

Course Description

Welcome to STAT 578: Advanced Bayesian Modeling! This course explores practical methods and models for Bayesian data analysis. The major topics include Bayesian fundamentals, prior selection, posterior inference tools, hierarchical models, methods of Bayesian computation, model evaluation, and ordinary and generalized regression models. In particular, there will be an emphasis on computational implementation. To be successful in this course, we recommend that you have taken STAT 420 and are comfortable using R.

Course Goals and Objectives

Upon successful completion of this course, you will be able to:

- Comprehend the implications of Bayes' rule and summaries of a Bayesian posterior distribution.
- Formulate appropriate Bayesian models, including data and prior distributions.
- Use R and JAGS for Bayesian Monte Carlo simulation.
- Assess Bayesian models through posterior predictive checking.
- Evaluate and compare Bayesian models.
- Apply hierarchical modeling and regression in a Bayesian framework.

Required Textbook

Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, and Donald B. Rubin. *Bayesian Data Analysis*, Third Edition, 2013, CRC Press.

This textbook will be used throughout the course, and it will commonly be referred to as BDA3 in the lectures.

Course Outline

This 4-credit hour course is 16 weeks long. You should invest 10-12 hours every week in this course.

Week	Duration	Topics
1	8/28 - 9/3	Orientation, Bayesian Fundamentals and Tools

2	9/4 - 9/10	Bayesian Analysis for Normal Samples
3	9/11 - 9/17	Hierarchical Models, Part I
4	9/18 - 9/24	Hierarchical Models, Part II
5	9/25 - 10/1	Monte Carlo Approximations to Bayesian Tools
6	10/2 - 10/8	Exam 1
7	10/9 - 10/15	Principles of Markov Chain Monte Carlo
8	10/16 - 10/22	Markov Chain Monte Carlo in Practice
9	10/23 - 10/29	Model Checking
10	10/30 - 11/5	Bayesian Linear Regression
11	11/6 - 11/12	Model Evaluation and Comparison
12	11/13 - 11/19	Exam 2
13	11/20 - 11/26	Hierarchical Linear Models
14	11/27 - 12/3	Generalized Linear Models, Part I
15	12/4 - 12/10	Generalized Linear Models, Part II
16	12/11 - 12/14	Models for Robust Inference

Elements of This Course

The course is comprised of the following elements:

- **Lecture Videos.** In each week, the concepts you need to know will be presented through a collection of short video lectures. You may stream these videos for playback within the browser by clicking on their titles or download the videos. You may also download the slides that go along with the videos. **The videos usually total 1 to 1.5 hours each week.** You generally should spend at least the same amount of time digesting content in the video. The actual amount of time needed to digest the content will vary based on your background.
- **Readings.** Each week has a list of required and optional readings from the textbook. The required readings contain information essential for successfully completing the quizzes, exams, and course assignments. Optional readings may add useful context or further details on a required topic, but you will not be assessed on material in the optional readings. The actual amount of time needed to digest the readings will vary based on your background.
- **Orientation Quiz.** The purpose of the orientation quiz is to ensure that you have gone through the orientation module and acquired the necessary information about the course before you start it. The orientation quiz is a required activity, but it's not part of the course grading. You have unlimited attempts on the orientation quiz. You need to answer all questions correctly in order to pass the orientation quiz.
- **Pre-requisite Quiz.** The purpose of the pre-requisite quiz is to ensure that you are up-to-speed on the knowledge you're expected to have prior to taking this course. You have unlimited attempts to take the pre-requisite quiz, and though it is not required or part of your final grade, we recommend that you understand the content covered in all of the quiz questions. Videos from STAT 420 will be provided for your review when possible.
- **Graded Quizzes.** Each week concludes with a graded quiz. You have unlimited attempts for each graded quiz with your highest attempt score used toward your final grade. There is no time limit on how long you take to complete each attempt at the quiz. Graded quizzes will be used when calculating your final score in the class.
- **Weekly Assignments** There are 6 total weekly assignments in this course, each of which you can expect to invest 4-6 hours toward completing. Please be aware that you have **1 attempt** to submit the assignment for staff grading. For more information about the assignments, please read the instructions for each assignment in their respective weeks.
- **Proctored Exams.** There are 2 proctored exams in this class. The exams will be proctored via a proctoring service called ProctorU. For more information about ProctorU and the proctor exams, read the **Proctored Exam** page.
- **Final Project.** The course concludes with a final project, which you will begin in the second half of the course. For more information about the final project, please read the About the Final Project page in the course orientation.

