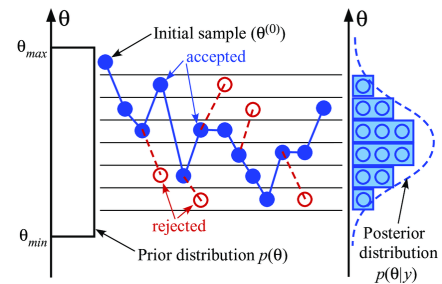


# STAT 4880|5088

## Bayesian Statistics and Statistical Computing

Fall 2024

## Course Information



### Meetings

STAT 4880/5088 section 01 meets TTh 11:00-12:15 in Ritter 323

### Instructor

Dr. Bryan Clair

bryan.clair@slu.edu

Office hours in Ritter 109: Tu 2:10-3:00, Wed 2:30-3:30, Thur 12:30-1:30, or by appointment.

### Textbook

The textbook for this course is *Bayes Rules!*, Johnson, Ott, Dogucu. It is available for purchase, or freely online at <https://www.bayesrulesbook.com>

### Technology

You will need a computer running updated versions of R and of RStudio. Bring your machine to class every day to do in-class projects and group work.

We will be using <https://www.myopenmath.com> as an online homework system. Access MyOpenMath assignments for this course through the canvas page with SLU's sign-on. That way your scores will be connected to your Canvas grade for the course.

Our course has an external web site: <https://turtlegraphics.org/bayes> I use this to distribute data and other files.

### Catalog Description

This course introduces Bayesian statistical methods and statistical computing techniques using statistical computing software. Topics include Bayesian models, Markov chain Monte Carlo, hierarchical modeling, model comparison and regression models.

Prerequisite: STAT 3850 Foundations of Statistics

### Grading

Grading is on a straight scale (uncurved), with 90%,80%,70%,60% guaranteeing A,B,C,D respectively.

Homework: 15%

Group labs: 15%

Quizzes: 15%

Exam 1: 15%

Exam 2: 15%

Final Exam: 25%

### Homework

Homework will be due weekly. Some will be through the online myOpenMath system, some handed in electronically (or on paper).

I encourage you to work together on homework, but write up results separately. Write your own R code, even if you are helping each other.

I'm usually willing to give individual deadline extensions for homework if you need one.

## Important Dates

- Exam 1: Tuesday, October 1.
- Fall break: Thursday, October 24.
- Exam 2: Tuesday, November 5.
- Thanksgiving: Thursday, November 28.
- Last day of class: Thursday, December 5.
- Final Exam: Tuesday, December 10 from 12-1:50pm

## Tentative Schedule

- Week 1: Probability review. Bayes' Rule.
- Week 2: Bayesian approach to probability.
- Week 3: Beta-Binomial model.
- Week 4: Balance and sequentiality.
- Week 5: Conjugate priors.
- Week 6: Grid approximation.
- Week 7: Markov Chain Monte Carlo. Metropolis-Hastings algorithm.
- Week 8: Posterior inference and prediction.
- Week 9: Posterior inference and prediction. Fall break.
- Week 10: Regression.
- Week 11: Regression.
- Week 12: Logistic regression.
- Week 13: Naive Bayes classification.
- Week 14: Hierarchical models. Thanksgiving break.
- Week 15: Hierarchical models.

## Learning Objectives

At the completion of this course, students will be able to:

- Demonstrate the role of the prior distribution in Bayesian inference.
- Perform Bayesian computation on a variety of models using Markov chain Monte Carlo methods.
- Select techniques appropriate to a given application involving a real-world data set.

## Honesty

SLU's official academic integrity policy appears later. This section gives guidelines specific to this course.

- **Homework:** You are allowed to use most resources to help you complete your homework, including help from tutors or your fellow classmates and internet references. Using generative AI on homework is not recommended, talk to me if you find it helpful. Do not use tutoring or homework help websites sites that allow you to post questions and receive answers.
- **Exams and quizzes:** These must be your own work. No use of generative AI or communication with other people is allowed on these assessments. You may use your notes and textbook. You may use the internet, but only as a reference. If you find one of our test problems posted on the internet with a solution, notify your instructor. Using such a solution in your own work violates academic integrity.

