MATH 5320 – Statistical Inference
Spring 2025
Department of Mathematical and Statistical Sciences
University of Colorado Denver

I.   Course Overview and Information

Professor: Joshua P. French, PhD
Office: SCB-4213
Email: joshua.french@ucdenver.edu
Course website: http://ucdenver.instructure.com

Class Meeting Times: Tuesday and Thursday from 11a-12:15p in SCB-4113. In the event that a virtual lecture is required, the following Zoom link can be used: https://ucdenver.zoom.us/j/95009608442?pwd=3aQ8lrLhnO9Ya2JSHQPVPEFYTIWUpN.1. That link will only be used when I specifically let you know that we will be conducting a virtual meeting.

Office Hours: Tuesday and Thursday 2:00-3:00p (other times by appointment).

Course Announcements:

Course announcements will usually be made via Canvas and/or your *ucdenver.edu* email address in accordance with university policy. You are responsible for the information contained in any messages I send you, regardless of whether the information is repeated in class.

Canvas:

Course homework, materials related to discussion, and resources (e.g. course syllabus, web resources, etc.) will be provided on the Canvas course site. It is your responsibility to know how to access this site. http://ucdenver.instructure.com

II. Course Description, Learning Outcomes, and Prerequisites

Course Credits: 3 Hours

Course Description:

Methods for constructing sampling distributions; sufficient, minimal sufficient, ancillary and complete statistics; methods for constructing and evaluating point estimators; estimator optimality; methods for constructing and evaluating hypothesis tests; methods for constructing and evaluating confidence interval estimators; asymptotic properties of estimators.

Learning Objectives:

By the end of this course, students should have an advanced understanding of the theoretical foundation of statistical areas such as estimation, hypothesis testing, and interval estimation. Students should also have a strong understanding of the statistical procedures related to these topics.

Learning Outcomes: This course will help build on several learning outcomes including:

- **Critical Thinking** – Students will enhance their critical thinking by developing the theoretical framework for many common statistical applications.

- **Problem Solving** – Students will develop their problem solving skills by proving key statistics theories and solving problems that depend on the correct application of these theories.

- **Written and Oral Communication** – An essential aspect of statistics is the ability to communicate the thought behind and results of a statistical analysis both in written form and orally. Students will develop and be assessed on their written communication through their homework, project, and exams. In addition, students will be assessed based on their interactions with the course instructor and classmates.

Prerequisites:

Formal perquisite: Graduate standing in Applied Mathematics or Statistics. AMEN-MS/PHD/STAT-MS or Instructor Permission

Note: This course assumes that students have the equivalent of an undergraduate-level course in probability (e.g., MATH 3800 or 4810).

III. Required Text and Materials

Required Textbook: <u>Statistical Inference</u> by George Casella & Roger L. Berger.

Required Materials for Zoom: Internet access, web camera, and microphone.

IV. Evaluation/Grades

Submitting work: All homework and exams will be submitted <u>as a single pdf</u> through our course Canvas site.

Final Grade Components: Your final grade will be determined as follows:

Homework (approximately one or two per chapter)	20%
2 Exams (40% each)	80%

Grading Scale: Final letter grades will be determined by the following scale (after rounding up to the nearest tenth of percent):

Percentage	Letter Grade	Percentage	Letter Grade
92.5 or higher	A	70.0 – 73.9	C
90.0 – 92.4	A-	68.0 – 69.9	C-
87.5 – 89.9	B+	66.0 – 67.9	D+
80.0 – 87.4	B	62.0 – 65.9	D
76.0 – 79.9	B-	60.0 – 61.9	D-
74.0 – 75.9	C+	0 – 59.9	F

Late Assignments or Missed Exams:

- Without prior approval from me or a documented health, disability, or emergency reason, missing homework and exams will be scored as a zero.
- Late homework will be accepted with a 10% grade reduction if submitted within one week of the due date. There will be a 20% grade reduction if submitted more than one week after the due date. Late homework will be accepted until the time of the next exam. For example, I will accept all

homework that is due any time before the midterm exam as long as it is submitted before the start of the midterm exam.

- Make-up exams can be arranged with me in advance for a documented health, disability, or emergency reasons. There will be no penalty for approved make-up exams.

