



THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STAT 3303

BAYESIAN ANALYSIS AND STATISTICAL DECISION MAKING

SPRING 2024

Course overview

Instructor

Instructor: Dr. Matthew Pratola

Email address: mpratola@stat.osu.edu

Office hours: Virtual Office Hours via Carmen Zoom, Fridays: 10:00am–11:00am

Graders

Contact information: provided on Carmen.

Office hours: Online (information available on Carmen).

Class Meetings

MWF from 11:30am–12:25pm in-person Pomerene Hall 250.

Course description

This course is an introduction to Bayesian analysis and statistical decision theory, the theory of making decisions in the presence of uncertainty. Topics covered include the formulation of decision problems and the quantification of their components, optimal decisions, Bayesian modeling, simulation-based approaches to obtaining Bayesian inferences (including MCMC algorithms), and hierarchical modeling.

Prerequisite: C- or better in 3301, or permission of the instructor.

Prerequisite or concurrent: n/a.

Course learning outcomes

By the end of this course, students should successfully be able to:

- Formulate the inputs to a decision problem including potential actions, losses and gains, and quantification of uncertainty.
- Develop Bayesian statistical models to quantify uncertainty and obtain inferences on unknown model parameters.
- Use posterior distributions to obtain optimal decisions based on available information.
- Assess the impacts of departures from model assumptions on inferences and decisions.
- Explain Bayesian statistical analyses to others, such as managers and other decision makers.

Course materials

Required

Doing Bayesian Data Analysis: A Tutorial with R, JAGS, and Stan, 2nd Edition, by John K. Kruschke, ISBN: 978-0-12-405888-0. (Available in electronic format through the library).

Course technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at <https://ocio.osu.edu/help/hours>, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** <http://ocio.osu.edu/selfservice>
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Carmen

Technology skills necessary for this specific course

- CarmenZoom

- Scanning and uploading a written document to Carmen

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

Necessary software

- This class requires you to use the statistical software package called R (The R Project for Statistical Computing; <http://www.r-project.org/>). This software package is available as Free Software.
 - You can download R for Windows, Mac, and Linux, from the CRAN archive at <https://cran.r-project.org>.
 - Students needing a review of programming using R should read Chapter 3 of the textbook carefully and consult the instructor for additional resources, if necessary.
- An easy-to-use interface to R is available in the software package RStudio. This package is available for Windows, Mac, and Linux and can be downloaded for free from <http://rstudio.org>. **Note that RStudio requires R to be installed.**
- We will also be using the Just Another Gibbs Sampler (JAGS) software, accessed through an interface with R. No prior experience with JAGS is expected.
- This class may use the (free) R Markdown authoring framework to complete assignments. Information about R Markdown can be found at <https://rmarkdown.rstudio.com>.
- Microsoft Office 365 ProPlus All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Each student can install Office on five PCs or Macs, five tablets (Windows, iPad® and Android™) and five phones.
 - Students are able to access Word, Excel, PowerPoint, Outlook and other programs, depending on platform. Users will also receive 1 TB of OneDrive for Business storage.
 - Office 365 is installed within your BuckeyeMail account. Full instructions for downloading and installation can be found <https://ocio.osu.edu/kb04733>.

Course delivery

The course will be delivered in-person. You are expected to attend lectures and participate in class. Class meetings will consist of a mix of lectures, in-class exercises, and informal discussions. Students are expected to attend all class meetings and actively participate in

discussions. Regular attendance and class participation are expected and will be used, in part, to determine the small participation component of the final grade. Please let the instructor know by via a Carmen email if you will miss any lectures. If there are circumstance that may affect your ability to attend class regularly, please let the instructor now as early as possible.

In case of instructor illness, emergency or research commitments, a lecture may be changed to online delivery. The instructor will provide as much notice as possible of any such changes via email and on Carmen. In such cases, a recorded asynchronous lecture will be made available on Carmen.

Virtual office hours will be held on Friday afternoons. The schedule and Zoom links will be posted on Carmen. The graders for the course will hold virtual office hours several times during the week. The schedule and information for how to attend these virtual sessions will be made available on Carmen.

Grading and faculty response

Grades

Assignment or category	Percentage
Homework	25
Midterm 1	20
Midterm 2	20
Final Exam Project	30
Participation	5
Total	100

Homework: Homework will be assigned (approximately) every other week, will be due on the dates announced in class and will be graded. Homework must be uploaded to Carmen by the due date and time. Submitted homework may be typed or handwritten, or some combination of the two, but should be combined and uploaded as a single PDF file. Figures and tables should be clearly referenced. All R/JAGS code should be submitted as an appendix, or you may use R Markdown to prepare your assignment. The lowest homework grade will be dropped.

Students may discuss homework assignments with other students enrolled in STAT 3303 this semester. However, you may not directly copy another student's work, including computer code and output. Use of written solutions to homework questions that are prepared by someone else is prohibited.

