

# STATS 579

## Intermediate Bayesian Modeling

### BASIC COURSE INFORMATION

**Course:** STATS 579                  DSH 318                  TuTh                  12:30–1:45pm  
**Instructor:** Fletcher Christensen                  Assistant Professor of Statistics  
**Contact:** ronald@stat.unm.edu                  <http://www.stat.unm.edu/~ronald/>  
**Office Hrs:** By appointment  
**Prerequisites:** STAT 577 (Introduction to Bayesian Modeling)

### COURSE SUMMARY

This class will cover more advanced ideas in Bayesian statistics, focusing most heavily on Bayesian inference methods and MCMC methods. If time permits, this course will also provide an introduction to a selection of special topics in Bayesian modeling: most likely some subset of diagnostic testing, survival analysis, and nonparametrics. Students are expected to have already had one class in Bayesian methods, and to have fluency with concepts in probability and linear models.

### TEXTS AND TOOLS

**Textbook:** *Bayesian Ideas and Data Analysis*                  Christensen, Johnson, Branscum, & Hanson

In addition to the textbook, we will make some use of statistical analysis software in this course. This is primarily for the purpose of coding MCMC algorithms—and thus our work will focus on R, which provides a sufficient coding foundation to allow us to do this type of work. As we cover topics in Bayesian modeling, we may also make use of other analysis software packages.

**Software:** R                  <https://www.r-project.org/>  
RStudio                  <https://www.rstudio.com/products/rstudio/>

## COURSE CALENDAR

Tuesday	21	Aug	Course introduction	
Thursday	23	Aug	Exchangeability	Chapter 4.2
Tuesday	28	Aug	Statistical Testing	Chapter 4.1
Thursday	30	Aug	Likelihood Functions & Sufficient Statistics	Chapter 4.3–4.4
Tuesday	4	Sep	Analysis Using Predictive Distributions	Chapter 4.5
Thursday	6	Sep	Flat Priors and Jeffreys Priors	Chapter 4.6–4.7
Tuesday	11	Sep	Model Selection Concepts	
Thursday	13	Sep	Bayes Factors	Chapter 4.8
Tuesday	18	Sep	Other Model Selection Criteria I	Chapter 4.9
Thursday	20	Sep	Other Model Selection Criteria II	
Tuesday	25	Sep	Topics in Inference I	Chapter 4.10–4.14
Thursday	27	Sep	Topics in Inference II	
Tuesday	2	Oct	Topics in Inference III	
Thursday	4	Oct	Midterm review	
Tuesday	9	Oct	<b>Midterm exam</b>	
Thursday	11	Oct	<b>Fall Break</b> – No class	
Tuesday	16	Oct	Traditional Monte Carlo Methods	Chapter 6.1–6.2
Thursday	18	Oct	Markov Chain Monte Carlo	Chapter 6.3–6.3.1
Tuesday	23	Oct	Gibbs Sampling	Chapter 6.3.2
Thursday	25	Oct	The Metropolis Algorithm	Chapter 6.3.3
Tuesday	30	Oct	Slice Sampling	Chapter 6.3.4
Thursday	1	Nov	Other MCMC Methods	
Tuesday	6	Nov	Project Introduction	
Thursday	8	Nov	<i>TBD</i>	
Tuesday	13	Nov	<i>TBD</i>	
Thursday	15	Nov	<i>TBD</i>	
Tuesday	20	Nov	<i>TBD</i>	
Thursday	22	Nov	<b>Thanksgiving Break</b> – No class	
Tuesday	27	Nov	<i>TBD</i>	
Thursday	29	Nov	<i>TBD</i>	
Tuesday	4	Dec	<i>TBD</i>	
Thursday	6	Dec	<i>TBD</i>	
<b>Thursday</b>	<b>13</b>	<b>Dec</b>	<b>Final Projects Due by 12pm noon</b>	

## ASSESSMENT

There will be three components to your grade in this class:

### 1. Homework Assignments (20%)

We will have a small number of homework assignments for this class, primarily covering questions from the textbook. These will be graded for completion only, but solutions will be provided so that you can check your own work.

### 2. Midterm Exam (40%)

The midterm exam will be held on **Tuesday, October 9<sup>th</sup>**, and will cover material from Chapter 4 in the textbook as well as supplemental material I assign and/or cover in lecture. The focus of this exam will be on statistical inference and how the Bayesian paradigm handles inference.

### 3. Final Project (40%)

Instead of a final exam, I will be asking you to complete a project showcasing what you've learned in this class. You can think of this like a take-home final exam. Your projects will be assigned toward the end of the class, and will be due by **Thursday, December 13<sup>th</sup> at 12pm noon**—the time our final exam would conclude if I gave an in-class final. The primary focus of this project will be on MCMC methods, but other material from the course may be included as well.

In addition to these, I expect you to complete the assigned textbook readings before each class session.

## POLICIES AND EXPECTATIONS

### *Class attendance:*

You are responsible for knowing material covered in the book and in class. These two elements of the course complement each other, but they will not overlap completely. For example, the book will cover some topics that I won't discuss in class but that you may see on class assessments. My lectures will cover some topics that the book doesn't get into—and elements of those may show up on assignments and exams as well.

Be respectful to your fellow students in class. Keep your cell phones and laptops muted. If you know you'll have to arrive to class late or leave early, try to sit near the doors so you can minimize the disturbance you cause.

### *Students with disabilities:*

In accordance with University Policy 2310 and the American Disabilities Act (ADA), students who need academic accommodations and/or assistance in emergency evacuations should contact me as soon as possible to ensure their needs are met in a timely manner.

### *Missed assignments and exams:*

In this class, I expect you to attempt to complete every homework assignment, especially since homework will be graded for completion only. Homework is a tool to help you practice the material we're learning in class, so I will provide solution sets for you to check your work against, to help you see if you're on the right track. Except for a brief submission grace period around deadlines, *late homework and projects will not be accepted.*

If you're in danger of missing the midterm exam (e.g. if you're sick, or if you get into a car accident on the way to school), *contact me by email ASAP.* If I'm aware of the issue, I can make arrangements for you to take the exam at an alternate time. But if you miss the exam without contacting me about your situation, I *will* give you a zero on the exam.

### *Academic misconduct:*

For the purposes of this class, academic misconduct is defined as submitting someone else's work and pretending it's your own. More detail on academic misconduct is provided by the Dean of Students' (<https://dos.unm.edu/images/dean-of-students-academic-integrity-guidelines.pdf>) and in the UNM Student Code of Conduct (<http://pathfinder.unm.edu/code-of-conduct.html>).

Cheating doesn't help you learn statistics better. Don't cheat.