Expectation of workload outside of class:

While individual time may vary, plan to spend 9 to 15 hours per week studying and completing homework.

Student Success:

- Students should strongly consider forming or joining study groups and/or regularly attending office hours. Please feel free to email me with questions, ideas, or concerns.
- It is not mandatory to complete the homework fully. It is okay to submit a homework with partial answers or questions.
- The ongoing pandemic may present challenges and obstacles to your performance, learning, and ability to complete work this semester. Please let me know if you are struggling for any reason. I will do my best to help you and/or make course-related adjustments to create the best structure to support your learning. All communications will be kept confidential between only us (student and myself).

Class Format:

- The class will largely follow the classic lecture format.
- There is no attendance policy with respect to mandatory attendance. However, you will benefit from participating in each lecture that you attend.
- There is no requirement to turn on your video camera during remote lectures. I reserve the right to require you to turn on your video camera for exams proctored by me through Zoom.
- Throughout the semester, supplemental materials or supplemental lecture videos may be posted to the course Canvas site.
- In the event of an unanticipated or emergency class cancelation, lecture videos for that class will be posted for your asynchronous review.
- Please limit cell phone or computer usage to class related activities or emergency use.

V.   Tentative Course Outline

Date	Covered Sections of Statistical Inference
Jan 21 (Tuesday)	Syllabus & 5.1
Jan 23 (Thursday)	5.2 & 5.3
Jan 28 (Tuesday)	5.4
Jan 30 (Thursday)	5.5
Feb 4 (Tuesday)	Finish Chapter 5
Feb 6 (Thursday)	6.1 & 6.2
Feb 11 (Tuesday)	6.2
Feb 13 (Thursday)	6.3
Feb 18 (Tuesday)	6.3
Feb 20 (Thursday)	Finish Chapter 6
Feb 25 (Tuesday)	7.1 & 7.2
Feb 27 (Thursday)	7.2
Mar 4 (Tuesday)	7.2 & 7.3
Mar 6 (Thursday)	7.3
Mar 11 (Tuesday)	7.3
Mar 13 (Thursday)	Finish Chapter 7 **Exam 1**
Mar 18 (Tuesday)	8.1 & 8.2

Mar 20 (Thursday)	8.2
Mar 24 – Mar 30	*Spring Break*
Apr 1 (Tuesday)	8.3
Apr 3 (Thursday)	8.3
Apr 8 (Tuesday)	9.1 & 9.2
Apr 10 (Thursday)	9.2
Apr 15 (Tuesday)	9.2 & 9.3
Apr 17 (Thursday)	9.3
Apr 22 (Tuesday)	9.3
Apr 24 (Thursday)	Finish Chapters 8 & 9
Apr 29 (Tuesday)	10.1
May 1 (Thursday)	10.3
May 6 (Tuesday)	Make-up
May 8 (Thursday)	Make-up
May 12 – 17	**Exam 2**

University, college, and department policies

Academic Calendar

For university deadlines and procedures (such as the last day to withdraw from a course), please see the Academic Calendar. https://www.ucdenver.edu/student/calendars/academic/

Academic Support

Instructor office hours or other appointments are the best way to get additional help. I'm happy to help with questions not answered during class, additional explanation, or homework assistance.

Other sources of support are

- The Math and Stat Support office is located in the Learning Commons Building Room 1225 and regularly offers CU Denver students free drop-in assistance. Hours of operation, zoom links for virtual options, and other forms of support for mathematics and statistics courses are available on the Math and Stat Support webpage. https://clas.ucdenver.edu/mathematical-and-statistical-sciences/math-and-stat-support

- The Learning Resources Center (LRC) provides individual and group tutoring, Supplemental Instruction (SI), study skills workshops, and ESL support.

https://www.ucdenver.edu/learning-resources-center

- The College of Liberal Arts and Sciences has a summary of campus academic support and school/college advising offices. https://clas.ucdenver.edu/faculty-staff/content/clas-academic-policies-deadlines

Recording of Class Meetings

Class meetings held on or streamed over a video conferencing platform (such as Zoom, Microsoft Teams, etc) may be recorded and posted for all members of the class. Student participation and interaction may be included in the recording. If you have any concerns about this, please contact the instructor.

Diversity Statement

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture, etc. I would like to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, etc). To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official records, please let me know!

- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you. Remember that you can also submit anonymous feedback (which will lead to me making a general announcement to the class, if necessary to address your concerns). If you prefer to speak with someone outside of the course, the Office of Diversity, Equity and Inclusion, is an excellent resource.

- I (like many people) am still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, including by me, please talk to me about it. (Again, anonymous feedback is always an option).

Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious or other cultural events, please let me know so that we can make arrangements for you.

Health and Wellness

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, traumas, increased anxiety, substance use, feeling down, difficulty concentrating, and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. If you or someone you know is struggling, you can find supportive campus and community resources at the Health Center at Auraria or the CU Denver Counseling Center. On weekends, holidays or after-hours you can contact the 24/7 Mental Health Crisis and Victim Assistance Line at 303-615-9911.

The University of Colorado Denver is committed the health and well-being of all students. We recognize that diminished mental health, including significant stress, mood changes, excessive worry, or problems with eating and/or sleeping can interfere with optimal academic performance. The source of such symptoms can be quite varied, and include experiences of trauma (such as sexual and relationship violence, stalking, discrimination, crimes, and accidents), responses to course work, family worries, loss, personal struggle, or crisis. If you or someone you know is struggling, you can find supportive campus and community resources at

https://www.ucdenver.edu/counseling-center

or by calling the CU Denver Counseling Center (303-315-7270) or the Health Center at Auraria (303-615-9999). On weekends, holidays or after-hours you can contact the 24/7 Mental Health Crisis and Victim Assistance Line at 303-615-9911.

Disability Accommodation and Access

The University of Colorado Denver is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you have a disability or think you have a disability and need accommodations to succeed in this course, I encourage you to contact Disability Resources and Services (DRS) and/or speak with me as soon as you can. DRS is located in Student Commons Building Suite 2116, and can be reached at disabilityresources@ucdenver.edu and online at https://www.ucdenver.edu/offices/disability-resources-and-services. I am committed to providing equal access as required by federal law, and I am interested in developing strategies for your success in this course.

Nondiscrimination and Sexual Misconduct

The University of Colorado Denver is committed to maintaining a positive learning, working and living environment. University policy and Title IX prohibit discrimination on the basis of race, color, national origin, sex, age, disability, pregnancy, creed, religion, sexual orientation, veteran status, gender identity, gender expression, political philosophy or political affiliation in admission and access to, and treatment and employment in, its educational programs and activities. University policy prohibits sexual misconduct, including harassment, domestic and dating violence, sexual assault, stalking, or related retaliation. If you have experienced any sort of sexual misconduct or discrimination, please visit the Office of Equity web site at https://www.ucdenver.edu/offices/equity to understand the resources available to you or contact the Office of Equity/Title IX Coordinator at equity@ucdenver.edu.

Please note that I am a Responsible Employee, which means that if I witness or receive information regarding possible prohibited protected characteristic discrimination or harassment, any form of sexual misconduct, and/or related retaliation, I am required to promptly report the information to the Office of Equity or their designee.

Religious Holiday Accommodation

Faculty in the University of Colorado system provide reasonable accommodations to students who must be absent from classes because of religious holidays. If you will miss class or graded assignments in order to observe religious holidays, you must contact me with all course conflicts by the end of the first week of classes.

Student Code of Conduct

As members of the University community, students are expected to uphold university standards, which include abiding by state civil and criminal laws and all University policies and standards of conduct. These standards are

outlined in the student code of conduct, which can be found at https://www.ucdenver.edu/student/wellness/student-conduct

Academic Honesty

Students are expected to know, understand, and comply with the ethical standards of the university. A university's reputation is built on a standing tradition of excellence and scholastic integrity. As members of the University of Colorado Denver academic community, faculty and students accept the responsibility to maintain the highest standards of intellectual honesty and ethical conduct.

Academic dishonesty is defined as a student's use of unauthorized assistance with intent to deceive an instructor or other such person who may be assigned to evaluate the student's work in meeting course and degree requirements.

This course assumes your knowledge of the policies and definitions. University policies allow the instructor to decide how to respond to an ethics violation, whether by lowering the assignment grade, lowering the course grade, and/or filing charges against the student with the campus Office of Student Conduct. For more information regarding the Office of Student Conduct policies and procedures, please refer to https://www.ucdenver.edu/student/wellness/student-conduct/academic-integrity. Violating the academic honor code can lead to expulsion from the University.