Tentative due dates for the assignments are posted on Carmen. The assignments and assignment solutions will be posted on Carmen. You must show all your work for all homework problems; do NOT just write the final answer. Late submissions will NOT be accepted. Academic misconduct of any sort will NOT be tolerated. Please review OSU's policies at <http://studentlife.osu.edu/csc/>.

Midterm Exams: There will be two in-class midterms that cover material from lecture, the assigned readings and homework. The second exam will be cumulative, but will emphasize the material covered after the first midterm exam. A basic calculator will be necessary for all exams (cell phone calculators, iPad's, etc., are not permitted). Cellphones must be silenced during class and are not allowed to be on the desk or otherwise accessible during exams. No make-up exams will be given.

Final Exam Project: Students will have a take-home individual final exam project rather than an in-class final exam. The individual final exam project will be assigned several weeks prior to the end of the semester and will be due on Friday April 26th at 12:00pm.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70 –72.9: C-
67 –69.9: D+
60 –66.9: D
Below 60: E

Faculty feedback and response time

I am providing the following to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** if you have a technical problem.)

Grading and feedback

For large weekly assignments, you can generally expect feedback within **7 days**.

E-mail

I will reply to e-mails within **24 hours on school days**. Specific technical questions about the course material that require significant back-and-forth communication are not well suited for e-mail; while I will do my best to answer such questions, I may ask that you attend virtual office hours if your question isn't easily answerable over email.

Attendance, participation, and discussions

Student participation requirements

The following is a summary of everyone's expected participation:

- **Attend class meetings:**
Students are expected to attend and participate in class meetings.
- **Logging in:**
Be sure you are logging in to the course in Carmen each week, including weeks with holidays. You will need to log in to Carmen to view the reading assignments and upload homework assignments. (During most weeks you will probably log in many times.) If you have a situation that might cause you to miss an entire week of class, discuss it with me as soon as possible.
- **Office hours: OPTIONAL OR FLEXIBLE**
All office hours are optional. If you need to speak with me privately about a topic that cannot be easily discussed during office hours, please contact me to schedule a time to meet.

Other course policies

Student academic services

Student academic services offered on the OSU main campus

<http://advising.osu.edu/welcome.shtml>.

Student support services

Student support services offered on the OSU main campus <http://ssc.osu.edu>.

Academic integrity policy

Policies for this online course

- **Exams:** You must complete all midterm and final exams on your own without assistance from anyone other than the course instructor. You may not assist anyone on an exam. You may not communicate about an exam with anyone until after the exam window for all students has closed. You will be able to use all your course materials as a reference during the exams.
- **Written assignments:** Your written assignments should be your own original work. In formal assignments, you should cite the ideas and words of your research sources.
- **Reusing past work:** In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.
- **Collaboration and informal peer-review:** While study groups and peer-review of major written projects are permitted, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free to ask the instructor.

Ohio State's academic integrity policy

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course. **No course materials provided by the instructor (notes, videos, recordings, computer code, homework assignments, homework solutions, quizzes, exams, etc.) may be distributed publicly or privately to anyone outside of the class.**

Statement on title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been

sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614- 292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273- TALK or at suicidepreventionlifeline.org

Religious Accommodations

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

Accessibility accommodations for students with disabilities

The university strives to make all learning experiences as accessible as possible. In light of the recent pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; <http://slds.osu.edu>; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- [Carmen \(Canvas\) accessibility](#)
- Streaming audio and video
- Synchronous course tools

Disclaimer

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular we reserve the right to change due dates or the methods of grading and/or assessment if necessary. Any changes will be communicated to you through official course announcements.

Course schedule (tentative)

The following tentative course schedule is subject to change. The schedule for each week will be posted on Carmen on Mondays.

Week	Dates	Topics, Readings, Assignments, Deadlines
1	Jan 8-12	Chapter 4
2	Jan 17-19	Chapter 4
3	Jan 22-26	Chapter 5+2; Chapter 6
4	Jan 29-Feb 2	Chapter 6
5	Feb 5-9	Chapter 6; Chapter 16.1
6	Feb 12-16	Chapter 6; Chapter 16.1; Notes
	Feb 19	Midterm 1
7	Feb 21-23	Chapter 6; Chapter 16.1; Notes
8	Feb 26-Mar 1	Notes
9	Mar 4-8	Chapter 7
10	Mar 11-15	Spring Break
11	Mar 18-22	Chapter 7; Chapter 9; Notes
12	Mar 25-29	Chapter 9; Notes
13	Apr 1-3	Chapter 9; Notes
	Apr 5	Midterm 2
14	Apr 8-12	Chapter 9; Notes
15	Apr 15-19	Chapter 17.1; 17.3; 18.1-18.2; 15.1-15.3; 19.2-19.3
16	Apr 22	Chapter 15.1-15.3; 19.2-19.3
	Apr 26	Final Exam Project due at noon

Syllabus version

July 16, 2022: original

Aug 22, 2022: tentative midterm dates added

Aug 25, 2022: added final exam date

Aug 13, 2023: revised for AU2023 in-person

Jan 4, 2024: revised for SP2024 in-person