

CHEN 3010 – Applied Data Analysis

Spring 2026 ~ Course Syllabus

Meeting Schedule: MW 3:50 – 5:05 pm in BIOT A104 (lectures are recorded & posted on Canvas)

Instructor: Dr. Wendy Young wendy.young@colorado.edu (JSCBB D1B20)

CAs:

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Office Hours: check Canvas for most recent office schedule; there will be no office hours the first week of class

Text: **Applied Statistics and Probability for Engineers, 7th Edition**, Douglas C. Montgomery and G. C. Runger, Wiley, 2020.

Software

- **Excel:** please use a current or recent version with “Solver Add-in” and “Analysis ToolPak” enabled
 - To enable these in Excel go to File → Options (at bottom left) → Add-ins → Excel Add-ins & Go
- **RStudio:** see RStudio Installation Instructions in Canvas in the General Course Information module
- **Minitab:** in Chrome, Safari, or Edge sign in at <https://licensing.minitab.com/Login/Home> using “University of Colorado SSO”; go to My Products → Open Web App → Analytics

Prereqs: CHEN 1310 (Excel) and APPM 2360 or MATH 2130 and MATH 3430 (differential eqs & linear algebra)

Course Learning Outcomes: By the end of this course, students should be able to do the following.

1. Characterization of Experimental Data
 - Demonstrate understanding of probability concepts that relate to experimental measurement
 - Describe measurements using common distributions
 - Represent distributions using standard graphical and computing techniques
2. Statistical Methods
 - Demonstrate understanding of the relationship of sample statistics to background distributions
 - Compute sample statistics and confidence intervals
 - Apply hypothesis tests common to engineering analyses
3. Model Building
 - Demonstrate understanding of the concepts of regression analysis, including correlation and analysis of residuals
 - Compute linear, multilinear, curvilinear, and nonlinear regression
 - Express confidence intervals on model parameters
 - Assess goodness of fit and discriminate amongst competing models
4. Design of Experiments
 - Demonstrate understanding of factorial design of experiments and response surface methods
 - Plan an efficient experimental campaign based on factorial design
 - Demonstrate understanding of the principles of analysis of variance as they apply to factorial design
 - Process and interpret the results of factorial experiments
 - Develop response surface models from the results of factorial experiments and use these models for prediction and evaluation
5. Statistical Tools
 - Utilize tools such as Excel, R, and Minitab for statistical analyses

Why Take Stats?

No practical engineering work gets done without taking measurements of some type, and in today's world most measurements are automated with modern instrumentation and computer-based data acquisition systems. Important decisions are made based on data acquired through measurement systems; consequently, dealing with measurement errors and the appropriate application of statistical methods are critically important. In the immediate future, you will be required to make such measurements and interpretations in your engineering lab courses; in the more distant future or perhaps sooner you will be carrying out such activities in a professional setting. It is important that you be equipped with the knowledge and practice required for industrial measurement and data analysis before you are confronted abruptly with their need.

Course Format

This course utilizes a flipped classroom approach. Before most classes, you will be required to watch and interact with several Learning Modules, which are short videos with required in-video questions. These Learning Modules will be the main way that you are exposed to new material for the first time, in addition to the daily reading assignments in the textbook. Each day's reading assignment is given in the course Schedule at the end of this syllabus. You will come to class prepared with a general idea of the topics for that day so class time can be used to solidify these concepts through a short review of material, graded conceptual and quantitative clicker questions, and daily worksheets with example problems.

The content of this course follows closely the contents of the Montgomery and other standard texts. It is a logical building sequence, starting with the foundation topics of probability and distributions, proceeding with sample statistics and inference, and finishing with regression analysis and design of experiments. The last topic is more advanced, but the exposure provided in this course is considered to be introductory overall.

Grading Basis

Overall Grade Breakdown	100%	Grading Scheme	
Clicker Questions (lowest 4 days dropped)	10%	90 / 93.33 / 100 %	A-, A
Learning Modules (lowest 6 dropped)	15%	80 / 83.33 / 86.67 / 89.99 %	B-, B, B+
Homework (lowest dropped)	15%	70 / 73.33 / 76.67 / 79.99 %	C-, C, C+
Learning Assessments (lowest dropped)	30%	60 / 63.33 / 66.67 / 69.99 %	D-, D, D+
Final Exam (cannot be dropped)	25%	< 60%	F
Creative Project	5%		

Late Policy & Importance of Planning Ahead

All work in this class needs to be completed in the required time frame. Late work will not be accepted unless due to severe emergencies. In those rare cases, you are expected to inform the instructor ideally before the assignment is due or within one day of the due date. All assignments need to be submitted through Canvas and should not be emailed directly to the instructor. Be aware that technology failures (computer crashing, connectivity issues, etc.) will not be excused, nor will extensions be granted for these types of issues. Technology fails! Make sure you plan early so if a technology failure arises, there will be plenty of time to meet your deadline.

If there is an especially difficult load one week for a majority of students then let the instructor know to see if a deadline adjustment is warranted.

