

Course Policies and Syllabus

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Office Hours	Tu 10:00AM–11:00AM or by appointment

Web page: <https://canvas.ucsc.edu/>

Lectures: TuTh 11:40AM-01:15PM, Crown Classroom 105

Course Description: The course covers Bayesian statistical methods for inference and prediction including prior, likelihood, posterior and predictive distributions; exchangeability; coherence and calibration; conjugate analysis; Markov Chain Monte Carlo methods for simulation-based computation; hierarchical modeling; Bayesian model selection.

Prerequisite: Course STAT-203. Enrollment is restricted to graduate students.

Bibliography: The following is a list of books that will be used. You don't need to buy any of them (some are available electronically from the UCSC library), but I recommend *The Bayesian Choice* by C. Robert if you want to buy just one. Additional reading material will be available online.

- Robert, C. (2007) *The Bayesian Choice*. Second Edition, Springer Verlag: New York. **Available electronically through the UCSC library**
- Hoff, P. (2009) *A First Course in Bayesian Statistical Method*. Springer Verlag: New York. **Available electronically through the UCSC library**
- Berger, J.O. (1984) *Statistical Decision Theory and Bayesian Analysis*. Springer.
- Gelman, A., Carlin, J.B., Stern, H.S., Dunson, D.B., Vehtari, A. and Rubin, D.B. Robert, C. (2013) *Bayesian Data Analysis*. Third Edition, Chapman & Hall.

Homework: There will be about 4 homework assignments. Some of the problems in the homework assignments will be graded. The exams will be based on the homework assignments so it is very important that you solve *all* the problems in each assignment.

Exams: We will have two midterms and a final. The midterms are in-class exams, and the final is a take-home test. The final will be from March 22nd (Mon) to March 23rd (Tu) (tentative).

Course grade: Your course grade will be based on the exams and homework assignments as follows: (a) Homework (25%); (b) Midterms (40%, each 20%); (c) Final (35%).

Tentative Class Schedule

**** The order of the topics may change although all will be covered.**

Date	Topics
01/04	Introduction; Review of distribution. Exponential families. Conjugate Analysis
01/06	Exponential families. Conjugate Analysis (contd)
01/11	Foundations: A decision theoretic approach to statistical inference
01/13	Foundations: Priors and the subjective interpretation of probability. Exchangeability
01/18	Foundations: The likelihood principle: Sufficiency. Exchangeability– revisited
01/20	Bayesian point and interval estimation. Loss functions.
01/25	Admissibility of Bayes estimators. Shrinkage priors. Bias and MSE of Bayes estimators.
01/27	Objective Bayes and estimation problems.
02/01	Midterm 1
02/03	More general priors and asymptotic properties of Bayesian estimates.
02/08	Discrete case & Continuous case: Laplace expansions & “Bayesian CLT”. Approx. inference
02/10	Sequential updating, Simulation-based inference. MC integration
02/15	President’s day
02/17	Simulation-based inference: Importance sampling & Metropolis Hastings
02/22	Simulation-based inference: Gibbs sampling
02/24	Bayesian hypothesis testing and model comparison
03/01	Midterm 2
03/03	Simulation-based methods for model comparison
03/08	Hierarchical modeling and mixture representations
03/10	Data augmentation