PubH 8442

Spring 2011, 3 credits, A/F or S/N

Title: Bayesian Decision Theory and Data Analysis

Course Description: This course will introduce students to contemporary Bayesian statistics. As such, the emphasis will be on data analysis using probability models. We will cover specification, estimation and model diagnosis. Homework will require the use of R or S-plus in addition to some simple C programming (with much code supplied).

Course Instructor: Dr Cavan Reilly, email: cavanr@biostat.umn.edu, phone: (612)624-9644, office: Mayo A440, office hours: T and Th 4:00-5:00.

For whom intended: This course is designed for second-year biostatistics/statistics graduate students who want to learn about using probability models in a Bayesian context. Students should be familiar with matrix algebra and the usual basic probability models.

Prerequisites: Familiarity with computing (R, S-plus and some C or FORTRAN), Statistics at the level of Stat 5101–5102 (Theoretical Statistics), Stat 8311 (Linear Models) or equivalent or permission of instructor.

Objective: After taking the course, the student should be able to set up and conduct inference for a variety of statistical models.

Evaluations: Course evaluation will be based on homework assignments (30%), a midterm exam (40%) and a final project (30%). Late homeworks will receive a 10% penalty if turned in within one week of the due date, otherwise late homeworks are not allowed without a documented reason.

Incomplete Grade: A grade of incomplete I shall be assigned at the discretion of the instructor when, due to extraordinary circumstances, the student was prevented from completing the work of the course on time. The assignment of an incomplete requires a written agreement between the instructor and student specifying the time and manner in which the student will complete the course requirements. In no event may any such written agreement allow a period of longer than one year to complete the course requirements.

University of Minnesota Uniform Grading and Transcript Policy: A link to the policy can be found at onestop.umn.edu. VIII. Other Course Information and Policies

Grade Option Change (if applicable): For full-semester courses, students may change their grad option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester) can be found at onestop.umn.edu.

Course Withdrawal: Students should refer to the Refund and Drop/Add Deadlines for the particular term at onestop.umn.edu for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw. Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Student Services Center at sph-ssc@umn.edu for further information.

Course web site: http://www.biostat.umn.edu/~cavanr/pubh8442.html.

Disability statement: It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have a documented disability (e.g., physical, learning, psychiatric, vision, hearing, or systemic) that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact Disability Services to have a confidential discussion of their individual needs for accommodations. Disability Services is located in Suite 180 McNamara Alumni Center, 200 Oak Street. Staff can be reached by calling 612-626-1333 (voice or TTY).

Student Conduct, Scholastic Dishonesty and Sexual Harassment Policies: Students are responsible for knowing the University of Minnesota, Board of Regents' policy on Student Conduct and Sexual Harassment found at www.umn.edu/regents/polindex.html. Students are responsible for maintaining scholastic honesty in their work at all times. Students engaged in scholastic dishonesty will be penalized, and offenses will be reported to the Office of Student Academic Integrity (OSAI, www.osai.umn.edu). The University's Student Conduct Code defines scholastic dishonesty as plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis. Plagiarism is an important element of this policy. It is defined as the presentation of another's writing or ideas as your own. Serious, intentional plagiarism will result in a grade of F or N for the entire course. For more information on this policy and for a helpful discussion of preventing plagiarism, please consult University policies and procedures regarding academic integrity: http://writing.umn.edu/tww/plagiarism/. Students are urged to be careful that they properly attribute and cite others' work in their own writing. For guidelines for correctly citing sources, go to http://tutorial.lib.umn.edu/ and click on Citing Sources. In addition, original work is expected in this course. It is unacceptable to hand in assignments for this course for which you receive credit in another course unless by prior agreement with the instructor. Building on a line of work begun in another course or leading to a thesis, dissertation, or final project is acceptable. If you have

any questions, consult the instructor.

Textbooks: The required textbook is

1. Carlin, B., and Louis, T. (2000), *Bayesian Methods for Data Analysis: Thrid Edition*, Chapman and Hall.

The following recommended references are on reserve in the Biostatistics reading room, Mayo A460:

1. Berger, J. (1980), *Statistical Decision Theory and Bayesian Analysis*, Springer, New York.
2. Chen, M., Shao, Ibrahim, J., (2000) *Monte Carlo Methods in Bayesian Computation*, Springer.
3. Gelman, A., Carlin, J.B., Stern, H.S. and Rubin, D.B. (1995), *Bayesian Data Analysis*, Chapman and Hall.
4. Gilks, W., Richardson, S., Spiegelhalter, D. (1996), *Markov Chain Monte Carlo in Practice*, Chapman and Hall.
5. Lee, (1989) *Bayesian Statistics: An Introduction*, Oxford University Press.
6. Liu, J. (2001), *Monte Carlo Strategies in Scientific Computing*, Springer.
7. Press, W., Teukolsky, S., Vetterling, W., and Flannery, B. (1992), *Numerical Recipes*, Cambridge University Press: Cambridge.
8. Vernables, W.N. and Ripley, B.D. (1999), *Modern Applied Statistics with S-plus*. Spring-Verlag, New York.

Weekly Schedule:

Week	Topics
1	Introduction to Bayesian statistics and decision theory
2	Bayes analysis: priors and inference for some common settings
3	Specification and hierarchical modeling
4	Empirical Bayes methods
5	Interval estimation
6	More on interval estimation
7	Performance of Bayes estimates
8	Computing-asymptotic methods
9	Computing-non-iterative sampling methods, Metropolis algorithm
10	Computing-Gibbs sampler, Metropolis-Hastings
11	Pragmatic aspects of Bayesian computation
12	Model criticism and more on specification
13	Aspects of some specialized models: dynamic linear models, spatial models
14	Some case studies: political polling, medical image analysis
15	Student presentations