
PSC 404
Probability and Inference

Fall 2021
15:25-16:40 T/Th
Fenno Room

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PURPOSE

This course in mathematical statistics provides graduate students in Political Science with a solid foundation in estimation, statistical inference, and linear models.

PREREQUISITES

The math “boot camp” is the only course prerequisite, as familiarity with calculus is necessary to understand the material.

COURSE REQUIREMENTS

Evaluation is based on homework assignments (20%), a midterm exam (25%), a final exam (25%), and a data analysis project (30%). In addition to office hours, the teaching assistant will hold a weekly recitation. Attendance is mandatory. Students are responsible for material covered in lecture, recitation, and the required readings.

TEXT

The required texts for this course are:

- Shalizi (2019). *Advanced Data Analysis from an Elementary Point of View*.
- Sahoo (2013). *Probability and Mathematical Statistics*.
- Lavine (2013). *Introduction to Statistical Thought*.
- Faraway (2002). *Practical Regression and Anova using R*.

COURSE SCHEDULE

Topic 1: Sampling distributions

Specifics: Functions of random variables. The sample mean. Central limit theorem. χ^2 , t , and F .

Reading: Sahoo Ch. 10, 13, 14.

Topic 2: Estimation

Specifics: Finding estimators. Evaluating estimators. Interval estimation.

Reading: Sahoo Ch. 15-17; Lavine Ch. 2

Topic 3: Hypothesis testing

Specifics: Fisher v. Neyman-Pearson. Simple hypotheses. UMP tests.

Reading: Sahoo Ch. 18.

Topic 4: Categorical Data and Nonparametric Methods

Specifics: χ^2 tests. Simpson's paradox. Sign and rank tests.

Reading: Sahoo Ch. 21

Midterm. Covers topics 1-4.

Topic 5: Regression

Specifics: Least squares. Inference. Asymptotics. Misspecification.

Reading: Shalizi Ch. 1-3; Lavie Ch. 3; Faraway Ch. 2-4, 7

Topic 6: Extensions.

Specifics: Instrumental variables. Panel data.

Reading: Shalizi Ch. 23; TBA

Topic 7: Generalized linear models.

Specifics: Probit. Logit. Poisson.

Reading: Lavine Ch. 3; Faraway Ch. 5, Shalizi Ch. 11-12

Topic 8: Simulation

Specifics: The bootstrap.

Reading: Shalizi Ch. 5-6

Final Exam. Cumulative with weight on second half.