>
<td>Asymptotic normality of various simple estimators Variance calculation using the Delta method</td>
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<tr>
<td>Week 4-5</td>
<td>Maximum Likelihood Score Equation One step MLE Fisher’s scoring algorithm</td>
</tr>
<tr>
<td>Week 6</td>
<td>Efficiency consideration</td>
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<tr>
<td>Week 7</td>
<td>M-estimation Midterm Exam</td>
</tr>
<tr>
<td>Week 8-9</td>
<td>Estimating Equations Model misspecification Robust variance estimation (sandwich formula)</td>
</tr>
<tr>
<td>Week 11-12</td>
<td>Testing Hypotheses General introduction to various optimality criteria both finite sample and asymptotic</td>
</tr>
<tr>
<td>Week 13</td>
<td>Asymptotically optimal tests: The Holy Trinity</td>
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<tr>
<td>Week 14</td>
<td>U-statistics</td>
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<tr>
<td>Week 15</td>
<td>Missing Data Problems</td>
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**Course Materials**

*Required Text*
Lecture notes will be given from a number of sources including the following.

**Course Policies**

**Course Requirements**

1. Students are allowed to have group discussion on homework matters, but they must work through and write up the assignments **entirely** on their own without looking at the assignments of their peers. If asked, they should be able to explain fully and reproduce the answers.

2. Students are expected to complete all assignments by the due dates communicated in class. Grade penalties will be imposed on homework accepted late. Late acceptance is at the discretion of the instructor.

3. Students should check their email and the course web-page regularly for homework assignments and other course related communication.

4. Participants should read from the lecture notes given in the previous lecture and from the suggested/required textbooks prior to each.

5. Learners are expected to participate by attending every class possible and by taking responsibility for course material when attendance is impossible. Participation also means actively engaged in class discussions, assignments, and activities.

6. Participants are expected to act with integrity.

**Grading**

**Evaluation/Grade:**

**Homework: 40%**

Eight regular homework assignments will be given. For each assignment, students will be given a problem set which will generally require following the techniques introduced in the lectures before the assignment due date. Students will have one to one and half weeks to complete each assignment. For data based assignments, data sets will be available on the day the respective homework is assigned via e-mail and/or on the instructor’s website and/or in the School of Public Health and Information Sciences computer lab.

**Mid-term: 25%**
An open-book, in-class Mid-term exam will be administered.

**Final Exam 35%**
A take-home final exam will be assigned. Team-work not allowed.

**Grading Scale**

<table>
<thead>
<tr>
<th>Grading Scale</th>
<th>99-100% - A+</th>
<th>95-98% - A</th>
<th>93-94% - A-</th>
</tr>
</thead>
<tbody>
<tr>
<td>91-92% - B+</td>
<td>87-90% - B</td>
<td>85-86% - B-</td>
<td></td>
</tr>
<tr>
<td>83-84% - C+</td>
<td>79-82% - C</td>
<td>77-78% - C-</td>
<td></td>
</tr>
<tr>
<td>75-76% - D+</td>
<td>71-75% - D</td>
<td>69-70% - D-</td>
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**Other Policies**

**Policy on Instructional Modifications:**

Students with disabilities, who need reasonable modifications to complete assignments successfully and otherwise satisfy course criteria, are encouraged to contact the instructor as early in the course as possible to identify and plan specific accommodations. Students will be asked to supply a letter from the Disability Resource Center or other documentation to assist in planning modifications.

**Technological Expectations**

Use of e-mail and www technology (web-access) is required. Capability of reading PDF file is required.

**Date Prepared and By Whom Prepared**

Prepared February 21, 2005, by Somnath Datta, Ph.D.