

ASEN 5519: Special Topics – Experimental Design and Statistical Methods

Lecture: T/Th 10:00-11:15 am, AERO 232

Instructor:

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1. Overview

This 5000 level graduate student course is aimed at examining the applied issues of designing experiments and performing statistical analyses to reach justified scientific conclusions. The approach will rigorously address the mathematical underpinnings of statistical tests and modeling through applied examples. Efficient and appropriate experimental design approaches will be integrated with statistical analysis techniques to enable application to real-world research questions. A special focus will be placed on the unique challenges of human subject experiments. Statistical software (e.g., R) will be used extensively.

A wide range of topics will be covered to provide a “one stop” overview of statistics for the engineer. This includes data visualization, hypothesis formulation, inferential statistics (e.g. t-test), briefly correlation and (multiple) regression, uncertainty and confidence intervals, ANOVA (fixed effects, random effects, and mixed), ANOVA-derived methods (e.g. ANCOVA, Nested designs), post-hoc comparisons and corrections, diagnostics and remedial measures, and best practices for reporting statistics in publication. Approaches and challenges that are common for human subject experiments will receive special attention, including repeated measures (within subjects) designs and analyses, outlier identification, non-parametric techniques, and small N approaches such as Bayesian statistics. Additional topics beyond the scope of the course will be touched upon to provide guidance for self-exploration of areas of interested for individuals’ research.

2. Assessment

Table 1 outlines the material by which student performance will be assessed. The primary evaluation components of the course will be homework and exams. There will

also be a semester group project, with teams of 4 people performing an experiment with statistical analyses. Final presentations will occur during the final exam week. This course will have 2 exams. Additional details on timeline and due dates can be found in the course schedule document.

Table 1: Distribution of course assessments

Exams (2)	30%
Homework (4)	40%
Semester Project	30%
	100%

3. Textbook

There is no required textbook for the class. An online version of the primary text, “Applied Linear Statistical Models” by Kutner, Nachtsheim, Neter, and Li, can be found here:

<http://users.stat.ufl.edu/~rohitpatra/4210/KNNL.pdf>

Readings will be assigned from other resources as needed, and will be announced at least one week in advance of the due date.

4. Distance Students

This course is offered for distance students via classroom capture. The class will be recorded and automatically uploaded to the Canvas website. Any student wishing to attend the class in real time should email me directly so I can set up a Zoom meeting, allowing you to call in. If you have issues viewing or hearing the lecture, please let me know immediately so I can resolve the issue prior to the next class.

5. Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services](#)

[website](#). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see [Temporary Medical Conditions](#) under the Students tab on the Disability Services website.

6. Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the policies on [classroom behavior](#) and the [Student Code of Conduct](#).

7. Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

8. Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu; 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

9. Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, intimate partner abuse (including dating or domestic

violence), stalking, or protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#).

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

10. Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please let me know at least 2 weeks in advance prior to any accommodations you may need for religious observances.

See the [campus policy regarding religious observances](#) for full details.