STAT:3210 Experimental Design & Analysis SPRING 2025

Class Meeting: MWF 2:30P–3:20P, 40 SH

Instructor: Prof. Erning Li, 231 SH, 335-0820, *erning-li@uiowa.edu*
Office hours: MWF 1:00–2:00 pm, and by appointment.

Grader: Bowen Su, *bowen-su-1@uiowa.edu*

Department Information: Department of Statistics and Actuarial Science, 241 SH, 335-2082.
DEO: Professor Kung-Sik Chan, 241 SH, 335-0712, *kung-sik-chan@uiowa.edu*

Prerequisite: STAT:3200 and prior exposure to basic use of statistical programming software R.

Course Description and Objective: This course emphasizes practical aspects of experimental design and analysis. Both design and analysis of experiments as well as statistical computing (primarily R) are discussed. At the end of the semester, students should understand the principles, models and strategies commonly used for experimental design and data analysis, and be comfortable planning and analyzing experiments.

Main coverage: Basic principles of experimental design; Randomization; Completely randomized design; Paired design; Randomized blocks, Latin Squares, Greco-Latin Squares and related designs; Factorial design; Blocking in factorial design; 2^k factorial design; Extension of 2^k factorials; Blocking and confounding in 2^k factorials; Partial confounding; Fractional factorial designs; Blocking in fractional factorials; Nested and split-plot designs; Replicated and unreplicated designs; Regression, ANOVA, and follow-up analysis; Power calculation; Sample size determination; Relative efficiency; Response surface; Random effects model.

R computing is taught and conducted throughout the semester. It can be downloaded to personal computer for free from `https://www.r-project.org/`. It is also available on the university Virtual Desktop and at the Instructional Technology Centers (ITCs) such as 41 SH. See a review of R in ICON.

ICON Course Website: `https://icon.uiowa.edu/`. Course materials including syllabus, lecture notes, grades, answer keys, etc. will be posted under "Modules". Homework will be assigned and submitted under "Assignments" navigation.

Communication: Have your UI email address in the class roster and use it when corresponding with me via email (state the course number or title in your email). Important announcements to the class will be emailed via the ICON class roster.

Lecture Notes: My lecture notes and handouts consist a "mini textbook" for the class. They are posted on ICON in advance and will be intensively used in lectures and assignments. Students are strongly recommended to diligently take additional notes in class.

Reference Book (recommended but not required):

Design and Analysis of Experiments by Montgomery, D. C., Wiley.

Regular Homework:

- Regular homework will be assigned periodically in ICON; mostly week-long assignments. Students submit homework using file upload in ICON by its due date and time—have all your pages in a single file (PDF, Word doc, or clear and readable images/scans) of a reasonable size. Unreadable file or missing pages or submission via email won't be accepted/graded. Please double check your submission each time—points will be deducted if submission cannot be opened or read, or has wrong files or missing pages.
- All assignments are essential, vital practices and will be counted towards overall grade.
- Unless prior or prompt arrangements are made for reasons judged to be acceptable by Prof. Li, homework turned in after it is due will receive 0 (zero) credit. Homework submitted via email to me or grader won't be accepted/graded. Additionally, as answer keys will be posted soon after an assignment is graded, late homework submission will only be considered in exceptional circumstances and with prior or prompt notification.
- Students are allowed to discuss homework assignments, but every student is responsible for submitting their own work, reflective of their own effort (write up their own individual answers and do their own computing). If "blind copying" in a student's answer sheets is identified, all involved students will receive zero score and be considered as plagiarism.

Exams:

Midterm 1	**Friday March 7, 2:30-3:20 pm, in class**
Midterm 2	**Monday April 21, 2:30-3:20 pm, in class**
Final exam	**TBA by the University**

- You can bring one standard letter-size (about 8.5in $\times$ 11in) sheet of paper with anything you want written or typed on both sides to each midterm exam, and three such self-prepared help sheets to the final exam. Also bring a scientific calculator (any type) to each exam. Other than these, all exams are closed-book, closed-notes, and no-computer.
- Any unexcused absence from an exam will result in a score of zero with no opportunity for a makeup. A makeup exam will be considered only with documentation of reasons required by the university policy and under prior or prompt arrangement made with Prof. Li (e.g., no later than the exam day), and it should be scheduled as soon as possible.
- All exams and makeups are in-person and proctored. These exam rules apply to all exams and makeups.
- The midterm exams are given at regular class meeting times. The final examination date and time will be announced by the Registrar generally by the fifth week of classes. Do not

plan your end of the semester travel plans until the final exam schedule is made public. It is your responsibility to know the date, time, and place of the final exam. See the University Final Exam Policies at *https://registrar.uiowa.edu/final-exam-policies*.

Grading: A numerical final score on the scale of 0 to 100 will be determined according to the following (tentative) breakdown

Homework	16%
Midterm 1	26%
Midterm 2	26%
Final	32%

Conversion of these scores into letter grades will be made according to the following scale:

$$[100, 90]\ \text{A}; \quad [90, 80)\ \text{B}; \quad [80, 65)\ \text{C}; \quad [65, 50)\ \text{D}; \quad < 50\ \text{F}.$$

- At the discretion of Dr. Li, depending on class performance and participation, these ranges may be adjusted, but only downward - criteria will only become easier, not harder.
- Plus (+) and minus (-) gradings will be given as deemed appropriate. A+ grade will be used to indicate rare and extraordinary academic achievement.

