SYLLABUS: STAT 3303 BAYESIAN ANALYSIS AND STATISTICAL DECISION MAKING - SPRING 2021

Course overview

Instructors

- Oksana Chkrebtii (coordinator)—record lectures, coordinate the course
- Olivia Cleymaet (instructor) – lead weekly synchronous lab sessions, answer questions
    - Mondays, 9:10 am - 10:05 am for section 10 (20662)
    - Mondays, 10:20 am - 11:15 am for section 20 (28803)
- Juan Xie (grader) - grade homework, answer questions about graded work, hold office hours
- Haozhen Yu (grader) - grade homework, answer questions about graded work, hold office hours

How to contact us

This is a large class, so please use the following rough guide to make sure your question is answered as efficiently as possible. We will work hard to answer your questions within 48 hours on business days:

Olivia Cleymaet
- Questions regarding material (office hours, Carmen discussion board, Carmen email)
- Clarification about test grading (office hours, Carmen email)
- Give notice of lab absence (Carmen email)
- Clarification about graded tests (office hours, Carmen email)

Oksana Chkrebtii
- Questions regarding material (office hours, Carmen email)
- Special accommodation requests (Carmen email)
- General questions about course policy (Carmen discussion board "Course Q&A")
- Request meeting outside of office hours (Carmen email & list times in the following 5 business days when you will be available, the more the better)

Juan Xie or Haozhen Yu (whoever graded your work)
- Clarification about graded homeworks (Carmen email)

Office Hours

Virtual Hours via Carmen Zoom (see Carmen page for Zoom link) will be held on:

- Oksana Chkrebtii: TBD, TBD
- Olivia Cleymaet: TBD, TBD

MSLC virtual office hours via Carmen Zoom (Zoom link can be found [here](#))

- Juan Xie: TBD, TBD
- Haozhen Yu: TBD, TBD

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.

Prerequisites: C- or better in STAT 3202 and 3301, or permission of instructor.

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
- Camera and/or scanner or tablet functionality: ability to scan, photograph, or write directly on a tablet and upload documents to Carmen

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.
  - An in-depth introduction to R is available at http://cran.r-project.org/doc/manuals/R-intro.pdf
  - Hands-on tutorials are available in the Swirl system, which you can learn about at http://swirlstats.com/. In particular, "R Programming: The basics of programming in R" is an appropriate first tutorial for students who have never used R.
- An easier 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.**

- [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

Each week several lecture videos, totaling approximately 1.5 hours of lecture, will be posted on the course website. You are responsible for watching the videos and studying the material that is assigned each week. On Mondays, a live online lab session will be conducted during the regularly-scheduled class (9:10 am - 10:05 am for section 10 [20662] and 10:20 am - 11:15 am for section 20 [28803]). Participation is mandatory, and attendance will be taken. Please notify the lab instructor in case of illness, planned absence, or other situation requiring accommodation.

In addition to the lecture videos, assignments will be posted on the class website approximately every two weeks. You will be given approximately one week to complete the assignments. See Carmen calendar for specific due dates.

The instructors will hold weekly office hours via CarmenZoom. The dates and times will be announced later and posted on the Carmen website.

Exams will take place on Fridays from 9:10am to 10:05am for both sections. Anyone with a conflict must notify

Grading and faculty response

Grades

Assignment or category	Percentage
Homework (lowest grade will be dropped)	**30**
Test 1	**15**
Test 2	**15**

Test 3	15
Final Project	15
Participation	10
Total	100

Note: Any final grade that is up to one percentage point away from a letter grade cut-off will be rounded up to the larger letter grade. No other individual adjustments will be made unless they benefit the entire class equally.