Unexpected illness may arise during the semester. To account for this, at the end of the semester the lowest grades are dropped (see Overall Grade Breakdown above for details). Make sure to start your homework

and Learning Modules early; if you become sick the night before something is due, the instructor will tell you, "It's been available on Canvas for almost a week!" Start early!

Clicker Questions

Graded clicker questions will be asked during class; **students must be in class in A104 to answer clicker questions and each can only answer for themselves**. The total points for each day will be 5, consisting of 3 points awarded for answering at least 50% of the questions and the remaining 2 points based on correctness of answers. For instance if 6 clicker questions are asked and you answer 4 correctly and 2 incorrectly, your clicker score that day will be 3 (answered over 50% of questions) + 1.33 (answered 4 of 6 correctly) = 4.33 out of 5 possible.

The lowest 4 clicker days will be dropped to account for illness, conferences, interviews, travel, etc. There is no need to contact the instructor about missing class unless you have an extended absence. Please make sure to register your clicker at <https://buffportal.colorado.edu/card/cuclicker> and download and set up the app before you get to class.

Learning Modules

On most lecture days, there will be Learning Modules on Canvas that are **due by 3:00 PM each day of class**. A Learning Module consists of a short (typically 4-9 minutes) screencast with 1-5 in-video questions that you must answer. These are designed to keep you on track with learning the course material and to prepare you for lectures. Learning Modules (LMs) are available one week before they are due (e.g., Monday LMs are due by 3:00 PM and become available the previous Monday at 3:00 PM; Wednesday LMs are due by 3:00 PM and become available the previous Wednesday at 3:00 PM). Be sure to plan ahead and **START EARLY**. There is **NO PENALTY FOR COMPLETING THEM EARLY!**

Each Learning Module has the same weight/value and the **lowest 6 will be dropped**. If there is only one Learning Module assigned on a given day, this is worth only a quarter of the points on a day when four Learning Modules are assigned. Thus, it is important not to miss Learning Modules on the days when several of them are assigned and due. You have the opportunity to answer most in-video questions twice (i.e. you have two attempts for each question) and there is a participation component of each Learning Module (i.e. even if you miss all questions in a LM, you will still get 50% of the credit for "participating" as long as you watch the entire video and answer the participation question at the end).

Homework

Homework is due on Gradescope at 11:59 pm on Wednesdays and **your lowest single homework score will be dropped**. Homework can be completed individually or in groups of up to three (3); if you work in a group make sure to add all group member names when submitting to Gradescope so everyone gets points. Homework is an incredibly important way to learn the material and do well on Learning Assessments so you are most strongly advised to complete each problem yourself.

Learning Assessments & Final Exam

There will be 3 in-class Learning Assessments (LA) throughout the semester and a cumulative Final Exam during finals week; all will be closed-book/note and an equation sheet will be provided. Each LA will be one hour long during class and will start at the beginning of class; the schedule below shows the LA dates. **The lowest LA score will be dropped**.

The final exam date is set by the university and per university rules students can only reschedule if it is the third of three exams on the same day or if it is scheduled at the same time as another exam. The final exam cannot be dropped.

Project

An open-ended project will allow students to apply three class concepts of their choosing to an area of personal interest (with awards for creativity!). Information on the project will be provided throughout the semester and it will be due at the end of the semester.

AI Policy

There are many tools for statistical analysis these days, including AI, which make computations much easier. The potential problem is if engineers are using these tools without understanding the meaning behind them, which can lead to inappropriate tests being used and/or misinterpretation of results. This course aims to give students a more fundamental understanding behind these tools and software commands so when you leave CU you can more confidently analyze your data.

For this reason students are NOT allowed to use AI for solving homework problems, though students can use AI to check answers (noting that many homework problems are required to be solved by hand and Excel/R so answers can already be compared).

Be sure you understand how to solve problems by hand; you will NOT be able to use AI tools on Learning Assessments and the Final Exam, which make up 55% of the points in this course.

Classroom Environment

In our discussions, a culture of respect is essential; we are all expected to help create that culture. It is my intent that students from all backgrounds and perspectives belong in this course, that students' learning need to be addressed both in and out of class, and that the various perspectives that students bring to this class be framed as a resource, strength, and benefit. It is also my intent to present materials and activities that are respectful of all backgrounds. Your suggestions throughout the semester on ways to improve the effectiveness of the course are encouraged and appreciated!

University Policies University Policies can be found [here](#).

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 Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), 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. Understanding the course's syllabus is a vital part of adhering to the Honor Code.

Using another person's work, AI solutions, or book solutions; allowing another person to use your work; clicking for another student; or allowing another student to click for you will be considered a dishonest act and thus grounds for failure of the class and an Honor Code report.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from Student Conduct & Conflict Resolution and will be subject to academic sanctions from the faculty member. Visit [Honor Code](#) for more information on the academic integrity policy.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

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, see [Temporary Medical Conditions](#) on the Disability Services website.