Examples of academic dishonesty include, but are not limited to, the following:

Plagiarism.

Plagiarism is the use of another person's distinctive words or ideas without acknowledgment. Examples include:

1. Word-for-word copying of another person's ideas or words;

2. The mosaic (the interspersing of one's own words here and there while, in essence, copying another's work);

3. The paraphrase (the rewriting of another's work, yet still using their fundamental idea or theory);

4. Fabrication of references (inventing or counterfeiting sources);

5. Submission of another's work as one's own;

6. Neglecting quotation marks on material that is otherwise acknowledged.

Acknowledgment is not necessary when the material used is common knowledge.

Cheating.

Cheating involves the possession, communication, or use of information, materials, notes, study aids or other devices not authorized by the instructor in an academic exercise, or communication with another person during such an exercise. Examples include:

1. Copying from another's paper or receiving unauthorized assistance from another during an academic exercise or in the submission of academic material;

2. Using a calculator when its use has been disallowed;

3. Collaborating with another student or students during an academic exercise without the consent of the instructor.

Note on use of Generative AI.

Generative AI tools such as ChatGPT may not be used on exams, tests, or quizzes that do not permit the use of outside resources. The instructor will provide guidelines on whether such tools can be used for assignments and projects.

Fabrication and Falsification.

Fabrication involves inventing or counterfeiting information, i.e., creating results not obtained in a study or laboratory experiment. Falsification, on the other hand, involves the deliberate alteration of results to suit one's needs in an experiment or other academic exercise.

Multiple Submissions.

This is the submission of academic work for which academic credit has already been earned, when such submission is made without instructor authorization.

Misuse of Academic Materials.

The misuse of academic materials includes, but is not limited to, the following:

1. Stealing or destroying library or reference materials or computer programs;

2. Stealing or destroying another student's notes or materials, or having such materials in one's possession without the owner's permission;

3. Receiving assistance in locating or using sources of information in an assignment when such assistance has been forbidden by the instructor;

4. Illegitimate possession, disposition, or use of examinations or answer keys to examinations;

5. Unauthorized alteration, forgery, or falsification;

6. Unauthorized sale or purchase of examinations, papers, or assignments.

Complicity in Academic Dishonesty.

Complicity involves knowingly contributing to another's acts of academic dishonesty. Examples include:

1. Knowingly aiding another in any act of academic dishonesty;

2. Allowing another to copy from one's paper for an assignment or exam;

3. Distributing test questions or information about the materials to be tested before the scheduled exercise;

4. Taking an exam or test for someone else;

5. Signing another's name on attendance roster or on an academic exercise.

Incomplete Policy

When a student has special circumstances that make it impossible to complete course assignments, faculty members may choose to award an incomplete grade. All incomplete courses are assigned a grade of Incomplete (I). Incomplete grades are not awarded for poor academic performance or as a way of extending assignment deadlines. Faculty are not required to award an Incomplete.

To be eligible for an Incomplete grade, students MUST:

- Have participated in the class for a significant proportion of the term.

- Have successfully completed a significant proportion of the course assignments.

- Have special circumstances (verification may be required) that preclude the student from attending class and/or completing graded assignments.

- Make arrangements to complete missing assignments with the original instructor by a mutually agreed upon date but within one calendar year. Note that it is not the instructor's responsibility to teach the student missed material.

- Both the instructor and student should complete and sign a Course Completion Agreement found at

- The instructor gives a copy of the signed Course Completion Agreement to the department.

Incompletes cannot:

- require a student to repeat the entire course,

- repeat or replace existing grades,

- allow the student an indeterminate period of time to complete a course, or

- allow the student to repeat the course with a different instructor.

Student Grievances

Students who have concerns about the course or instructor should first contact the instructor to discuss the issue. If the issue is not resolved, the student should next contact the Associate Chair of the Department of Mathematical and Statistical Sciences (currently Stephen Hartke <stephen.hartke@ucdenver.edu>). If not satisfied, the student should then appeal to the appropriate Associate Dean of the student's home school or college (for CLAS, this is the Associate Dean for Student Success). No step in this process should be skipped.