Integrity of Course Materials: I request that you preserve the integrity of the course materials. This means that under no circumstance should you make public (either in print or via web postings, social networks, etc.) or disseminate any course materials such as lecture notes, handouts, assignments, exams, solutions, recordings, as well as other materials that I prepare. You must also strive to avoid making use of any solutions provided by anyone outside of this class. Compliance with this request will be considered part of the academic honesty requirements discussed further below under Administrative Policies.

Participation and Classroom Environment: Participation in course activities is very vital to your success in this course. Regular attendance is expected and roll may be taken on random days. Students who are absent from class without acceptable excuse should not seek help regarding missed lectures during my office hours.

When in class, please refrain from talking on cell phones, texting, using laptops/tablets (if not for note-taking purpose), and prolonged conversation with a fellow student. Wireless-capable devices such as laptops, tablets, smart phones, etc. must be put away during exams.

Extra Help: (if necessary)

The Department of Statistics and Actuarial Science maintains a list of private tutors at *https://stat.uiowa.edu/resources/tutoring*

Topics:

Schedule	Reading	Coverage
Week 1	Notes 1	Introduction - basic principles of experimental design, Why and how to conduct randomization.
Week 2-3	Notes 2	Comparative experiments and analysis with randomized designs and pairing designs, Fundamental power calculation and sample size determination.
Week 3-4	Notes 3	Single-factor experiments and analysis, Power calculation and sample size determination in Complete Randomized Designs.
Week 4-5	Notes 4.1	Randomized Complete Block Design and analysis, Types of sums of squares, Power calculation and sample size determination in Randomized Complete Block Designs.
Week 6-7	Notes 4.2	Latin Squares Design and analysis, Graeco-Latin Squares.
Week 8-9	Notes 5	Factorial Design and analysis, Power calculation and sample size determination in Factorial Designs.
Week 10-11	Notes 6	2^k Factorial Design and analysis.
Week 12	Notes 7	Blocking 2^K Factorial Design and analysis.
Week 13	Notes 8	Fractional Factorial Design and analysis.
Week 14-15	Notes 9	Split-plot Design and analysis, Propensity scores for causal effects (if time allows).

Academic Honesty and Misconduct
All students in CLAS courses are expected to abide by the CLAS Code of Academic Honesty. Undergraduate academic misconduct must be reported by instructors to CLAS according to these procedures. Graduate academic misconduct must be reported to the Graduate College according to Section F of the Graduate College Manual.

Student Complaints
Students with a complaint about a grade or a related matter should first discuss the situation with the instructor and/or the course supervisor (if applicable), and finally with the Director or Chair of the school, department, or program offering the course.

Undergraduate students should contact CLAS Undergraduate Programs for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS Associate Dean for Graduate Education and Outreach and Engagement when additional support is needed.

Drop Deadline for this Course
You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course here. When you drop a course, a "W" will appear on your transcript. The mark of "W" is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the Registrar's website. Undergraduate students can find policies on dropping CLAS courses here. Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

Date and Time of the Final Exam
The final examination date and time will be announced by the Registrar generally by the fifth week of classes and it will be announced on the course ICON site once it is known. **Do not plan your end of the semester travel plans until the final exam schedule is made public. It is your responsibility to know the date, time, and place of the final exam.** According to Registrar's final exam policy, students **have a maximum of two weeks after the announced final exam schedule** to request a change if an exam conflict exists or if a student has more than two exams in one day (see the policy here).

Attendance and Absences
Students with UI-authorized activities must discuss their absences with the instructor as soon as possible. Religious obligations must be communicated within the first three weeks of classes.

Communication: UI Email
Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community. For the privacy and the protection of student records, UI faculty and staff can only correspond with UI email addresses.

Mental Health Resources and Student Support

Students are encouraged to be mindful of their mental health and seek help as a preventive measure or if feeling overwhelmed and/or struggling to meet course expectations. Students are encouraged to talk to their instructor for assistance with specific class-related concerns. For additional support and counseling, students are encouraged to contact University Counseling Service (UCS). Information about UCS, including resources and how to schedule an appointment, can be found at counseling.uiowa.edu. Find out more about UI mental health services at mentalhealth.uiowa.edu.

Student Care and Assistance provides assistance to University of Iowa students who are experiencing a variety of crisis and emergency situations, including but not limited to medical issues, family emergencies, unexpected challenges, and sourcing basic needs such as food and shelter. More information on the resources related to basic needs can be found at basicneeds.uiowa.edu/resources/. Students are encouraged to contact Student Care & Assistance in the Office of the Dean of Students (Room 135 IMU, dos-assistance@uiowa.edu, or 319-335-1162) for support and assistance with resources.

University Policies

Accommodations for Students with Disabilities
The University is committed to providing an educational experience that is accessible to all. If a student has a diagnosed disability or other disabling condition that may impact the student's ability to complete the course requirements as stated in the syllabus, the student may seek accommodations through Student Disability Services (SDS). SDS is responsible for making Letters of Accommodation (LOA) available. **The student must provide an LOA to the instructor as early in the semester as possible, but requests not made at least two weeks prior to the scheduled activity for which an accommodation is sought may not be accommodated.** The LOA will specify what reasonable course accommodations the student is eligible for and those the instructor should provide. Additional information can be found on the SDS website.

Free Speech and Expression
Absences for Religious Holy Days
Classroom Expectations
Non-discrimination
Sexual Harassment/Misconduct and Supportive Measures
Sharing of Class Recordings (if appropriate)