STAT 535A - Statistical Computing

Term 1, 2003-2004

Mon. 13:30-15:00 throughout the term, LSK 301

1.5 credits

DESCRIPTION. This course will focus on computational algorithms which are useful in statistical work. In particular, we will seek to

- understand the statistical purpose and applications of the algo rithms,
- understand how the algorithms work,
- **implement** variants and special cases of the algorithms.

The list of topics is not yet firm, but some likely topics are:

- Numerical linear algebra algorithms.
- Direct function optimization algorithms.
- Indirect model fitting algorithms which convert a hard problem into an iterative sequence of easier problems. The expectation-maximization (EM) algorithm, and the iteratively reweighted least squares algorithm are prime examples.
- Monte Carlo algorithms for random simulation, including Markov chain Monte Carlo methods. This topic will receive special emphasis, as it is something the instructor knows about!
- Other specific algorithms perhaps the Kalman Filter and the Fast Fourier Transform. Some 'machine learning' algorithms may also be considered.

AUDIENCE. This course is open to any graduate student in the Department of Statistics – I hope to have a mix of new and experienced students in the class. Graduate students from other departments are welcome after consultation and permission of the instructor.

COURSEWORK. The details are not finalized, but students taking the course for credit will undertake a project. The expectations for this project will be commensurate with the 1.5 credits attached to the course.

REFERENCES. There is no text for the course. Some references which I will be using in preparing lectures include

Chen, M.H., Shao, Q., and Ibrahim, J.G. (2000). *Monte Carlo Methods in Bayesian Computation.* Springer.

Gentle, J.E. (1998) *Random Number Generation and Monte Carlo Methods.* Springer.

Gentle, J.E. (1998). *Numerical Linear Algebra for Applications in Statistics.* Springer.

Lange, K. (1999). *Numerical Analysis for Statisticians.* Springer.

Liu, J.S. (2001). *Monte Carlo Strategies in Scientific Computing.* Springer.