BIOST/STAT 570: Advanced Regression Methods for Independent Data
Fall Quarter, 2019

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Class Hours and Location: Mondays and Wednesdays 1:30pm – 2:20pm, Health Sciences K069.
Fridays 1:30pm – 2:20pm, Health Sciences T639.

Class Website: Syllabus, slides, assignments, and more will be available at:

https://canvas.uw.edu/courses/1318378

Course Description

This course covers regression methods for independent outcomes. It provides more formal and general justifications for regression methods you may have seen in BIOST 514/515 (Biostatistics I and II), STAT/BIOST 533 (Theory of Linear Models), or STAT 502 (Design and Analysis of Experiments) / 504 (Applied Regression). Inference will be both Bayesian and frequentist, with the latter based on estimating equations (including those derived from a likelihood function). This is a methods course, and the emphasis will be on application and interpretation of the methods discussed, in practical circumstances. Formal proofs and similarly-mathematical arguments are not a major part of the course though some theory will be encountered. You will be expected to be able to choose appropriate methods, implement them accurately, interpret the output accurately, and explain output in language appropriate for scientific collaboration. To do this, statistical insight, mathematical and computational skill, and ability to communicate are all essential.

Prerequisites

STAT 512 and STAT 513 (Statistical Inference); BIOST/STAT 533 (Theory of Linear Models) or STAT 421 (Applied Statistics and Experimental Design) / STAT 502 (Design and Analysis of Experiments) and STAT 423(Applied Regression and Analysis of Variance) / STAT 504 (Applied Regression); a course in matrix algebra.

Course Materials

In each lecture we will cover a set of slides that draw contents from Jon Wakefield's book:

Wakefield, J.C. (2013). *Bayesian and Frequentist Regression Methods*. Springer.

You can obtain a copy of the e-book from the UW library:

`https://alliance-primo.hosted.exlibrisgroup.com/permalink/f/kjtuig/CP7197950170001451`

We will cover Chapters 1–3 and 5–7. R code for all examples in the book are available at:

`http://faculty.washington.edu/jonno/regression-methods.html`

You are expected to read the relevant book chapters before the lectures.

Also, make sure you have a copy of the errata at hand:

`http://faculty.washington.edu/jonno/book/Errata.pdf`

Additional resources include, but are not restricted to:

- Davison, A.C. (2003). *Statistical Models*. Cambridge University Press.

- McCullagh, P. and Nelder, J.A. (1989). *Generalized Linear Models*, Second Edition, Chapman and Hall.

- Cameron, A.C. and Trivedi, P.K. (1998). *Regression Analysis of Count Data*, Cambridge University Press.

- Gelman, A., Carlin, J.B., Stern, H., Dunson, D., Vehtari, A. and Rubin, D.R. (2013). *Bayesian Data Analysis*, Third Edition, CRC Press.

Class Schedule

This is a tentative schedule, subject to modifications.

Week	Chapter from Wakefield's Book	Homework/Exam
1	1. Introduction and Motivating Examples	
2	2. Frequentist Inference	HW1 posted
3	2. Frequentist Inference	HW2 posted, HW1 due
4	3. Bayesian Inference	HW3 posted, HW2 due
5	3. Bayesian Inference	HW4 posted, HW3 due
6	5. Linear Models	HW5 posted, HW4 due
7	5. Linear Models	HW6 posted, HW5 due
8	6. General Regression Models	HW7 posted, HW6 due
9	6. General Regression Models	HW8 posted, HW7 due
10	7. Binary Data Models	HW9 posted, HW8 due
11	7. Binary Data Models	HW9 due
12		Final exam (in-class part on Dec 9)

Note: no class on university holidays: Nov 11, 2019 (Veterans Day); Nov 28–29, 2019 (Thanksgiving).

Grading

The final grade will be based on nine homework assignments and a final exam. Each homework assignment will be worth 50 points and the final exam will be worth 150 points, for a maximum of 600 points. The final exam will have an in-class part and a take-home part. The homework assignments will be posted and due on Wednesdays via the Canvas website, except for homework 9, which will be due on Friday December 6 2019 to accommodate time off for Thanksgiving. Late assignments will be graded over $\max\{p(1 - h/48), 0\}$ points, where p is the maximum number of points for the assignment and h is the number of late hours. You are encouraged to discuss homework assignments with your classmates, but solutions are to be your own. The final exam should not be discussed with your classmates.

Course Policies

Attendance and Participation:

Although attendance and participation in class are not required, they are highly encouraged. Keep in mind the following points:

- Our sessions will occasionally have interactive discussions, where you will be asked to comment on or solve certain problems. These discussions might lead to part of the homework assignments, so if you come to class, you will have an advantage.

- Attending and being active in class by asking and answering questions will benefit you and your classmates. If you have a question, do not be afraid to ask! Chances are that others are confused on the same point as well.

- If you miss a lecture it is your responsibility to catch up with the contents of the class.

Electronic Discussion Board and Email:

The Canvas web page contains an electronic discussion board. The board will be used for announcements and questions from the students. If a student has a question about a homework or the course in general, s/he should post the question to the electronic discussion board rather than e-mailing the instructor or the TAs. The discussion board can be used to discuss any topic related to the course material. Students are encouraged to answer as well as ask questions on the board.

Access and Accommodations:

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or disability.uw.edu. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Academic Integrity:

Students at the University of Washington (UW) are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity.
The UW School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). We expect you to know and follow the university's policies on cheating and plagiarism, and the SPH Academic Integrity Policy. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct website.

Religious Accommodations:

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. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form.