1 Course Information

- Prof: Scott Schmidler
- Email: (put “Sta 214” in subject line) schmidler@stat.duke.edu
- Office: 223D Old Chem Building
- Phone: 684-8064
- Office hours: Mon 4-5pm or by appt.
- Course homepage: http://www.stat.duke.edu/courses/Fall05/sta214/
- Course lectures: Mon/Wed 2:50-4:05pm, Old Chem Building 025

2 Overview

This course covers theory, methodology, and computation for probabilistic modeling and inference from an applied perspective. Particular emphasis is given to the development and use of simulation methodology and applied probability models in statistical analysis. Applications are drawn from Bayesian statistical analysis, frequentist statistics, statistical mechanics, image processing, bioinformatics, artificial intelligence, finance.

The course emphasizes two major themes:

- **Modeling**: Conditional independence and its role in specifying complex probabilistic models. Bayesian analysis of standard statistical models; Markov chains; missing data problems; mixture models; hidden Markov and state space models; Markov random fields; graphical models.

- **Computation**: Inference in probabilistic models, with particular emphasis on Monte Carlo integration including Markov chain Monte Carlo. EM algorithm. Metropolis, Gibbs, and Langevin algorithms. Exact algorithms where feasible (HMMs, Kalman filters, Bayesian networks).

Advanced topics in later lectures will be determined by time availability and student interests.
3 Lecture Schedule

See the online lecture schedule on the course homepage for lecture and reading schedules.

4 Readings

The course text is *Monte Carlo Statistical Methods* by Robert & Casella, Springer-Verlag (1999). We will follow this text loosely, covering significant supplemental material. Other useful references include:


5 Homework and Grading

*Homework (50%)*: 5-6 homework assignments will be handed out during the semester, approximately 1 every 2 weeks. Each assignment consists of both theoretical and computational problems, and will require computer programming. High-level languages (S-plus,Matlab) are preferred; C/C++/Java is fine; check with me for other languages.

*Project (50%)*: There will be a final project in lieu of a final exam. The project will ask you to identify a problem domain and/or data set, develop and implement one or more modeling techniques covered in the class, and write and present the resulting analysis. Theoretical projects will also be possible. More details will be handed out in later in the semester.

6 Miscellaneous

- Office hours will be determined during the first week of class. You may also make an appointment or send me email.

- Please check the course homepage regularly for updated information.

- Please be sure you get added to the course mailing list.