TEXAS A&M UNIVERSITY

SYLLABUS

Fall 2009 **STAT 630-601** (Overview of Mathematical Statistics) TR 9:35-10:50 BLOC 150

Course description and prerequisites

STAT 630 is intended for graduate students in various fields who require an introduction to mathematical statistics. Prerequisite: MATH 221, 251, or 253 (Calculus of Several Variables).

Course objectives

STAT 630 is designed to introduce students to the fundamental concepts of statistics from a theoretical perspective. We begin with an introduction to probability theory, as the necessary background for developing statistical methods. By the end of the course students should be familiar with key concepts of statistical inference, such as parameter estimation including the maximum likelihood approach, the construction of confidence intervals, and hypothesis testing, in particular likelihood ratio tests.

Instructor

Uschi Müller-Harknett

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Office hours: **TR** 2:00-3:00, **F** 10:00-11:00, and by appointment.

Textbook and other resources

Your main resources for this course are our regular classes and the textbook: *Mathematical Statistics and Data Analysis*, Third Edition, by John Rice

The statistical software used is R (available at http://lib.stat.cmu.edu/R/).

Homework and additional materials will be posted on the web. You will be sent details by email.

Grader

Hsiang-chun Chen
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Office hours: **T** 12:15-2:15, **W** 10:00-11:00

Course topics and exam dates

I. Introduction to Probability (Chapter 1)
1. Interpretation, experiments, sample space, events
2. Set theory, definition
3. Finite sample spaces, counting methods, combinatorial methods
4. Conditional probability, Bayes theorem
5. Independent events

II. Random Variables (Chapter 2)
1. Discrete random variables
2. Continuous random variables
3. Important discrete and continuous distributions
4. Functions of a random variable

III. Joint Distributions (Chapter 3)
1. Discrete random variables
2. Continuous random variables
3. Independent random variables
4. Marginal and conditional distributions
5. Functions of jointly distributed random variables

IV. Expected Values (Chapter 4)
1. Expectation and its properties
2. Moments including mean and variance
3. Covariance and correlation
4. Conditional expectations
5. Moment generating functions

V. Limit Theorems (Chapter 5)
1. Law of large numbers
2. Central limit theorem

VI. Distributions Derived from the Normal Distribution (Chapter 6)

VII. Estimation of Parameters and Fitting of Distributions (Chapter 8)
1. Parameter estimation
2. Properties of estimators—bias, variance, mean squared error
3. Method of moments estimators
4. Maximum likelihood estimation
5. Large sample properties of maximum likelihood estimators
6. Definition of confidence intervals
7. Construction of confidence intervals using pivots
8. Construction of approximate confidence intervals
9. Bayesian inference
10. Information inequality and efficiency of estimators

VIII. Testing Hypotheses (Chapter 9)
1. Bayes approach to testing and the likelihood ratio
2. Basic concepts of hypothesis testing
3. Neyman-Pearson approach to hypothesis testing
4. Duality of confidence intervals and tests
5. Generalized likelihood ratio tests
6. Wald and score tests
7. Applications of likelihood ratio tests

Exams will be held in class on Tuesday, October 6 (new date) and Thursday, November 5 (Midterms I and II) and on Friday, December 11, 12:30-14:30 (Final).

Course grade

Your grade will be based on your performance over the semester. **Homework** will make up 10% of the course grade, the two **midterm exams** will count for 25% each and the **final exam** for the remaining 40%. Your lowest homework score, and the lowest scoring answer at each exam, will be dropped.

If you have to miss one of the midterm exams due to illness or other circumstances beyond your control, please notify me or the Department of Statistics main office *before* the exam. If the absence is approved, the final exam score will be given additional weight to compensate.

The previous two paragraphs set out the **only** methods that will be used to determine course grades. If you feel that personal circumstances are affecting your academic performance, or are concerned that your work is not going to earn you the grade that you require for some purpose (e.g. getting/keeping an assistantship or a scholarship), please explore your options and take appropriate action in good time.

Other course information

Regular class attendance is assumed. I do not monitor attendance or give unannounced quizzes. However, syllabus details, including homework assignments and test dates, may be changed by in-class announcements. Anything that is missed because a student is not in class is the student's responsibility.

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

Academic integrity and fairness

Honor code: *"An Aggie does not lie, cheat, or steal, or tolerate those who do."*

I aim to treat you fairly. I expect you to treat me and your fellow students fairly. I take academic honesty seriously, and expect you to do so as well. You should be aware of the definitions of "academic misconduct" at http://aggiehonor.tamu.edu/Student Rules/definitions.html .