

STAT3303 – 3 CREDIT HOURS

Bayesian Analysis and Statistical Decision Making

Term: Spring, 2022

Instructor: Matthew T. Pratola

Email: mpratola@stat.osu.edu

Location: MoWeFr 11:30-12:25am Pomerene Hall 250

Office Hours: Fr 1:00-2:00pm (Zoom)

Grader: yang.5733@osu.edu

DALC Hours: <https://data-analytics.osu.edu/dalc>

Course Website: Carmen (Canvas)

Long course title: Bayesian Analysis and Statistical Decision Making

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.

Expected Learning Outcomes:

Upon successful completion of the course, students will be able to

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

Course Prerequisites:

C- or better in STAT 3202: Introduction to Statistical Inference for Data Analytics, or permission of instructor.

Textbooks: The required textbook for the course is *Doing Bayesian Data Analysis: A Tutorial with R, JAGS, and Stan, 2nd Edition* (2015) by John K. Kruschke, ISBN: 978-0-12-405888-0. **The OSU library has an e-book version of text available.**

Course Requirements:

Students will be required to use the R software environment for statistical computing and graphics. R can be downloaded for free at <http://cran.r-project.org>. Prior experience with R is expected. 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. 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. Many students prefer to use

RStudio, an IDE designed for use with R. RStudio is available for free at <http://www.rstudio.com>.

Students are responsible for all material covered in class, in the assigned readings and in homework problems. As an introductory course, the quantity of material covered in the lectures is extensive. *It is highly recommended that you do not fall behind.* All course materials (including reading and homework assignments) will be available on the course Carmen page (<http://www.carmen.osu.edu>).

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 know as early as possible.

Assignments:

Homework will be assigned (approximately) every other week, will be due on the dates announced in class and will be graded. Students are expected to turn in hard copies of homework assignments at the beginning of class on the day the assignment is due. Submitted homework may be typed or handwritten, or some combination of the two. 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 shown below. The assignments and assignment solutions will be posted on Carmen (Canvas). 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 29th at 12:00pm.

Dates:

Homework due dates and midterm dates are tentatively as follows (please refer to in-class announcements for official dates):

Homeworks				
HW1: 01/28	HW2: 02/11	HW3: 02/18	HW4: 03/11	HW5: 04/06
HW6: 04/22	-	-	-	-

Midterms

Midterm 1: *Monday February 21st* Midterm 2: *Friday April 8th*

Last time I checked, the last day to drop the course without a ‘W’ appearing on your record is February 4th and the last day to drop a course without petition is March 25th. However, please refer to the OSU registrar’s office for official drop guidelines in case these dates change.

Grading:

The weights for each component of the grades are: **25%Homeworks, 20%Midterm 1, 20% Midterm 2, 30% Final Exam Project, 5% Participation.**

Schedule of Topics (tentative):

See the *schedule.pdf* file on Carmen for a tentative schedule. I will update this as we go along.

Data Analytics Learning Center: GTA / Grader Office Hours:

Graduate teaching assistants (GTAs) for Stat 3201, 3202, 3301, 3302, 3303 and 4620 will hold their office hours in the Data Analytics Learning Center (DALC) in Pomerene 151. The hours during which the GTA/grader for our course will hold office hours in PO 151 can be found at the top of the syllabus. You can meet with the GTA for our course in the DALC during his or her office hours to discuss questions you have about the course material, homework assignments, R, etc.

You are welcome to stop by the DALC when it is open even if it is not currently being staffed by the GTA for our course, e.g. if you are looking for a place to study or work on an assignment for one of the supported courses. If the DALC is staffed by a GTA for another Statistics course when you stop by, he or she will help you if possible, but may not be able to answer all of your questions.

A complete list of hours during which the DALC will be staffed by GTAs for Statistics Department courses can be found at <https://data-analytics.osu.edu/dalc>.

In rare situations due to last minute emergencies, the GTA assigned to the DALC may not be able to attend his or her office hours. If the DALC is closed when the schedule indicates it should be open, we recommend waiting for a few minutes. If no one shows up in a reasonable amount of time, please email your instructor to let us know about the problem. You can also contact your GTA to see about arranging a make-up time to meet.

Academic Misconduct:

ACADEMIC MISCONDUCT OF ANY SORT WILL *NOT* BE TOLERATED.

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/>.

Special Accommodations:

The University strives to make all learning experiences as accessible as possible. 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: sllds@osu.edu; 614-292-3307; sllds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

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.

Sexual Misconduct/Relationship Violence:

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.

Diversity at Ohio State:

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.