Assignment information

Homework will be assigned approximately every two weeks. It will consist of mostly textbook-style problems, problems motivated by real-world applications, and analyses requiring the use of statistical software. You may work together on assignment problems, but each student must hand in their own work, written in their own words. Do not copy any part of another student's homework including computer code or output. Use of homework solutions distributed in previous offerings of the course or available on the web constitutes academic misconduct and will be handled according to university rules. Sharing or disseminating solutions, or in any way knowingly enabling others to commit academic misconduct also constitutes academic misconduct, and will be reported. Homework must be uploaded to Carmen before the beginning of class on the due date. The solutions may be handwritten and scanned, entered directly into a tablet, or typed. Any software output must appended to the homework file prior to submission. **All work and software output must be uploaded as a single pdf file**. Please be sure that the questions are clearly labeled, all supporting work (including software output) can be easily identified, and that all figures/tables are referenced and interpreted in the text.

Late assignments

Assignment solutions will be posted shortly after submission. No late assignments will be accepted without prior permission or formal documentation. The lowest homework grade will be dropped for each student. Accommodations can be made in special circumstances (most must be officially documented), so please notify the instructor as soon as possible if this situation arises.

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

Grading and feedback

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

E-mail

Please use the Carmen email tool to get in touch with us. Due to the large volume of emails, we will aim to reply to e-mails within **48 hours on school days**.

Attendance, participation, and discussions

Students may miss class, for a variety of reasons related to COVID-19. As much as possible, please stay in contact with the instructors so that we can discuss accommodations should they be needed.

Student participation requirements

Because this is a distance-education course, your attendance is based on your online activity and participation. The following is a summary of everyone's expected participation:

- **Lab sessions**: **WEEKLY, SOME ABSENCES ALLOWED**
  Attendance at the lab sessions is mandatory. Students will be allowed at most three absences without questions. Any additional absences must be justified to the lab instructor in writing via email.

- **Carmen content quizzes**: **EVERY TWO WEEKS**
  Short Carmen quizzes will be assigned weekly. All must be completed. These will be graded for completeness rather than correctness.

- **Logging in**: **AT LEAST ONCE PER WEEK**
  Be sure you are logging in to the course in Carmen each week, including weeks with holidays or weeks with minimal online course activity. (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 and live sessions**: **OPTIONAL OR FLEXIBLE**
  All live, scheduled events for the course, including my office hours, are optional. For live presentations, I will provide a recording that you can watch later. If you are required to discuss an assignment with me, please contact me at the beginning of the week if you need a time outside my scheduled office hours.

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. Informality (including an occasional emoticon) is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. (For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.)
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Other course policies

Health and safety

The Ohio State University Wexner Medical Center's Cornavirus Outbreak site (https://wexnermedical.osu.edu/features/coronavirus) includes the latest information about COVID-19 as well as guidance for students, faculty and staff.

Potential disruptions to instruction

Contingencies to be addressed:

- Student is unable to attend class because of positive diagnosis, symptoms, or quarantine required following contact tracing
- In-person classes are suspended at the university
- Instructor is unable to be present in person because of positive diagnosis, symptoms, or quarantine following contact tracing

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 the midterm and final exams yourself, without any external help or communication. Weekly quizzes are included as self-checks without points attached.
- **Written assignments**: Your written assignments, including discussion posts, should be your own original work. In formal assignments, you should follow APA style to cite the ideas and words of your research sources. You are encouraged to ask a trusted person to proofread your assignments before you turn them in--but no one else should revise or rewrite your work.
- **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.
- **Falsifying research or results**: All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.
- **Collaboration and informal peer-review**: The course includes many opportunities for formal collaboration with your classmates. While study groups are allowed, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

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.

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

Accessibility accommodations for students with disabilities

The university strives to make all learning experiences as accessible as possible. In light of the current 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

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

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

Please see course Carmen page for detailed calendar.

Week	Topics, Readings, Assignments, Deadlines
1	Review of probability and decision making
2-4	Principles of Bayesian inference
5-6	Bayesian prediction
7-8	Bayesian regression and hierarchical models
9-10	Bayesian Computation
11-13	Markov chain Monte Carlo (MCMC) and JAGS
14	Bayesian Linear Models