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Applied Bayesian Analysis
STAT 5143/6043
SPRING SEMESTER 2026
TH 2:00 pm – 3:20 pm, 60WCHARL 273

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Instructor:	Dr. Siva Sivaganesan, Professor, Statistics.
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Office Hours:	Th. 1:00-1:50 PM (in-person), Mon. 9-10 am (Virtual), or by appointment (in-person or virtual). Please send an email at least 30 min. ahead. If virtual, you will receive a Zoom link via email.

Course Description: This is a course on Bayesian statistics, which is a particular approach to statistical inference that differs philosophically and operationally from the classic frequentist approach many of the students are familiar with from other courses.

Objective: This course will introduce students to the Bayesian paradigm for data analysis. Students will learn how uncertainty regarding parameters can be explicitly described using a prior distribution and using a posterior distribution which blends information from a sampling model and the prior distribution. The course will emphasize modeling and computations under the Bayesian paradigm. Statistical software in R and RJAGS for Bayesian statistics will also be introduced.

Topics Covered:
- Introduction to Bayesian inference,
- Prior and Posterior distributions
- Bayesian Inference.
- Choice of Prior distributions.
- Bayesian inference for parameters in standard families of distributions for which closed form solutions are available.
- Bayesian inference with large samples.
- Bayesian inference using Monte Carlo.
- Markov Chain Monte Carlo Methods and application to Bayesian inference.
- Hierarchical Models and their applications.
- Special Topics such as logistic regression, generalized linear models and mixed models, and applications.

Textbooks/References/ Notes:
Textbook**:** Lecture notes will be posted on canvas.
However, a good reference for the class is:
Peter Hall, A First Course in Bayesian Statistical Methods" Springer Publishing Company 2009, Incorporated.
- For the book website: https://pdho.github.io/book/
- For book online pdf: https://link.springer.com/content/pdf/10.1007%2F978-0-387-92407-6.pdf
Following are three complementary textbooks:
- Gelman, J. B. Carlin, H. S. Stern, D. B. Dunson, A. Vehtari, and D. B. Rubin, Bayesian Data Analysis", Third Edition, Chapman & Hall/CRC Texts in Statistical Science, 2013. This is mostly showing
- John Kruschke, Doing Bayesian Data Analysis: A Tutorial with R, JAGS, and Stan" 2016. This is a good book to assist with coding for application of Bayesian statistics in simple models and applications. Access through UC Library:
- Bayesian Choice" by Christian P. Robert, 2nd Edition, Springer 2011. This is for advanced readers and a good reference for PhD Students

Prerequisites: Students are required to have satisfactorily completed STAT 6021 or obtain permission from the instructor.

Computing
Initially, required computing can be done using R. Later, we will mostly use JAGS (which is based on the original software WinBUGS).

Canvas: Please follow Canvas closely and frequently for important announcements, course notes, homework assignments and grades.

Homework: Homework will be assigned through Canvas. You need to submit a scanned pdf document of your homework solution to Canvas. No late homework will be accepted unless there are extenuating circumstances of extreme nature. You are encouraged to prepare the homework using a word processor (e.g., Word. LaTex) and include Sloppy or illegible answers will not be graded and will receive zero credit. No late homework will be accepted except for extreme circumstances supported by documentation.

Attendance: Class attendance is important for learning and knowing what is covered. Make sure to attend each class. Avoid arriving late or leaving before the end of class and get advance permission from the instructor if you must miss a class. Attendance will be taken regularly and one percent of the course total per missed class (up to a total of 5 percent) will be deducted for missing a class without advance permission from instructor via email, except in cases of extreme circumstances supported by documentation.

Tests and Project: There will be two tests and a project.

Personal Communication Devices Policy: Cell phones must be either turned off or put on vibrate mode during class, and must be turned off during exams. Additionally, please make all efforts not to use cell phones during the class time.

TENTATIVE EXAM SCHEDULE AND COURSE GRADE DETERMINATION

Work	Date	Percent towards Course Grade
Homework	Periodically	25%
Attendance and participation		See policy on Attendance
TEST #1	**TBD**	25%
TEST #2	**TBD**	25%
Project	**TBD**	25%

COURSE GRADES

96-100:	A	87-89:	B+	77-79:	C+	67-69:	D+	<60:	F
90-95:	A-	83-86:	B	73-76:	C	63-66:	D		
		80-82:	B-	70-72:	C-	60-62:	D-		

Withdrawal: Friday, April 10, 2026 is the last day to withdraw from the class. If you withdraw, the instructors will be required to affirm whether or not you minimally participated in the class. Although the instructors will do the best to answer accurately, in the absence of any evidence to the contrary the instructors will affirm that you did not minimally participate. Ways for you to provide clear evidence of your presence in the class include taking a test, turning in a homework, or signing an attendance sheet.