In cases when two or more students collaborate on an exam, all will be subject to penalties.

# Official SLU Policies

## Academic Integrity Policy

Academic integrity is the commitment to and demonstration of honest and moral behavior in an academic setting. Since the mission of the University is "the pursuit of truth for the greater glory of God and for the service of humanity," acts of integrity are essential to its very reason for existence. Thus, the University regards academic integrity as a matter of serious importance. Academic integrity is the foundation of the academic assessment process, which in turn sustains the ability of the University to certify to the outside world the skills and attainments of its graduates. Adhering to the standards of academic integrity allows all members of the University to contribute to a just and equitable learning environment that cultivates moral character and self-respect. The full University-level Academic Integrity Policy can be accessed on the Provost's Office website at:

<https://www.slu.edu/provost/policies/academic-and-course/academic-integrity-policy.pdf>

Specific instructions for this course are indicated earlier in the syllabus.

## Disability Services

Students with a documented disability who wish to request academic accommodations must formally register their disability with the University. Once successfully registered, students also must notify their course instructor that they wish to use their approved accommodations in the course.

Please contact the Center for Accessibility and Disability Resources (CADR) to schedule an appointment to discuss accommodation requests and eligibility requirements. Most students on the St. Louis campus will contact CADR, located in the Student Success Center and available by email at [accessibility\\_disability@slu.edu](mailto:accessibility_disability@slu.edu) or by phone at 314.977.3484. Once approved, information about a student's eligibility for academic accommodations will be shared with course instructors by email from CADR and within the instructor's official course roster. Students who do not have a documented disability but who think they may have one also are encouraged to contact CADR. Confidentiality will be observed in all inquiries.

## Title IX

Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of sexual harassment, including sexual assault, stalking, domestic or dating violence, we encourage you to report this to the University. If you speak with a faculty member about an incident that involves a Title IX matter, that faculty member must notify SLU's Title IX Coordinator that you shared an experience relating to Title IX. This is true even if you ask the faculty member not to disclose the incident. The Title IX Coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus.

Anna Kratky is the Title IX Coordinator at Saint Louis University (DuBourg Hall, room 36; [anna.kratky@slu.edu](mailto:anna.kratky@slu.edu); 314-977-3886). If you wish to speak with a confidential source, you may contact the counselors at the University Counseling Center at 314-977-TALK or make an anonymous report through SLU's Integrity Hotline by calling 1-877-525-5669 or online at <http://www.lighthouse-services.com/slu>. To view SLU's policies, and for resources, please visit the following web addresses: <https://www.slu.edu/about/safety/sexual-assault-resources/index.php>.

## Student Success

The best source of help in this class is to come to the instructor office hours with questions, or even with no questions.

The department of mathematics and statistics provides drop-in tutoring for this class, in Ritter 111. Help sessions are staffed by mathematics graduate students, and no appointments are necessary. Check the department webpage for hours.

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. The Student Success Center assists students with academic-related services and is located in the Busch Student Center (Suite, 331). Students can visit <https://www.slu.edu/life-at-slu/>

[student-success-center/](#) to learn more about tutoring services, university writing services, disability services, and academic coaching.

## **Basic Needs Security**

Students experiencing food insecurity, housing insecurity, and any other challenges that are impacting their personal and/or academic wellbeing are encouraged to contact the Dean of Students Office for support. Students can submit an intake form, email [deanofstudents@slu.edu](mailto:deanofstudents@slu.edu), or call 314-977-9378 to connect with their office. Students may also communicate directly with their instructors about any challenges they are experiencing to receive support and resource referrals.

## **University Counseling Center**

The University Counseling Center (UCC) offers free, short-term, solution-focused counseling to Saint Louis University undergraduate and graduate students. UCC counselors are highly trained clinicians who can assist with a variety of issues, such as adjustment to college life, troubling changes in mood, and chronic psychological conditions. To make an appointment, call 314-977-8255 (TALK), or visit the clinic on the second floor of Wuller Hall. For after hours needs, please press 9 after dialing the clinic number.

