



Syllabus

STAT 7410 Linear Models

Autumn 2024

3 Credit Hours

Course overview

Lectures

MWF 1:50pm-2:45pm in Bolz Hall 118

Instructor

- Name: Yoonkyung Lee
- Office: Cockins Hall 440H
- Office Hours: T 2:00-2:55pm, F 3:00-3:55pm, or by appointment
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Grader

- Name: Zhenbang Jiao
- Office: Cockins Hall 420
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Course webpage

The course has a web page on Carmen (<https://carmen.osu.edu/>). You will find the class schedule, course announcements, homework assignments, and other information about the class on the web page. Please check it out on a regular basis.



Course description

Statistics 7410 is a course on linear models, the most commonly used statistical model. The course will present topics on the definition, estimation and hypothesis testing in this class of models, and model comparisons. In addition, this course will introduce modern regression models that extend the linear model and explore the concepts of penalized estimation and nonparametric regression.

Course expected learning outcomes

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

1. Demonstrate an understanding of the algebraic and geometric underpinnings and interpretation of the linear model
2. Demonstrate an understanding of the theory of the linear model
3. Discuss the definition and the assumptions of the general linear model
4. Carry out appropriate statistical inference under the general linear model
5. Describe the breadth of models that extend the linear model
6. Perform statistical inference and prediction for a variety of models that extend the linear model
7. Interpret the results of statistical analyses based on models that extend the linear model.

Prerequisites

Stat 6802 (Statistical Theory II), 6860 (Foundations of the Linear Model) and solid understanding of linear algebra at the undergraduate level, 6910 and 6950 (Applied Statistics I and II)

Attendance Policy

You are expected to attend all lectures.

Textbooks

Required

1. A First Course in Linear Model Theory, 2nd edition by N. Ravishanker, Z. Chi and D. K. Dey, CRC Press.
Available online at ProQuest Ebook Central through the OSU library.
2. Advanced Linear Modeling: Statistical Learning and Dependent Data, 3rd edition by R. Christensen, Springer.
Available online at Springer Link through the OSU library.

Grading

How your grade is calculated

Category	Percentage
Homework Assignments	30%
Midterm	30%
Final exam	40%
Total	100%

Grading Scale

While the standard grading scale generally applies, final grades may be curved upwards.



Homework assignments

There will be homework assignments posted on the course website. Homework is due approximately once per week, typically on Friday of the week following the homework posting. Check Carmen for exact dates and times. Homework assignments will be submitted for grading via Carmen.

Late assignments

No late homework assignments will be accepted with few exceptions. If you have documented reasons for missing work or needing extra time, please contact me as soon as possible prior to the due dates. Where appropriate, due dates could be extended.

Exams

There will be one midterm exam. The midterm will be in person, during class time. Information about the exam will be posted well in advance through the course website and also announced in class. The final exam will be comprehensive and cover all the material for the course. It will be in person, during the scheduled final exam hours. There will be no make-up exams.



Academic policies

Academic integrity policy

Although students are encouraged to work together on assignments, each student is expected to write and submit individual solutions to homework problems. The midterm and final exam are to be completed on your own without any external help or communication. Academic misconduct will not be tolerated and will be dealt with procedurally in accordance with university policy.

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-48.7(B)). For additional information, see the Code of Student Conduct: <http://studentlife.osu.edu/csc/>.

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Accessibility accommodations for students with disabilities

Requesting accommodations

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers



based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Religious accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam,



altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the [Office of Institutional Equity](#).

Policy: [Religious Holidays, Holy Days and Observances](#)

Disclaimer

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular we reserve the right to change due dates or the methods of grading and/or assessment if necessary. Any changes will be communicated to you through official course announcements.



Course Schedule (tentative)

Refer to our Carmen course page for up-to-date assignment due dates.

Week	Date	Topics/Readings	Assignments Due
1	8/20-8/23	Introduction, Linear models (4.1), Linear algebra (ch. 1)	
2	8/26-8/30	Least squares, Geometry (4.2, 2.6)	
3	9/2-9/6	9/2 (M): Labor Day Generalized inverse (3.1-3.2), Fitted values, Residuals (4.2)	9/6 (F): HW1
4	9/9-9/13	Estimability, Gauss-Markov theorem, Generalized LS (4.3-4.5)	9/13 (F): HW2
5	9/16-9/20	Multivariate Normal distribution (5.1-5.3)	9/20 (F): HW3
6	9/23-9/27	Multivariate Normal distribution (5.1-5.3), Distribution of quadratic forms (5.4)	9/27 (F): HW4
7	9/30-10/4	Inference for estimable functions (7.1), Hypothesis testing, F-test (7.2-7.3)	10/4 (F): HW5



Week	Date	Topics/Readings	Assignments Due
8	10/7-10/11	F-test (7.2-7.3) 10/9 (W): Midterm 10/10 (R)-10/11 (F): Autumn Break	
9	10/14-10/18	Likelihood ratio test (8.1) Confidence intervals and regions (7.4)	
10	10/21-10/25	Departures from model assumptions (8.2), Model diagnostics (8.3)	10/25 (F): HW6
11	10/28-11/1	Model selection criteria (8.1, 9.1), Model comparison (7.3)	11/1 (F): HW7
12	11/4-11/8	Collinearity, Ridge regression (9.2, C2.2), Principal component analysis (9.2, C14.1-14.2)	11/8 (F): HW8
13	11/11-11/15	11/11 (M): Veterans Day Principal component regression, LASSO (14.3, C2.3)	



Week	Date	Topics/Readings	Assignments Due
14	11/18-11/22	Penalized regression (14.3, C2), Nonparametric regression (14.2, C1)	11/18 (M): HW9
15	11/25-11/29	Nonparametric regression (14.2, C1) 11/27 (W)-11/29 (F): Thanksgiving Break	11/25 (M): HW10
16	12/2-12/4	Review	
17	12/11 (W)	Final exam (2:00pm-3:45pm)	