

POS 5747: Advanced Quantitative Analysis in Political Science

Course Description

This course introduces PhD students to the theory and practice of likelihood inference for statistical models, as applied to social science data. Models covered in this course include those designed for binary, nominal, ordinal, count, and continuous outcome variables. Topics include likelihood theory, computational issues, estimation and statistical inference, model diagnostics and robustness checks, and the interpretation and effective presentation of results, as well as bootstrapping and multiple imputation.

Information

Course

Term: Fall 2025

Time: Wednesday, 9:00 AM to 11:30 AM

Place: Bellamy 113

Instructor

Name: Carlisle Rainey

Email: crainey@fsu.edu

Office: Bellamy 540

Office Hours: Tuesday and Thursday, 1:00 PM to 2:00 PM

Course Schedule

I *tentatively* plan to cover the following topics:

1. Review
2. Maximum Likelihood Estimation
3. The Delta Method
4. Covariates
5. Bayesian Inference
6. Markov Chain Monte Carlo
7. The {marginaleffects} R package
8. Hierarchical Models
9. IRT
10. MRP
11. Case Study I: Moderates (Fowler et al. 2023 and others)
12. Case Study II: Human Rights Scores (Fariss 2014 and others)

Learning Outcomes

By the end of this course, students will be able to:

1. Distinguish between descriptive and causal inferences.
2. Explain numerous probability models (e.g., logistic regression, negative binomial regression) and identify appropriate models for binary, count, ordinal, categorical, and other outcomes.
3. Fit models via maximum likelihood and Bayesian methods.
4. Evaluate the plausibility of models and discuss the implications of their violations.
5. Compute, explain, and interpret various quantities of interest.
6. Write clear, well-documented analysis scripts using R.

7. Develop materials for teaching data analysis techniques.
8. Write clear and compelling research paper in the style and format of political science journal articles.
9. Write a useful peer review.

Prerequisites

The following courses are prerequisites and we will build the material learned in this courses: POS 5744, 5736, 5737, and 5746.

Required Texts

None. I will supply PDFs of all required and recommended readings.

Grading

Assignments

There are three major components to your grade in the class.

- **Exams** (45%): A *midterm exam* (20%) and *final exam* (25%) based primarily on the weekly exercises.
- **Workshop** (15%): A one-hour workshop including slides, handout, and reproducible examples and materials.
- **A Research Paper** (30%): A *first draft* (5%), *second draft* (10%), *peer review memo* (5%), and *final draft* (10%).

I will provide detailed instructions and evaluation criteria for each assignment in separate documents during the semester.

Late Work

I penalize unexcused late work 10% per day. For example, if your unpenalized evaluation is P but you submitted K days late, then your penalized score is $(1 - 0.1)^K \cdot P$. For a unpenalized score of 80% and submission 3 days late, the penalized score is $(1 - 0.1)^3 \cdot 0.8 = 0.9^3 \cdot 0.8 = 0.729 \cdot 0.8 = 0.5832$.

Final Letter Grades

The following table shows how your final percentage grade is translated into a letter grade:

Percentage Grade	Percentage Grade	Percentage Grade
93.0–100.0 A	77.0–79.9 C+	63.0–66.9 D
90.0–92.9 A–	73.0–76.9 C	60.0–62.9 D–
87.0–89.9 B+	70.0–72.9 C–	< 60.0 F
83.0–86.9 B	67.0–69.9 D+	
80.0–82.9 B–		

Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

University Policies and Student Resources

University Attendance Policy

Excused absences include documented illness, deaths in the family, and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid written excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of student's academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "... be honest and truthful and ... [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/academic-resources/academic-integrity-and-grievances/academic-honor-policy>.)

Americans With Disabilities Act

FSU is committed to providing reasonable accommodation for all persons with disabilities in a manner that is consistent with the academic standards of the course while empowering the student to meet the integral requirements of the course. Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Office of Accessibility Services; and (2) request a letter from the Office of Accessibility Services to be sent to the instructor indicating the need for accommodation and what type; and (3) meet (in person, via phone, email, zoom, etc...) with each instructor to whom a letter of accommodation was sent to review approved accommodations. Please note that instructors are not allowed to provide classroom accommodations to a student until appropriate verification from the Office of Accessibility Services has been provided. This syllabus and other class materials are available in an alternative format upon request.

For the latest version of this statement and more information about services available to FSU students with disabilities, contact the:

Office of Accessibility Services
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
oas@fsu.edu
<https://dsst.fsu.edu/oas>

Academic Success

Your academic success is a top priority for Florida State University. University resources to help you succeed include tutoring centers, computer labs, counseling and health services, and services for designated groups, such as veterans and students with disabilities. The following information is not exhaustive, so please check with your advisor or the Department of Student Support and Transitions to learn more.

Confidential campus resources

Various centers and programs are available to assist students with navigating stressors that might impact academic success. These include the following:

Victim Advocate Program

University Center A, Rm. 4100
(850) 644-7161
Available 24/7/365
Office Hours: M-F 8-5
<https://dsst.fsu.edu/vap>

Counseling and Psychological Services (CAPS)

Florida State University's Counseling and Psychological Services (CAPS) primary mission is to address psychological needs and personal concerns, which may interfere with students' academic progress, social development, and emotional well-being. The following in-person and virtual (tele-mental health) services are available to all enrolled students residing in the state of Florida:

1. Individual therapy

2. Group therapy
3. Crisis Intervention
4. Psychoeducational and outreach programming
5. After hours crisis-hotline
6. Access to community providers for specialized treatment

Call 850-644-TALK (8255) for more information on how to initiate services.

Counseling and Psychological Services

250 Askew Student Life Center

942 Learning Way

(850) 644-TALK (8255)

Walk-in and Appointment Hours:

M-F 8 am – 4 pm

<https://counseling.fsu.edu/>

University Health Services (UHS)

Services at UHS are available to all enrolled students residing in Florida. The mission of University Health Services (UHS) is to promote and improve the overall health and well-being of FSU students. UHS provides a coordinated continuum of care through prevention, intervention, and treatment. Services include general medical care, priority care, gynecological services, physicals, allergy injection clinic, immunizations, diagnostic imaging, physical therapy, and a medical response unit. The Center for Health Advocacy and Wellness (CHAW) assists students in their academic success through individual, group, and population-based health and wellness initiatives. Topics include wellness, alcohol and other drugs, hazing prevention, nutrition and body image, sexual health, and power based personal violence prevention. For more information, go to uhs.fsu.edu.

University Health Services

Health and Wellness Center

960 Learning Way

Tallahassee, FL 32306

Hours: M-F, 8 am – 4 pm

(850) 644-6230

<https://uhs.fsu.edu/>

Statement on HB233 Recording

In this class, consistent with state law and university policy, students are permitted to make recordings of class lectures for personal use only. As noted, sharing, posting, or publishing classroom recordings may subject you to honor code violations and legal penalties associated with theft of intellectual property and violations of other state laws. Moreover, students and educators have expressed concern that recording classroom activities may negatively impact the learning experience for others, especially in classes that involve questions, discussion, or participation. To protect a learning environment in which everyone feels free to experiment with ideas, we ask you to refrain from recording in ways that could make others feel reluctant to ask questions, explore new ideas, or otherwise participate in class. Students must monitor their recordings so that they do not include participation by other students without permission. Students with disabilities will continue to have appropriate accommodations for recordings as established by the Office of Accessibility Services.