

STAT 535, Introduction to Bayesian Data Analysis – Spring 2022

Instructor:

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Course Web Page: <http://people.stat.sc.edu/hitchcock/stat535.html>

(Also will be accessible via Blackboard)

Classes:

Meeting Times: MWF 9:40 a.m.-10:30 a.m., Carolina Coliseum Room 2006 (COL 2006)
(also available online via Blackboard Collaborate Ultra)

Office Hours:

Mon-Tues-Wed-Fri 10:45-11:45 a.m., or please feel free to make an appointment to see me at other times.

Prerequisites:

STAT/MATH 511 and STAT 515 or equivalent, or CSCE 582 (= STAT 582).

Textbook : *Bayes Rules! An Introduction to Applied Bayesian Modeling*, by Alicia A. Johnson, Miles Q. Ott, Mine Dogucu. CRC Press, 2022. Online version available at: <https://www.bayesrulesbook.com/>

Other Resource (not required): Kruschke, John K.. *Doing Bayesian Data Analysis*, Second Edition. Academic Press, 2015.

Course Outline: Topics covered include: Principles of Bayesian statistics; one- and two-sample Bayesian models; Bayesian linear and generalized linear models; Monte Carlo approaches to model fitting; Prior elicitation; Hypothesis testing and model selection; Complex error structures, hierarchical models; Statistical packages such as BUGS/WinBUGS, R, or SAS.

Learning Outcomes: Upon completion of the course, successful students will:

- Understand the philosophy of Bayesian statistical modeling
- Understand Bayesian models for numerous common data analysis situations, including prior elicitation
- Be able to use software such as R and Stan to implement Bayesian analyses
- Understand basic principles of both conjugate analyses and MCMC-based Bayesian analyses

Homework: Homework will be assigned on the course web page. Due dates will be posted given on the course web page. Late homework will be penalized and will not be accepted after solutions are posted. You must do each homework problem independently. You may not look at another student's work while doing the homework. You may ask me for help on the homework problems. If homework is found to have been copied, all students involved will receive a 0. [To be clearer, students can ask each other informal ORAL questions about homework, but cannot look at or copy each other's homework papers. All submitted homework must be the student's own work and NOT come from any other person or external source.]

Exams: There will be two midterm exams (an in-class exam scheduled for February 18, and a take-home exam around late March). There will also be a final exam (format to be announced later); if it is in-class, it will be May 2 at 9:00 a.m. The first midterm exam will be given in the classroom during the regularly scheduled class time. If you are not able to come to campus for the exam, you must contact the distance education office to set up a proctor. If you are on campus and not able to attend class live, you may either contact Shannon Carson in the distributed learning office (scarson@mailbox.sc.edu or 803-777-2189) to set up a proctor, or may arrange with me to take it at some other time.

Data Analysis Project: The project will be due near the end of the semester and will involve collecting or obtaining a real data set and analyzing it using the methods discussed in this class. There will be the option of working in teams or individually. More information will be given out later in class.

Graduate Students: Any students enrolling in the course for graduate credit will do some extra homework problems during the semester.

Grading:

The course grade will be based on homework (15%), the project (15%), 2 midterm exams (22.5% each), and a final exam (25%). The overall course average will result in the following grades: 90-100 = A, 87-89 = B+, 80-86 = B, 77-79 = C+, 70-76 = C, 67-69 = D+, 60-66 = D, 59 and below = F.

Computing:

Some problems in this course involve significant computations, and for these, we will learn to use the statistical software packages R and several packages needed to run Stan code within R. It is required to download R (for free) and the associated packages; instructions are given on the course web page, within the links at the online textbook website, and via a video in Blackboard Collaborate Ultra on the STAT 535 Blackboard course page.