

Bayesian Methods Syllabus

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Office Hours: Monday, Wednesday, 2-4pm.

This course is an introduction to Bayesian statistics and data analysis, which is now at the heart of many advanced methods such as multilevel models, probabilistic graphical models, and a wide range of methodologies under active development. Our primary text will be Scott Lynch's *Introduction to Applied Bayesian Statistics and Estimation for Social Scientists*, which offers a mixture of theoretical introduction along with code and exercises in R. This text will be augmented on the theoretical side with Gelman's somewhat more advanced text, *Bayesian Data Analysis*, and on the practical side with Kruschke's *Doing Bayesian Analysis*, which provides more extensive code and exercises in R. Familiarity with R is thus strongly recommended, but we will be learning proper coding in R and sampling techniques along the way. Along with weekly homework, there will be one larger project that students must produce using some of the methods developed in this class.

Reading List

S.M. Lynch. *Introduction to Applied Bayesian Statistics and Estimation for Social Scientists*. Springer Princeton, NJ, 2007

A. Gelman. *Bayesian Data Analysis*. CRC press, 2004

J.K. Kruschke and K. John. *Doing Bayesian Data Analysis: A tutorial introduction with R and BUGS*. Academic Press, 2010

Week 1: Introduction and review of Bayesian statistics and R

Gelman, Ch. 1.

Lynch, Ch. 2.

Kruschke, Ch 2-4.

Week 2: Single and Multi-Parameter Models

Gelman, Ch. 2-3

Lynch, Ch. 3

Kruschke, Ch. 5

Week 3: Gibbs Sampling

Lynch, Ch. 4

Gelman, Ch 10, 11.1-11.3

Kruschke, Ch. 6, Ch.8

Week 4: Metropolis-Hastings Sampling

Lynch, Ch. 5

Gelman, Ch. 11.4-11.12

Kruschke, Ch. 7

Week 5: Sampling: Problems, Techniques, and Postestimation

Lynch, Ch. 6

Gelman, Ch. 12-13

Kruschke, Ch. 23

Week 6: Linear Regression Models

Lynch, Ch. 7

Gelman, Ch. 14

Week 7: Generalized Linear Models

Lynch, Ch. 8

Gelman, Ch. 16

Kruschke, Ch. 14

Week 8: Hierarchical Models

Gelman, Ch. 15

Lynch, Ch. 9

Kruschke, Ch. 9-10

Week 9: Multivariate Models and student-selected topics

Gelman, Ch. 19

Lynch, Ch. 10

Kruschke, Ch. 20-21

Week 10: Student project presentations and wrap-up