

**THE GEORGE WASHINGTON UNIVERSITY**  
**Department of Statistics**

**STAT 4198: Introduction to Bayesian Statistics**

**SYLLABUS**

**Course and Contact Information**

Course: STAT 4198-10 Introduction to Bayesian Statistics (CRN: 67821)

Semester: Spring 2023

Lecture: Tuesday and Thursday, 3:45 – 5:00pm

Location: Tompkins Hall, Room 205

**Instructor**

Name: Joshua Landon

Campus Office: Rome Hall, Room 756

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Office hours: 1:00 – 3:00pm on Tuesday and Thursday, and by appointment, either in person or remotely at <https://gwu-edu.zoom.us/j/3217834899>

**Course Description**

The aim of this course is to introduce students to the Bayesian statistical modeling and inference and to the related computational strategies and algorithms. The course starts with the treatment of simple models, such as those based on normal and binomial distributions. Concepts of conjugate and non-informative priors are illustrated, for single- and multi-parameters models. Treatment of hypothesis testing and linear regression models are also covered. Bayesian computational methods such as the Gibbs sampler and Metropolis-Hastings algorithms are presented with an emphasis on their implementation and use on simple cases.

**Course prerequisites**

A course in regression analysis. Competence in basic algebra. Familiarity with calculus.

**Recommended Text**

Author	Title
John K. Kruschke	Doing Bayesian Data Analysis: A Tutorial with R and BUGS
Bolstad and Curran	Introduction to Bayesian Statistics

### **Learning Outcomes:**

As a result of completing this course, students will be able to:

1. Develop an understanding of the basic concepts underlying the Bayesian approach to statistical thinking.
2. Develop skills and appreciation for the development of Bayesian models and prior choices.
3. Provide knowledge on Bayesian computing, for the practical application of Bayesian models to data problems solving.

### **Average minimum amount of independent, out-of-class, learning expected per week:**

Over 15 weeks, students will spend 2.5 hours (150 minutes) per week in lecture. Homework assignments and other out-of-class work is estimated at around 5 hours per week (75 hours for the semester) and includes a 2-hour final exam for which approximately 10 hours of review is assumed.

### **Grading**

- Homeworks (40%)
- Midterm Exam (30%)
- Final Exam (30%)

Homeworks will be assigned every week. Exams will be closed-book and closed-notes, but a one-page “cheat sheet” will be allowed.

### **Software**

In this course we will use the following software:

- R (<http://www.r-project.org/>)
- RStudio (<http://www.rstudio.com/>)
- JAGS (<http://mcmc-jags.sourceforge.net/>)
- The rjags package in R

## Tentative Class Schedule

Date	Topic(s) covered
Week 1	Probability and Bayes Rule
Week 2	Specifying Priors and Likelihoods
Week 3	Bayesian Inference for Binomial Proportion
Week 4	Monte Carlo Methods
Week 5	Bayes Factors
Week 6	Bayesian Hypothesis Testing for a Binomial Proportion
Week 7	Bayesian Inference for Poisson
Week 8	Midterm
Week 9	Bayesian Inference for a Normal Mean and Variance
Week 10	Bayesian Hypothesis Testing for a Normal Mean
Week 11	Introduction to JAGS
Week 12	Bayesian Simple Linear Regression
Week 13	Bayesian Multiple Linear Regression
Week 14	Miscellaneous
Week 15	Review
	NOTE: In accordance with university policy, the final exam will be given during the final exam period and not the last week of the semester

## **University policies**

### **Academic Integrity Code**

Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the [Code of Academic Integrity](#). If you have any questions about whether or not particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact the Office of Student Rights and Responsibilities (SRR) to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the university and may include a transcript notation. For more information, please refer to the SRR website (<https://studentconduct.gwu.edu/academic-integrity>), email [rights@gwu.edu](mailto:rights@gwu.edu), or call 202-994-6757.

### **University policy on observance of religious holidays**

Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see “Religious Holidays” at [provost.gwu.edu/policies-procedures-and-guidelines](http://provost.gwu.edu/policies-procedures-and-guidelines).

### **Use of Electronic Course Materials and Class Recordings**

Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Please contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Please contact Disability Support Services at [disabilitysupport.gwu.edu](http://disabilitysupport.gwu.edu) if you have questions or need assistance in accessing electronic course materials.

## Academic support

### Writing Center

GW's Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked online at [gwu.mywconline](http://gwu.mywconline).

### Academic Commons

Academic Commons provides tutoring and other academic support resources to students in many courses. Students can schedule virtual one-on-one appointments or attend virtual drop-in sessions. Students may schedule an appointment, review the tutoring schedule, access other academic support resources, or obtain assistance at [academiccommons.gwu.edu](http://academiccommons.gwu.edu).

## Support for students outside the classroom

### Disability Support Services (DSS) 202-994-8250

Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services at [disabilitysupport.gwu.edu](http://disabilitysupport.gwu.edu) to establish eligibility and to coordinate reasonable accommodations..

### Counseling and Psychological Services 202-994-5300

GW's Colonial Health Center offers counseling and psychological services, supporting mental health and personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success. [healthcenter.gwu.edu/counseling-and-psychological-services](http://healthcenter.gwu.edu/counseling-and-psychological-services).

### Safety and Security

- In an emergency: call GWPD 202-994-6111 or 911
- For situation-specific actions: review the Emergency Response Handbook at: [safety.gwu.edu/emergency-response-handbook](http://safety.gwu.edu/emergency-response-handbook)
- In an active violence situation: Get Out, Hide Out, or Take Out. See [go.gwu.edu/shooterpret](http://go.gwu.edu/shooterpret)
- Stay informed: [safety.gwu.edu/stay-informed](http://safety.gwu.edu/stay-informed)