STAT 443/851 Theory of Linear Models (University of Saskatchewan, 2026-01)

Instructor

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Description

This course is a rigorous examination of the general linear models using vector space theory, in particular the approach of regarding least square as projection. The topics includes: vector space; projection; matrix algebra; generalized inverses; quadratic forms; theory for point estimation; theory for hypothesis test; theory for non-full-rank models.

Prerequisite(s): MATH 164 (formerly MATH 264) or MATH 266, STAT 342, and STAT 344 or 345.

Textbook and Course Materials

- LINEAR MODELS IN STATISTICS, Second Edition, by Alvin C. Rencher and G. Bruce Schaalje, ISBN 978-0-471-75498-5 (cloth). *The book is not required but it is good to have it.*
- I will primarily follow my own lecture notes. The assignments and solutions are available in a one-drive folder. All the links are given on this page.

List of Topics

1. Vector Space and Projection (supplemented or Ch 4,5,7 in Kuttler's book)
2. Matrix Algebra (Ch 1 and 2 in LINEAR MODELS IN STATISTICS)
3. Distribution of Multivariate Normal (Ch 3,4 in LINEAR MODELS IN STATISTICS)
4. Distribution of Quadratic Forms (Generalization of Sum Squares) (Ch 5 in LINEAR MODELS IN STATISTICS)
5. Theory for Multiple Regression (Ch 6, 7, 8 in LINEAR MODELS IN STATISTICS)
6. Non-full-rank Models (Ch 12 in LINEAR MODELS IN STATISTICS)

Times and Places

Lecture Classroom: MCLN 242.1, MWF 9:30-10:20; Office hour: TBA; Lab: no lab.

Evaluation Components

Grading Scheme

3 assignments: 3x10% = 30%, 1 term test: 20%, final exam: 50%.

Assignments and Tests

Assignment questions are released in the one-drive folder. You will submit your solutions via Canvas. **If you miss an assignment without proper excuse, the weight will NOT be shifted to the final.** Undergraduate students will be assigned with different assignments and tests.

Assignments

- I will accept late assignments only for three (3) days beyond the due date. The penalty for your delay is 10 percentage points per day of lateness from the value of the assignment (including weekends). **Extensions are only granted in rare instances (notably as a result of family or medical emergencies) and upon receipt of adequate documentation/proof.**
- Answer the questions in the order they appear in the assignment. Neatness is important.
- Solutions to problems are to be included. Hence, simple answers without work will receive few (or no!) marks.
- Most problems in statistics have a "real-life" basis. Hence, solutions should include not only numerical solutions but also a statement as to what the numbers say about the problem.
- The work handed in must not be an exact duplicate of others.
- Submitting Assignments: The assignment can be typed and/or handwritten. Save your assignment as **one PDF file** (for handwritten assignments, feel free to take a picture/scan of your work and save it as one PDF file). Upload the **PDF file** as an assignment submission in Canvas.
- More details will be provided ahead of each assignment.
- Due Date: See Course Schedule.

Midterm

- The midterm is given in class period.
- Midterms must be written on the dates scheduled. Students must do midterms completely on their own. More details (including syllabus) will be provided ahead of each midterm.
- Type: Short-answer questions, problem-solving, open-book.
- Calculator: A scientific calculator is allowed.
- Make-up exam will not be given. If you miss an exam for a legitimate reason (e.g., illness, emergency) and notify me within 48 hours of the scheduled exam, the weight of the missed exam will be transferred to the final exam.

Final Exam

- Scheduling: Final examinations may be scheduled at any time during the examination period; students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of their own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures: http://students.usask.ca/academics/exams.php.
- The final exam will cover material of the entire course. More details will be provided ahead of the exam.
- Length: 3-hour in-person exam.

- Type: Short-answer questions, problem-solving, open-book.

Criteria That Must Be Met to Pass

The **final exam is a required component of the course**. Students must complete the final exam in order to be eligible to receive a passing grade in this class.

Attendance Expectation

Attendance is highly correlated with student performance. While a syllabus and suggested readings are provided, it is not an adequate substitute for attending class. Your **attendance is highly recommended** but not required, and you will not be graded on your attendance.

Recording of the Course

Recording of the lectures will only be allowed in certain circumstances. Please see the instructor for information on how to receive approval. In general, there will be no videos available for in-person lectures. Therefore, **attendance is strongly recommended**.