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ST 515-001 Course Syllabus

Experimental Statistics for Engineers I

Fall 2025

Instructor Information

Name	Office Phone	Mobile Phone	Email	Office Location
Dr. Dan Harris	919-515-1924	828-446-3635	doharris@ncsu.edu	SAS 4264
Kyle McKee (TA)			kjmckee@ncsu.edu	

Dan Harris

Office Hours

Dr. Harris: Wednesdays from 9:00am-10:00am either in-person (SAS 4264) or via Zoom link, or by appointment (please request an appointment via email, with the understanding I will respond within one business day).

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Preferred Method of Communication & Response Time

- **Preferred method of communication:** If you need to contact me directly, my preferred method of communication is email. You can expect to receive a response within one business day (i.e. not over the weekend). If I email you directly, please strive to respond within one business day. It is recommended that you check your NC State email at least once a day to stay on top of course communications.

- **Asking questions about the course:** If you have a question about the course or its content, you can email me or post your question on the Student Discussion Forum in Moodle. You can expect to receive a response within one business day (i.e. not over the weekend).

- **Email guidelines:** Always include a descriptive, specific, but concise subject. Please provide adequate context for your question in order to ensure I fully understand your email. Be sure to use your NC State email account.

Course Information

Course Website: [ST 515 Moodle Site](#)

Meeting Time and Location: TuTh, 8:30am-9:45am, 1102 SAS Hall

Course Credit Hours: 3

Catalog Description

An introduction to the foundations of probability theory and mathematical statistics useful for research in engineering. Topics include descriptive statistics, probability, discrete and continuous random variables and probability distributions, joint probability distributions and random samples, point estimation, confidence intervals, hypothesis testing, analysis of variance, and simple linear regression.

Structure

The majority of this course is **synchronous**, delivered through real-time, face-to-face class sessions. Additional materials and activities are delivered through **Moodle**, a secure and easy-to-use online learning platform. Live lectures will be recorded for asynchronous viewing on Moodle.

- Lectures: Two per week
- Homework: 11 total assignments (roughly weekly)
- Exams: Two midterm exams and one final exam.

Meeting Time and Tool Used

Class meets every Tuesday and Thursday – excepting NCSU holidays and Wellness Days – from 8:30am-9:45am in room 1102 in SAS Hall. All lectures are recorded for asynchronous viewing over Panopto and can be accessed via the class Moodle site.

Prerequisites/Corequisites

Graduate standing

Minimum Technical and Digital Information Literacy Skills

Required technical Skills:

- Navigate and use Moodle, NC State's Learning Management System.
- Use Gmail, including attaching files to email messages.
- Create and submit files in commonly used formats (MS Word, Google Docs, pdf's).
- Download and install software as needed (see section on required software).
- Download and upload attachments.
- Use the Zoom web conferencing tool.
- Post to discussion boards and forums.

Required digital information literacy skills:

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- Perform online research using various search engines and library databases. Visit [NC State University Libraries](#).

- Use online search tools for specific academic purposes, including the use of search criteria, keywords and filters.

General Education Program (GEP) Information

GEP Category Fulfilled

None

GEP Corequisites

None

Learning Outcomes

Upon completion of this course, students will be able to:

1. Graphically describe data distributions and understand probability basics.

2. Decide which distribution to use for some common processes; for some commonly used distributions, calculate related probabilities, mean and variance.

3. Describe the relationship between two variables using their joint distribution, covariance and correlation.

4. Understand sampling distribution, central limit theorem and its application.

5. Understand theoretical basis of point estimators and their bias and variance characteristics and use to estimate parameters of interest using sample data.

6. Understand theoretical basis of interval estimates, and compute and interpret intervals for parameters of interest using sample data.

7. Understand theoretical basis and assumptions behind one- and two-sample hypothesis tests and perform hypothesis tests using sample data.

8. Understand theoretical basis and assumptions behind analysis of variance (ANOVA), fixed and random effects, and perform ANOVA to identify significant effects using sample data.

9. Understand theoretical basis and assumptions behind simple linear regression and perform regression analysis using sample data.

Course Materials

Required textbook

Verzani, *Using R for Introductory Statistics*, 2nd edition, 2024. Approximate cost $45

Other required materials

None

Optional materials

Sahu, *Introduction to Probability, Statistics & R*, 2024. (optional text)

Technology Requirements

NC State University Libraries offers [Technology Lending](#), where many devices are available to borrow for a 7-day period. [Computer labs](#) are available in various locations around campus for student use.

Computer

A laptop computer is [required/recommended] for students taking this course. NC State's Office of Information Technology provides recommendations for [your computer at NC State](#).

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Other devices

Scientific calculator (you do not need a statistics or graphing calculator, although they are permitted for use during exams).

