BIOSTAT 682: Applied Bayesian Inference
Fall 2012

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Administrative information
Lectures: Mon-Wed 3:00 PM-4:30 PM, Room SPHII 1123
No class: Mon 09/17/2012; Wed 09/19/2012; Mon 10/15/2012
Office hours: Mon: 10:00 AM-11:00 AM; Thurs: 2:00 PM-3:00 PM and by appointment
C-Tool course webpage: BIOSTAT 682

Course description
This course is designed to introduce students in a graduate program to Bayesian data analysis. The course will briefly review the theory behind Bayesian methods and it will focus on the practical implementation of hierarchical Bayesian statistical methods. Data analysis via computer simulation methods will be emphasized and the free statistical software R and WinBUGS will be used throughout the course.

Learning objectives
Upon successful completion of the course, students will be able to formulate Bayesian hierarchical models for analyzing datasets arising from statistical designs and experiments. They will be able to carry out inference for these models using the statistical software R and WinBUGS and they will be able to interpret and write comprehensive reports for their analysis.

Prerequisites
BIOSTAT 602, 650, 651 or similar master level mathematical statistics and regression courses. Familiarity with the R computing environment is assumed.
Textbook
Peter D. Hoff “A First Course in Bayesian Statistical Methods”, Springer.

Suggested textbooks
The following textbooks are excellent books in Bayesian statistics that focus more on applied and computational aspects of Bayesian inference:

- Andrew Gelman, John B. Carlin, Hal S. Stern and Donald B. Rubin “Bayesian Data Analysis”, Chapman & Hall/CRC.
- Bradley P. Carlin and Thomas A. Louis “Bayesian Methods for Data Analysis”, Chapman & Hall/CRC.
- Ioannis Ntzoufras “Bayesian Modeling using WinBUGS”, Wiley.
- Walter R. Gilks, Sylvia Richardson and David Spiegelhalter “Markov Chain Monte Carlo in Practice”, Chapman & Hall/CRC.

Topics
The course will cover the following topics.

- Introduction: overview and basics of Bayesian inference
- Bayesian analysis of basic models
- Hierarchical models
- Bayesian computing: Markov Chain Monte Carlo
- Metropolis-Hastings algorithms
- Linear regression
- Linear mixed effect models
• Generalized linear models
• Models for missing data
• Bayesian model criticism and selection

**Grading**
Homework, midterm and a final exam contribute to the final grade in the following way:

- Homework: 30%
- Midterm Exam: 30%
- Final Exam: 40%

**Homework**
There will be 6 homework assigned during the course of the semester. Homework is due on the day indicated, at the beginning of class. **Late homework will not be accepted** except under very special circumstances (no more than one special circumstance per person). Students can discuss about the homework assignment, but **they must hand in their own work**. Changing font on someone else’s computer code is not considered “your own work”. Homework will include both exercises concerned with derivation of formulas and computational-based problems.

**Midterm**
There will be an in-class midterm exam on **Monday October 22** during the regular class time. The exam is closed-book and closed-notes.

**Final Exam**
There will be a take-home final exam. The final exam will be handed in during the last day of class (**Monday December 10**) and is due **Monday December 17 at 5 PM**. Students are not allowed to discuss about the final exam with other classmates or other fellow students.
Academic integrity

Students enrolled or registered in a course offered in the School of Public Health are expected to have a conduct consistent with that of a public health professional. Plagiarism, cheating, use of assistance from other students during written examinations, as well as use of aids of any kind during a written examination, if not approved by the instructor, is considered academic misconduct and will be referred to the Office of Academic Affairs.