Academic Integrity:

The University Rules, including the Student Code of Conduct, and other documented policies of the department, college, and university related to academic integrity will be enforced. If you are found responsible for academic misconduct of any kind, including acts of plagiarism or cheating, unauthorized use of material and tools, will be dealt with and sanction applied on an individual basis according to the severity of the misconduct. (http://www.uc.edu/conduct/Academic_Integrity.html)

Note: Any misconduct may result in **the failure of the entire course (with semester grade F)**, not only the failure of a test or homework.

In this class, the academic misconduct includes, but is not limited to, the following actions:
- Copy **classmates' homework** or cheat **classmates' exams**,
- Copy **homework solutions** provided to students who took the same course **in previous semesters**,
- Copy **homework solutions** downloaded or available **from internets** (even there are no copyrights or warnings on the documents displayed) or an anonymous source,
- Getting solutions using AI tools and providing them as your own solutions,
- as well as other misconducts which are prohibited by the Student Code of Conduct.

Personal Communication Devices Policy: Cell phones must be either turned off or put on vibrate mode during class and must be turned off during exams.

Email Communication Policy: All communications must be done via a **valid UC email**. The instructor will try his best to reply within one business day from receipt of emails. Any correspondence using a personal account, e.g., Gmail account, will not be responded.

Policy about early/make-up exams:
Except when prior arrangement is made and instructor's consent is obtained, make up for missed tests or homework will not be entertained unless there is an extenuating circumstance such as medical emergency and proper supporting documentation is provided.

The student must request the early/make-up test within a reasonable amount of time before/after one of the following **excusable** events occurs:
- **Illness**. Need official certification from your doctor, typed on medical stationery (with their license # to practice medicine).
- **Athletic event participation**. Need a signed letter from your coach no later than **one week prior to** the day of the exam.
- **Attending the funeral of an immediate relative**. Need proof of attending the funeral with the date of the ceremony.
- **Mandatory courtroom appearance**. Need a copy of your official court summons with the date.

Taking an exam early/late due to **a personal travel schedule** will not be permitted.

Special Needs Policy: If you have any special need related to your participation in this course, including identified visual impairment, hearing impairment, physical impairment, communication disorder, and/or specific learning disability that may influence your performance in this course, you should meet with the instructor to arrange for reasonable provisions to ensure an equitable opportunity to meet all the requirements of this course. At the discretion of the instructor, some accommodations may require prior approval by Disability Services. In order to take advantage of those available accommodations, students may contact the Disability Services Office at 210 University Pavilion (https://www.uc.edu/campus-life/accessibility-resources.html).

Regrading Policy: If a student believes that grading errors have occurred, the student should request for regrading **within the next four business days after receiving the graded work**. This will apply even if the student is absent on the day the work is returned unless prior permission was obtained from the instructor.

Religious Accommodation

Ohio law and the University's Student Religious Accommodations for Courses Policy 1.3.7 permits a student, upon request, to be absent for reasons of faith or religious or spiritual belief system or participate in organized activities conducted under the auspices of a religious denomination, church, or other religious or spiritual organization and/or to receive alternative accommodations with regard to examinations and other course requirements due to an absence permitted for the above-described reasons. Not later than fourteen days after the first day of instruction in the course, a student should provide the instructor with written notice of the specific dates for which the student requests alternative accommodations. For additional information about this policy, please contact the Executive Director of the Office of Equal Opportunity and Access at (513) 556-5503 or oeohelp@UCMAIL.UC.EDU.

*This syllabus is subject to change. Any changes will be notified either in class or via Canvas.

Tentative Schedule
(This will be regularly updated)

Week # - Beginning date	Topics
1 - August 25	Quick review of fixed effects models. ANCOVA
2 -September 1	Random Effects and Mixed effects models. *(No class on Monday, Sep .2 - Labor Day)*
3 -September 8	Mixed effects models.
4 -September 15	Mixed effects models and nested models
5- September 22	Nested-Factorial Design and Split Plot Design
6- September 29	Split Plot Design, **Midterm 1: Fri., Oct. 4 (Tentative. May be held another time/day)**
7 -October 6	Repeated Measures Designs *(Friday, Oct. 11 – Reading Day, No Class.)*
8 -October 13	Multivariate analysis,
9 -October 20	Multivariate normal distribution and inference for means.
10- October 27	Multivariate ANOVA
11- November 3	MANOVA **Midterm 2: Fri. Nov. 8^d (Tentative. May be held another time/day)**
12- November 10	Principal Component Analysis *(Veterans Day-Holiday, Monday, Nov. 11. No Class)*
13- November 17	Factor Analysis.
14 -November 24	Discriminant analysis. *(Thanksgiving Holiday, Th. Nov. 27. Fri. Nov. 28. (No Class.)*
15- December 1	Cluster analysis (if time allows).
Final Exam Week-December 8	**Final Exam: Wednesday, December 10, 2:45 am - 4:45 pm**