

STATS 477/577

Introduction to Bayesian Modeling

BASIC COURSE INFORMATION

Course:	STATS 477/577	TuTh	11:00am–12:15pm
Instructor:	Fletcher Christensen	Assistant Professor of Statistics	
Online Lectures:	MS Teams Webspace	(See MS Teams Application)	
	Zoom Meeting Room	https://unm.zoom.us/j/97248029618	
	YouTube Channel	Statistics at Home	
Office Hrs:	Through MS Teams or Zoom	By appointment	
Contact:	ronald@stat.unm.edu	http://www.stat.unm.edu/~ronald/	
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	19	Jan	Course introduction	
Thursday	21	Jan	Thinking like a Bayesian	Chapter 1
Tuesday	26	Jan	Fundamental ideas I	Chapter 2.1–2.2
Thursday	28	Jan	Fundamental ideas II	Chapter 2.3–2.5
Tuesday	2	Feb	Probability review I	
Thursday	4	Feb	Probability review II	
Tuesday	9	Feb	OpenBUGS	Chapter 3.1–3.3
Thursday	11	Feb	Bayesian simulation in R	Chapter 3.5
Tuesday	16	Feb	Bayesian data analysis workshop	
Thursday	18	Feb	Data analysis #1	
Tuesday	23	Feb	Inference for proportions	Chapter 5.1
Thursday	25	Feb	Inference for normal populations	Chapter 5.2
Tuesday	2	Mar	Inference for rates	Chapter 5.3
Thursday	4	Mar	Fun with Bayes	
Tuesday	9	Mar	Midterm exam	
Thursday	11	Mar	Midterm exam	
Tuesday	16	Mar	Spring Break – No class	
Thursday	18	Mar	Spring Break – No class	
Tuesday	23	Mar	Data analysis #2	Chapter 7
Thursday	25	Mar	Binomial regression	Chapter 8.1–8.3
Tuesday	30	Mar	Binomial regression priors	Chapter 8.4
Thursday	1	Apr	Binomial mixed models	Chapter 8.5
Tuesday	6	Apr	Linear regression I	Chapter 9.1–9.2
Thursday	8	Apr	Linear regression II	Chapter 9.3–9.4
Tuesday	13	Apr	Linear regression III	Chapter 9.5–9.7
Thursday	15	Apr	Mixed models	Chapter 10.1–10.2
Tuesday	20	Apr	Data analysis #3	
Thursday	22	Apr	Multivariate normal models	Chapter 10.3–10.5
Tuesday	27	Apr	Poisson regression	Chapter 11.1
Thursday	29	Apr	Poisson regression topics	Chapter 11.2–11.3
Tuesday	4	May	<i>TBD</i>	
Thursday	6	May	<i>TBD</i>	
Friday	14	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 a number of 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.

2. Midterm Exam (30%)

The midterm exam will be a take-home exam, due **Saturday, March 20th**, 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. The exam will be distributed on Saturday, March 13th.

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 15th at 11:59pm**—the end of finals week. Groups will be decided by me, and administered through the Microsoft Teams application.

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 Lectures and Attendance:

Our lectures will be conducted primarily through Microsoft Teams, which you have access to through UNM. You can download Teams and learn more about it through the UNM IT Apps website at <https://itapps.unm.edu/microsoft-teams/index.html>.

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.

Attendance for online lectures is recommended but not mandatory. I will make the lectures available online after they've been completed, and you will be able to watch them then. Students generally have gotten the most out of this class when they've had the opportunity to ask me questions, though, and it is much easier to ask questions while the lecture is happening than after the fact.

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.

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.