POLS/CSSS 510:  
Maximum Likelihood Methods  
for the Social Sciences

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University of Washington  
Fall Quarter 2019

Class Meets  
TTh 4:30–5:50 PM  
Electrical & Computer Engineering 125

Office  
Gowen Hall 145  
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Section Meets  
F 3:30–5:20 PM
TBA

Overview and Class Goals. Most social science data do not fit the assumptions of the linear regression model taught in introductory statistics courses. For example, social science data often consist of discrete categorizations or counts of events, rather than continuous outcomes. Observations may be correlated across periods, as in time series, or clustered into correlated groups, violating the linear regression assumption of independence. In this course, students will learn how use the method of maximum likelihood to derive statistical models that suit the particular behavior of their social science data and how to clearly communicate the substantive import of their findings to a broad audience. In the process, students will gain familiarity with basic statistical programming in R, a free and increasingly popular language. Topics of special interest to students will be covered as time permits.
**Prerequisites.** No specific courses are required; however, students should have a solid grounding in linear regression, as provided, for example, by courses in Political Science (POLS 501 and POLS 503), Sociology (SOC 504 and SOC 506), or Statistics (STAT/CSSS 504). Familiarity with or a willingness to quickly learn basic probability and matrix algebra is also required.

**Course Requirements.** Course evaluation will be based on (1) problem sets: five to six over the term, due in class in hardcopy, (2) a student poster presentation in class, also to be emailed to your instructor as a PDF, and (3) a research paper, due Tuesday 10 December 2019 at 3 PM in my mailbox in Gowen Hall and by email in PDF format.

Students *may* work in small groups on problem sets, but each student must complete and submit their own write-up of the assignment.

Students are **required to collaborate in groups of two or three** on the poster presentation and paper, which should apply methods studied in the course (or with instructor approval, related methods of similar sophistication) to a student-chosen topic. Papers developing new methodological tools are also acceptable. Each paper-writing group must propose a paper topic as part of the first assigned homework, so students should plan to form research partnerships quickly. Additional paper requirements and guidelines can be found on the course website.

**Office Hours.** Chris Adolph: Thursdays, 3:00 – 4:15 PM and by appointment in Gowen 145. TA office hours TBA.

**Course Website.** Consult [http://faculty.washington.edu/cadolph/mle](http://faculty.washington.edu/cadolph/mle) for problem sets, notes, and announcements.

**Notice Required by State Law.** Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW’s policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy ([https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy](https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy)). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form ([https://registrar.washington.edu/students/religious-accommodations-request](https://registrar.washington.edu/students/religious-accommodations-request)).

**Other relevant university policies.** See this website:
[https://registrar.washington.edu/staffandfaculty/syllabi-guidelines](https://registrar.washington.edu/staffandfaculty/syllabi-guidelines)
Course textbooks

Books recommended for purchase marked with a *.


Excellent general introduction to linear regression and hierarchical modeling; good for code and intuition, especially on simulation methods.


Classic introduction to maximum likelihood for social scientists. Emphasis on intuition and basic derivations.


Clearest step-by-step introduction to the logic of logistic regression and related models.


Main text for the course; written by a former UW professor & a POLS/CSSS alumnus.


Straightforward first course in R programming. Assumes you know (or are learning) introductory statistics already.

Optional books for further study


**Required and optional articles**


Course outline

This outline of topics is a guideline and may be altered to meet course needs. In particular, the pace of the course may vary to make sure we are moving as fast as possible conditional on everyone understanding the material. Students should come to class having read the material for the next topic to be covered.

Readings from Ward & Ahlquist, King, and Long may at times overlap somewhat; feel free to focus on the sources that best fit your learning style, while bearing in mind that Ward & Ahlquist is the most up-to-date treatment.

Numbers listed after texts indicate chapters, unless otherwise noted.

Part I: Fundamentals

26 September – 3 October: Introduction to the course, probability, and R

Required: Handout on probability
Handout on matrix algebra
Ward & Ahlquist, p. xxv–xxvii

Optional: King 3
Math review: csss.washington.edu/academics/math-camp/lectures
Zuur 1–6 (for R beginners)

8–15 October: Overview of maximum likelihood estimation

Required: Ward & Ahlquist 1, 2, 4

Optional: Long 1, 2
King 1, 2, 4

Problem Set 1 + Project Proposal Due Thursday 10 October in Class
Part II: Modeling Choice

17–22 October: Estimating & Interpreting models of binary data

Required: Ward & Ahlquist 3 and 6
          King 5.1–5.3
          King, Tomz, and Wittenberg

Optional: Gelman & Hill 5.1–5.3, 6.4, 7.1–7.4
          Long 3.1–3.9
          Berry, DeMeritt, and Esarey

Problem Set 2 Due Tuesday 22 October in Class

24–29 October: Fitting & selecting models of binary data

Required: Ward & Ahlquist 5
          Long 4
          Gelman & Hill 5.4–5.8, 8.1–8.3

Optional: Greenhill, Ward, and Sacks
          Raftery

31 October–5 November: Modeling ordered categorical data

Required: Ward & Ahlquist 8
          Long 5.1–5.7

Optional: King 5.4

Problem Set 3 Due Tuesday 5 November in Class

7 November: Non-ordered data: Multinominal logit & Multinominal probit

Required: Ward & Ahlquist 9

Optional: Long 6
          Gelman & Hill 6.5
          Alvarez and Nagler
          Imai and van Dyk
Part III: Modeling Counts

12–19 November: Poisson models of counts / Overdispersed & zero-inflated counts

Required:  
Ward & Ahlquist 7, 10  
King 5.5–5.9  

Optional:  
Long 8.1–8.7  
Gelman & Hill 6.2

PROBLEM SET 4 DUE THURSDAY 14 NOVEMBER IN CLASS

Part IV: Advanced Topics

21–26 November: Missing data and multiple imputation

Required:  
Ward & Ahlquist 12

PROBLEM SET 5 DUE TUESDAY 26 NOVEMBER IN CLASS

NO CLASS THURSDAY 28 NOVEMBER — THANKSGIVING

Part V: Student Poster Presentations

3 – 6 December: Student poster presentations

Students will prepare and present a poster on their research projects in progress; this yields valuable feedback prior to final write-ups. Requirements and suggestions for poster construction will be discussed in class. Presentation dates will be assigned to minimize discrepancy with student preferences. Early presentations are expected to be less complete and evaluated accordingly. Students unable to present on certain days due to schedule conflicts should inform the instructor.

PROBLEM SET 6 DUE THURSDAY 6 DECEMBER IN CLASS

FINAL PAPER DUE TUESDAY 10 DECEMBER AT 3 PM  
BOTH IN MY GOWEN MAILBOX AND BY EMAIL