

# STAT 598C: Computational Statistics

Fall 2005

INSTRUCTOR: Chuanhai Liu  
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Lectures: TTH 12:00PM - 1:15PM, BRWN 3102  
Office Hours: by appointment  
TEXT: *Computational Statistics*, First Edition,  
Geof H. Givens and Jennifer A. Hoeting  
PREREQUISITES: Taylor series, linear algebra, statistical background,  
and some experience in writing computer code

## Course Policies

- The course average will be determined solely from the following
  - Class attendance and participation: 20%
  - Homework: 40%
  - Term project: 40%
- Homework will be assigned most weeks, and some/all of them will be graded by me. You may discuss the homework problems with other students, but you should write up your solution independently. *Late homework will not be accepted.*
- Students should complete a term project on a research topic in the field of computational statistics. Overviews on research topics are acceptable. You may work on one project with at most two more other students. You should give a half a hour presentation.

## Course Outline

1. A brief overview of statistical computing with incomplete data from bivariate normal distributions in **R/S-plus** (1)

2. Probability distributions, simulation, and (simulated) data visualization
  - univariate distributions (inversion, acceptance and rejection, ratio-of-uniforms) (2)
  - multivariate normal distribution and the Wishart distribution (linear algebra: Cholesky decomposition and the sweep operator) (3-4)
3. Optimization I: Newton-Raphson and Quasi-Newton methods
  - Taylor series and Newton-Raphson
  - Line search and Quasi-Newton (5-6)
4. Optimization II: Expectation-Maximization algorithms
5. Numerical integration
6. Simulation and Monte Carlo integration
7. Markov chain Monte Carlo
8. Data stream processing