If you have a temporary illness, injury or required medical isolation for which you require adjustment, please contact the course instructor.

Accommodation for Religious Obligations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, please contact the course instructor. See the [campus policy regarding religious observances](#) for full details.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have your preferred name (rather than your legal name) and/or your preferred pronouns appear on your instructors' class rosters and in Canvas, visit the [Registrar's website](#) for instructions on how to change your personal information in university systems.

Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure 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, marital status, political affiliation, or political philosophy.

Additional classroom behavior information

- [Student Classroom and Course-Related Behavior Policy](#).
- [Student Code of Conduct](#).
- [Office of Institutional Equity and Compliance](#).
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Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits [protected-class](#) discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email OIEC@colorado.edu. Information about university policies, [reporting options](#), and [OIEC support resources](#) including confidential services can be found on the [OIEC website](#).

Please know that faculty and graduate instructors are required to inform OIEC when they are made aware of incidents related to these concerns regardless of when or where something occurred. This is to ensure the person impacted receives outreach from OIEC about resolution options and support resources. To learn more about reporting and support a variety of concerns, visit the [Don't Ignore It page](#).

Mental Health and Wellness

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact [Counseling and Psychiatric Services \(CAPS\)](#), located in C4C, or call (303) 492-2277, 24/7.

CHEN 3010 Schedule – Spring 2026

(Subject to Change)

Week	Monday	Wednesday	Assignments
1	Class 1 (1/12): pg 1-16 - Course introduction - Types of studies	C2 (1/14): pg 17-31; 3 LMs (Learning Modules) - Counting techniques - Combinations/permutations - Probability	
2	(1/19): MLK DAY, NO CLASS	C3 (1/21): pg 31-41; 4 LMs - Conditional probability, independence, total probability rule, Bayes' Theorem	Homework #1 due Wed (1/21) by 11:59 pm on Gradescope
3	C4 (1/26): pg 42-55; 2 LMs - Probability distributions - Binomial distribution	C5 (1/28): pg 55-65; 5 LMs - Discrete probability distributions	Homework #2 due Wed (1/28)
4	C6 (2/2): pg 66-79; 5 LMs - Continuous probability distributions	C7 (2/4): pg 83-86 & 113-114; 2 LMs - Exponential distribution - Multinomial distribution	Homework #3 due Wed (2/4)
5	C8 (2/9): pg 86-93 & 126-144; 2 LMs - Other continuous distributions - Descriptive statistics, graphical presentation of data	C9 (2/11): pg 144-156; 3 LMs - Probability plots - Sampling vs. population distribution - Central Limit Theorem	Homework #4 due Wed (2/11)
6	C10 (2/16): pg 171-191; 4 LMs - Confidence intervals on the mean - The T dist and chi-squared dist	C11 (2/18): Learning Assessment #1 (covering lectures C1-C7)	
7	C12 (2/23): pg 194-221; 6 LMs - Introduction to hypothesis testing	C13 (2/25): no new reading; 3 LMs - Hypothesis testing, continued - Type I and II errors	Homework #5 due Wed (2/25)
8	C14 (3/2): no new reading; 2 LMs - Power of the test - Choice of sample size	C15 (3/4): pg 222-229&245-261; 6 LM - Hypothesis tests on the variance and binomial proportions - Comparison of means (variance known and unknown)	Homework #6 due Wed (3/4) Creative Project Topic & Test due Fri (3/6)
9	C16 (3/9): pg 264-278; 3 LMs - Paired T tests - F dist and comparison of variances - Comparison of binomial proportions	C17 (3/11): Learning Assessment #2 (covering lectures C8-C14)	
WEEK OF 3/16-3/20: NO CLASS, SPRING BREAK!			
10	C18 (3/23): pg 281-293; 4 LMs - Empirical models - Simple linear regression	C19 (3/25): pg 293-300; 5 LMs - Simple linear regression, continued - Residual analysis - Model adequacy	Homework #7 due Wed (3/25)
11	C20 (3/30): pg 310-336; 5 LMs - Multilinear regression - Hyp. tests and conf. intervals in multilinear regression	C21 (4/1): pg 337-363; 4 LMs - Polynomial models - Model building techniques - ANOVA	Homework #8 due Wed (4/1)
12	C22 (4/6): pg 382-388; 1 LM - Regression and ANOVA wrap-up	C23 (4/8): p375-381&388-396; 5 LM - Intro to factorial designs - The 2 ² factorial design	Homework #9 due Wed (4/8) Creative Project due Fri (4/10)
13	C24 (4/13): pg 396-413; 5 LMs - Factorial designs, continued	C25 (4/15): Learning Assessment #3 (covering lectures C15-C21)	
14	C26 (4/20): pg 413-425; 2 LMs - Fractional factorial designs	C27 (4/22): 425-432 - RSM	C28 (4/24): none Review
FINAL EXAM: Wed, April 29 from 4:30–7 p.m.			

Note: page numbers correspond to the 7th Edition of Montgomery and Rundger