

STAT 6860: Foundations of the Linear Model

Spring 2024

STAT 6860

Course Information

- Instructor: Yunzhang Zhu
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Office Hours: Wednesday and Friday 10:00 am - 10:55 am and by appointment (via email).
- Grader: Yuxuan Xin
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- Lecture Time: Tuesday and Thursday 12:40 pm - 2:30 pm, Baker Systems Engineering - Room: 180
- Textbook: *Matrix Algebra from a Statistician's Perspective*, by D. A. Harville, Springer. The Ebook is freely available for download at <https://library.ohio-state.edu/record=b8695963>. This text is excellent, but it was not written with a course in mind. Instead, it has been written as a reference book and it contains a wealth of useful results. This text was chosen for the course because it is one you can read with only a standard undergraduate course on linear algebra as background and because it is a great book to have on your bookshelf.
- Description: STAT 6860 is designed to get you ready for the second year course on linear model. While you have all seen linear algebra in undergraduate coursework, the typical course is taught with the goal of mathematics in mind. In Statistics, different parts of linear algebra are more important, and we will spend time on some of these areas. Particular examples include the emphasis in Statistics on covariance matrices (square, symmetric, non-negative definite), projections and successive projections as they relate to least squares fits of a model, and the ordering of matrices that is useful for optimal design. During the course, we will review basic concepts of linear algebra and we will build connections to formal statistical models and methods – in particular to the multivariate normal distribution and to the linear model, as well as to least squares and related techniques.

Here is a tentative list of topics that will be covered:

- Basic notations and definitions of matrix and vector

- Column space of a matrix
 - Spans, bases and ranks
 - Geometric views of some matrix operations
 - Matrix decomposition
 - Idempotent matrices; systems of linear equations
 - Projections
 - Least squares
 - Successive projections
 - Generalized inverses
 - Weighted least squares and generalized least squares
 - Eigenvalues and Eigenvectors
- Prerequisites: Enrollment in the PhD program in Statistics or Biostatistics, or permission of the instructor

Course website

All course materials are kept on Canvas <http://carmen.osu.edu>.

Homework

Homework will be collected approximately weekly, making for about 6 homework assignments. You can work together and discuss problems, but make sure that the write-up is your own. Solutions to many of the homework problems are readily available, but finding solutions online or in printed form and copying them would constitute cheating. Please write your homework neatly, so that the TA can easily read it. A subset of problems from each assignment will be graded. Turning homework up to one day late will lead to 10% deduction from the assignment points, and no homework will be accepted more than one day late or after the solutions are available.

Evaluation

Your final grade for this course will be determined by your performance on homework, the midterm, and final exam. The weights for each are as follows:

Homework	30%
Midterm	30%
Comprehensive final	40%

Your final letter grade for this course will then be determined by the OSU standard grading scale.

Exam schedule

There will be one midterm and one comprehensive final exam.

- The midterm will be in class, closed-book and closed-notes. It will be approximately one hour, during the second half of the class on **February 8, in the lecture classroom.**
- The comprehensive final exam will also be closed-book and closed-notes, with more weight on post-midterm materials. It will be on **February 27, 12:40 pm - 2:25 pm, in the lecture classroom.**
- You have until one week after receiving your grades on the exams to dispute the grade; the same applies to any homework grade. Note that when asking for a question to be re-graded, the entire assignment/exam may be re-graded, and so you run the risk of losing more points than you gain back.

Academic Integrity

Although students are encouraged to work together on homework assignments, each student must submit their own written work in his or her own words. Academic misconduct will not be tolerated and will be dealt with procedurally in accordance with University Rule (<http://oaa.osu.edu/procedures>).

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 3335-5-487). For additional information, see the Code of Student Conduct (<http://studentlife.osu.edu/csc/>).

Disability Statement

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. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614-292-3307; email: slds@osu.edu.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Religious Accommodation Statement

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

Statement on title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu.

Disclaimer

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 advanced notice.