Please note, in order to access course materials and assignments, you will need to pay the Coursera fee (\$158) for this course in addition to the University of Illinois tuition.

Grading Distribution and Scale

Grading Distribution

Assignment	Occurrence	Percent of the Final Grade
Weekly Quizzes	14	10%
Bi-weekly problem sets	6	30%
Exams	2	40%
Final Project	1	20%

Grading Scale

Letter Grade	Percent Needed	Letter Grade	Percent Needed	Letter Grade	Percent Needed
A+	95%	B+	85%	C	70%
A	90%	B	80%	D	60%
A-	88%	B-	78%	F	Below 58%

Student Code and Policies

A student at the University of Illinois at the Urbana-Champaign campus is a member of a University community of which all members have at least the rights and responsibilities common to all citizens, free from institutional censorship; affiliation with the University as a student does not diminish the rights or responsibilities held by a student or any other community member as a citizen of larger communities of the state, the nation, and the world. See the [University of Illinois Student Code](#) for more information.

Academic Integrity

All students are expected to abide by [the campus regulations on academic integrity found in the Student Code of Conduct](#). These standards will be enforced and infractions of these rules will not be tolerated in this course. Sharing, copying, or providing any part of a homework solution or code is an infraction of the University's rules on academic integrity. We will be actively looking for violations of this policy in homework and project submissions. Any violation will be punished as severely as possible with sanctions and penalties typically ranging from a failing grade on this assignment up to a failing grade in the course, including a letter of the offending infraction kept in the student's permanent university record.

Again, a good rule of thumb: *Keep every typed word and piece of code your own*. If you think you are operating in a gray area, you probably are. If you would like clarification on specifics, please contact the course staff.

Disability Accommodations

Students with learning, physical, or other disabilities requiring assistance should contact the instructor as soon as possible. If you're unsure if this applies to you or think it may, please contact the instructor and [Disability Resources and Educational Services \(DRES\)](#) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, via phone at (217) 333-1970, or via email at disability@illinois.edu.

Quiz Deadlines

Quiz	Hard Deadline
Week 1 Quiz	Sunday of Week 1
Week 2 Quiz	Sunday of Week 2
Week 3 Quiz	Sunday of Week 3
Week 4 Quiz	Sunday of Week 4
Week 5 Quiz	Sunday of Week 5

Week 7 Quiz	Sunday of Week 7
Week 8 Quiz	Sunday of Week 8
Week 9 Quiz	Sunday of Week 9
Week 10 Quiz	Sunday of Week 10
Week 11 Quiz	Sunday of Week 11
Week 13 Quiz	Sunday of Week 13
Week 14 Quiz	Sunday of Week 14
Week 15 Quiz	Sunday of Week 15

Assignment Deadlines

Assignment (or MP)	Hard Deadline
Assignment 1	Sunday of Week 2
Assignment 2	Sunday of Week 5
Assignment 3	Sunday of Week 8
Assignment 4	Sunday of Week 10
Assignment 5	Sunday of Week 13

Assignment 6	Sunday of Week 15
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Exam Release and Exam Window (if applicable)

Week	Exam	Available Date (The exam can be only taken during the period below)
6	Exam I	10/4 12:15 AM to 10/8 10:30 PM US Central Time
12	Exam II	11/15 12:15 AM to 11/19 10:30 PM US Central Time

Late Policy

- Unless otherwise specified, all assignments are due at **11:59 PM US Central Time** on the due date. ([Time Zone Converter](#))
- No late submissions will be accepted, unless you reach out to the instructor ahead of time.

Academic Calendar

- The Graduate College at the University of Illinois maintains a [Graduate College Calendar](#). The calendar includes important dates such as final exam dates, course registration and cancellation, and holidays.
- There is also a [campus-wide calendar](#) available.
- The CS Department also sends reminders about upcoming deadlines. You will also receive the Graduate College newsletter in your Exchange email account.