

STATS 477/577

Introduction to Bayesian Modeling

BASIC COURSE INFORMATION

Course:	STATS 477/577	SMLC 352	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:	SMLC 328	Mo 2–3	Tu 3:30–4:30	Th 3:30–4:30
Website:	http://www.stat.unm.edu/~ronald/IntroBayes.html			
Prerequisites:	STAT 461 (Probability) and either STAT 427 or STAT 440 (Regression)			

COURSE SUMMARY

In this class, we'll introduce you to the basic ideas of Bayesian statistics and show you how to analyze data from a Bayesian perspective. Although a thorough understanding of probability and regression modeling is required for this class, our focus will involve less math and more statistical thinking and applications.

TEXTS AND TOOLS

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

In addition to the textbook, we will make frequent use of statistical analysis software in this course. Examples will be done in R and OpenBUGS. I strongly suggest that all students use R for their data analyses, but I don't mind if you use an alternative Bayesian analysis program like JAGS, STAN, or NIMBLE—as long as you can provide me with appropriate diagnostic output.

Software: R <https://www.r-project.org/>
RStudio <https://www.rstudio.com/products/rstudio/>
OpenBUGS <http://www.openbugs.net/w/FrontPage>

COURSE CALENDAR

Tuesday	15	Jan	Course introduction	
Thursday	17	Jan	Thinking like a Bayesian	Chapter 1
Tuesday	22	Jan	Fundamental ideas I	Chapter 2.1–2.2
Thursday	24	Jan	Fundamental ideas II	Chapter 2.3–2.5
Tuesday	29	Jan	Probability review I	
Thursday	31	Jan	Probability review II	
Tuesday	5	Feb	OpenBUGS	Chapter 3.1–3.3
Thursday	7	Feb	Bayesian simulation in R	Chapter 3.5
Tuesday	12	Feb	Bayesian data analysis workshop	
Thursday	14	Feb	Data analysis #1	
Tuesday	19	Feb	Inference for proportions	Chapter 5.1
Thursday	21	Feb	Inference for normal populations	Chapter 5.2
Tuesday	26	Feb	Inference for rates	Chapter 5.3
Thursday	28	Feb	Midterm review	
Tuesday	5	Mar	Midterm exam	
Thursday	7	Mar	Fun with Bayes	
Tuesday	12	Mar	Spring Break – No class	
Thursday	14	Mar	Spring Break – No class	
Tuesday	19	Mar	Data analysis #2	Chapter 7
Thursday	21	Mar	Binomial regression	Chapter 8.1–8.3
Tuesday	26	Mar	Binomial regression priors	Chapter 8.4
Thursday	28	Mar	Binomial mixed models	Chapter 8.5
Tuesday	2	Apr	Linear regression I	Chapter 9.1–9.2
Thursday	4	Apr	Linear regression II	Chapter 9.3–9.4
Tuesday	9	Apr	Linear regression III	Chapter 9.5–9.7
Thursday	11	Apr	Mixed models	Chapter 10.1–10.2
Tuesday	16	Apr	Data analysis #3	
Thursday	18	Apr	Multivariate normal models	Chapter 10.3–10.5
Tuesday	23	Apr	Poisson regression	Chapter 11.1
Thursday	25	Apr	Poisson regression topics	Chapter 11.2–11.3
Tuesday	30	Apr	<i>TBD</i>	
Thursday	2	May	<i>TBD</i>	
Friday	10	May	Final Projects Due by 11:59pm	

ASSESSMENT

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

1. Homework Assignments (30%)

We will have five homework assignments for this class, ranging from textbook questions to small computer projects. These will correspond with the primary topics of the class: fundamental ideas and probability, principles of Bayesian data analysis, Bayesian inference, binomial modeling, and linear modeling. You can expect one assignment about every 2-3 weeks, with a break for the midterm and Spring Break around the middle of the class.

2. Midterm Exam (30%)

The midterm exam will be held on **Tuesday, March 5th**, and will cover material from Chapters 1-5 in the textbook. The focus of this exam will be on the basic laws of probability and probabilistic modeling of random variables. Simulation and statistical thinking are also fair game here. There *may or may not* be a practice exam to look at, but the homework assignments should give you a good idea of what topics I think are important to cover.

3. Data Analysis Project (40%)

Instead of a final exam, I will be asking you to complete a group data analysis project showcasing what you've learned in this class. You can think of this like a take-home final exam. Your data analysis projects will be assigned toward the end of the class, and will be due by **Friday, May 10th at 11:59pm**—the end of finals week.

In addition to these, I expect you to complete the assigned textbook readings before each class session. In a lower-division course, I would assign regular reading quizzes to ensure this. I'm trusting that students in this class will be motivated and responsible enough to complete the readings without supervision. Please don't disappoint me on this.

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 assignments and exams. My classes will cover some topics in statistical thinking and some special 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:

With five homework assignments and more than 20 students, some of you may miss an assignment at some point or perform at a level below your expectations. I will drop your lowest homework assignment score when I calculate your grade. I expect you to complete every homework assignment, however, even if you know your scores on previous assignments are good. Except for a brief submission grace period around deadlines, *late homework and quizzes will not be accepted.*

If you miss the exam, you're out of luck—we're not tossing out exam scores. If you're in danger of missing the 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>).

Don't cheat. If I catch you, I will give you a zero for the assignment or exam I caught you on, and I will report you to the Dean of Students' Office. Depending on whether you've been reported before, that can result in something as small as a confidential note being placed on your record that will be expunged when you graduate, or something as large as dismissal from the university.

All that said, cheating usually happens when a student feels like he or she can't succeed and tries something desperate. If you feel like you're getting into that position, talk to me. If you've done something you think might be cheating, tell me about it and I'll be much more understanding and lenient than if I catch it myself. If you're not sure whether something constitutes cheating or not, ask me. There can be a lot of gray area, and I understand that. I want you to succeed in this course, but doing your own work is a critical part of successful learning.