Syllabus for ST440/ST540
Applied Bayesian Analysis, Spring 2025

Course:

Meeting time:	Mondays, 1216 SAS Hall, 1:30–2:45
Course website:	https://st540.wordpress.ncsu.edu/

Instructor: Brian Reich

Office:	5212 SAS Hall
Email:	bjreich@ncsu.edu
Office Hours:	Wednesdays, 1:30–2:30 PM in SAS and on zoom (link on moodle)
	Thursdays, 4:30–5:30 PM on zoom (link on moodle)

Teaching Assistant: Ryan Li

Email:	rli18@ncsu.edu
Office Hours:	Wednesdays, 8–9 PM on zoom (link on moodle)

Prerequisites for ST440: ST 422 and ST 430.

Prerequisites for ST540: ST 501 or ST 512 or ST 514 or ST 515 or ST 516 or ST 517.

Math prerequisites: This is a calculus-based course and requires basic derivatives and integrals.

Textbook: *Bayesian Statistical Methods.* Reich BJ and Ghosh SK.

Computing: The primary computing language will be R, which is freely available at `http://www.r-project.org/`. We will also use JAGS, which is freely available at `http://sourceforge.net/projects/mcmc-jags/files/`.

Course lectures: The course is "flipped" and follow the general format:

- **Mondays**: Lab session in SAS for in-person students, panopto for online students.

- **Wednesdays**: Watch a video with the week's content (schedule on moodle).

Grading: Final grade will be based on:

$$\text{Final Semester Score} = (5Q + 10H + 30E1 + 30E2 + 25F)/100,$$

where Q is weekly quiz average, H is the homework average, $E1$ and $E2$ exam grades, and F is the final exam (all out of 100).

Weekly quizzes: There will be a weekly quiz on moodle. The lowest score each month can be dropped and no replacement quizzes can be taken without written notice in advance of the quiz.

Homework: There will be six homework assignments. Problems and due dates will be posted moodle and work should be submitted through moodle. Students are encouraged to work in groups. All unexcused late homework will be given a 50% penalty.

Mid-term exams: The midterms will be take-home projects and are tentatively scheduled for Feb 17 and Apr 14.

Final project: The final is a group research project due April 28 at 12:00PM.

The final exam grade can replace a university-excused missing exam grade. Unexcused missing exams, or inadequate notice of missing an exam will result in a grade of 0 for the exam.

Course objectives:

1. Summarize the relative strengths of Bayesian and frequentist methods.
2. Derive the posterior distribution for one-parameter models with conjugate priors.
3. Use Markov Chain Monte Carlo (MCMC) via JAGS to simulate from the posterior.
4. Effectively summarize a posterior distribution using tables and graphics.
5. Compare models using cross-validation and goodness-of-fit diagnostics.
6. Apply and interpret Bayesian machine learning methods for large datasets.

Policy on Academic Integrity: The University policy on academic integrity is spelled out in Appendix L of the NCSU Code of Student Conduct. For a more details see the NCSU Office of Student Conduct website `http://www.ncsu.edu/student_conduct/`. For this course group work on homework is encouraged. However copying someone else's work and calling them your own is plagiarism, so the work you turn in should be your own.

Students with Disabilities: Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students (DSS), 1900 Student Health Center, CB 7509, 515-7653.