

**Economics G31.3001.004**  
**Topic in Advanced Econometrics II**  
**Spring 2022**

**Bruce McNevin, PhD**  
**bm76@nyu.edu**  
**Monday 6:20-8:20 pm**  
**Room: 736**

**Course Objective:** The goal of the course is to provide a toolkit of useful statistical methods not ordinarily covered in a first year econometrics course. The course is roughly divided into three sections: The Bayesian Algorithm, Monte Carlo Methods, and Applications using Monte Carlo Methods. The Bayesian algorithm section covers topics relating to Bayesian inference, prediction, and model criticism. The section on Monte Carlo Methods (MCMC) covers Markov chains, the Metropolis–Hastings Algorithm and the Gibbs sampler. The third section applies Monte Carlo Methods to the general linear model, panel data, discrete choice models, and finite mixture models. If time permits we will also discuss nonparametric Bayesian models. The emphasis of the course is on application. The software package R will be used extensively.

**Note: Advanced Econometrics I is not required for this course.**

**Grading**

Mid-term 35%

Assignments 25% - there will be 5 assignments emphasizing application of concepts discussed in class.

Final Exam 40%.

**Computer Requirement**

The statistical package R will be used throughout the course. You are encouraged to become familiar with this package. R which is the open source version of S-plus and can be downloaded free of charge from the website “The R Project for Statistical Computing” located at <http://www.r-project.org/>. In addition, we will be using Stan (we will use “rstan” for MCMC sampling) which can also be downloaded free of charge from the “The Stan Project” website located at <http://mc-stan.org>.

Please download both packages onto your PC. We will be using Stan as an application run from within R. My intention is to do examples in class, so it might be useful to bring your laptop to the lectures.

**Two useful books for learning R (R and S-Plus are virtually identical) are:**

“The Basics of S-Plus 3<sup>rd</sup> Edition”, Andreas Krause and Melvin Olson, Springer, (2002)

“Modern Applied Statistics with S 4<sup>th</sup> Edition”, W.N. Venables and B.D. Ripley, Springer (2003)

## **Course Material**

### **Two useful books for the courses:**

“An Introduction to Modern Bayesian Econometrics”, Tony Lancaster, Blackwell Publishing, (2004)

“Bayesian Data Analysis”, Gelman, Carlin, Stern and Rubin, 3<sup>rd</sup> Ed. Chapman & Hall, 2013  
**(BDA3)**

### **Additional sources that I will reference in the lecture material:**

“Bayesian Core”, Jean-Michel Marin and Christian Robert, Chapman & Hall (2007)

“The Analysis of Time Series”, Chris Chatfield, Chapman & Hall, 6<sup>th</sup> Edition

“Time Series Analysis and Its Applications: Applications with R Examples”, Robert Shumway and David Stoffer, Springer (2006)

“Markov Chain Monte Carlo: Stochastic Simulation for Bayesian Inference”, Dani Gamerman and Hedibert Lopes, Chapman & Hall, (2006)

“Monte Carlo Statistical Methods, 2<sup>nd</sup> ed.”, Christian Robert and George Casella, Springer (2004)

Introducing Monte Carlo Methods with R”, Christian Robert and George Casella, Springer (2010)

“Discrete Choice Methods with Simulation”, Kenneth Train, Cambridge University Press, (2009). This book is available for download at Professor Train’s website

<http://www.econ.berkeley.edu/books/choice2.html>

“Time Series Analysis”, James Hamilton, Princeton University Press, (1994)

### **Additional books on Bayesian Econometrics**

“Bayesian Computation with R”, Jim Albert, Springer (2009)

“Bayesian Econometrics”, Gary Koop, J.C. Wiley, (2003)

“Bayesian Econometric Methods”, Gary Koop, Dale Poirer, and Justin Tobias, Cambridge University Press (2007)

### Course Outline

<b>Week</b>		<b>Reading*</b>
1/24	Introduction to Bayesian inference	Lancaster Ch.1, BDA, Ch.1
1/31	Single & Multiple parameter models	Lancaster Ch. 2,3 BDA, Ch. 2,3
2/7	Prediction, model diagnostics, criticism & comparison	Lancaster Ch. 2, BDA Ch. 6 & 7
2/14	Markov chain simulation – part I	Lancaster Ch.4, BDA Ch. 10 & 11, Train Ch. 12
2/21	<b>No class</b>	
2/28	Markov chain simulation – part2	
3/7	<b>Midterm Examination</b>	
3/14	<b>Spring Recess</b>	
3/21	Hierarchical models	Lancaster Ch. 7, BDA Ch. 5 & 15
3/28	Modeling Volatility	Notes
4/4	Missing Data Imputation	Lancaster Ch. 5, BDA Ch. 18
4/11	Introduction to Bayesian Time Series Analysis	Lancaster Ch. 5, BDA Ch. 19 & 20
4/18	Linear Filters and State space models – Part 1	Lancaster Ch. 9, Notes
4/25	Linear Filters and State space models – Part 2	
5/2	Intro. to Nonlinear filters	Notes
5/9	Bayesian Vector Autoregressions	Lancaster Ch. 9, Notes