Software and digitally-hosted course components

The following software and tools will be used in this course. Some tools are a part of NC State's enterprise tools. See information about their purpose, how to access them, accessibility information, and privacy policies. The same information for any other tools required in this course is provided in the list below.

- **R statistical software and RStudio integrated development environment**

  - **Purpose:** R: perform statistical analyses and create data visualizations required for homework and exams; RStudio: user interface for R statistical software

  - **How to access:** download R and RStudio

  - **Accessibility:** Posit accessibility information and resources

  - **Privacy:** Posit privacy policy

Other Student Expenses

- None

Communication Guidelines

Respecting our learning community

The NC State Code of Student Conduct outlines expectations for behavior in the classroom (whether virtual or physical) and the consequences for students who violate these expectations. Any behavior that impacts other

students' ability to learn and succeed will be addressed but expressing diverse viewpoints and interpretations of course content is welcome.

Community guidelines for this course include:

- Use a respectful tone in all forms of communication (email, written, oral, visual).
- Maintain professionalism (avoid slang, poor grammar, etc.) in your written communication.
- Respect regional dialects and culturally embedded ways of oral communication.
- Stay home or in your dorm room if you are exhibiting symptoms of a contagious illness (fever, chills, etc.).
- Enter our virtual and/or physical classroom community respectfully by refraining from lewd or indecent speech or behavior, helping to maintain a safe physical environment, not using your cell phone for voice or text communication except when explicitly given leave to do so, and not attending class under the influence of any substance.
- Treat each community member with respect by not recording others without their consent or engaging in any form of hazing, harassment, intimidation, or abuse.
- Respect cultural differences that may influence communication styles and needs.]

Plan for interaction between instructors and students

Regular communication will be as follows:

- The instructor will post an overview of activities for the coming week no later than Monday morning of each week that will appear in the Announcements section of the Moodle site and be transmitted to all students via email.
- The TA will provide feedback on assignments approximately one week after they are submitted.
- The instructor and TA will hold weekly drop-in office hours that will be accessible both in person or via Zoom.

Policies regarding other communications:

- The instructor or TA will inform students of any changes in assignment dates, exam schedules or other important information via posts in the Announcements section of Moodle, which will also be relayed via email.

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- The instructor or TA will answer any question directed to them in the Student Discussion Forum within one business day of posting.
- The instructor and the TA will respond to questions posed via email within one business day.
- The instructor will be available after each class meeting (up to ten minutes) for discussions with students.
- Students may make requests via email for appointments to meet with the instructor outside of class and office hours.

Expectations for learner participation and interaction

Some course activities, including synchronous class sessions and Moodle Forums, will require you to interact with other students in the course. Any specific communication expectations, including frequency and content, are detailed in the information about each assignment or activity when it appears in the course.

Grading and Feedback

Grading criteria, details, and timing of feedback

Possible Points	Component	Details and timing of feedback
100	Homework	- There will be 11 homework assignments worth 10 points each. They will be posted to the course website and will be due the following week by submitting a single pdf or image file with solutions

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	Homework (continued)	plus a second file containing R code via Moodle. One lowest homework grade will be dropped. For each assignment, some additional problems will be assigned for extra practice; solutions for these problems to not need to be submitted. • *You will receive a grade/feedback within one week assignment submission**
100 points each	Two Midterm Exams	• The midterm exams with be two parts each: one part in-class (50 points) and a second part take-home (50 points). The in-class portion will be closed book and notes, but a basic calculator (such as TI-XX) and a single page of notes may be used. The take-home portion will be open book & note; basic calculators (such as TI-XX) or computer software (such as R) may be used, but no communication with anyone other than the instructor is permitted between the time the exam is posted and solutions are submitted. • Midterm Exam 1: in-class 10/7, take-home posted 10/7, due 10/10 • Midterm Exam 2: in-class 11/13, take-home posted 11/13, due 11/16 • *You will receive a grade/feedback within one week of the due date for the take-home portion.**

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100	Final Exam	- The take-home Final Exam is open book & note. Basic calculators (such as TI-XX) or computer software (such as R) may be used. No communication with anyone other than the instructor is permitted between the time the exam is posted and solutions are submitted. - Final Exam: posted 12/2, due 12/9. *You will receive a grade/feedback by 12/12.*

*modifications to the timing of grades/feedback, if required, will be announced via email.

Grading scale

Low	Letter	High
$388 \leqslant$	A+	≤ 400
$372 \leq$	A	< 388
$360 \leq$	A-	<372
$348 \leq$	B+	< 360
$332 \leq$	B	< 348
$320 \leq$	B-	< 332
$308 \leq$	C+	< 320

$292 \leq$	C	< 308
$280 \leq$	C-	< 292
$268 \leq$	D+	< 280
$252 \leq$	D	< 268
$240 \leq$	D-	< 252
$0 \leq$	F	< 240

Requirements for earning a grade of "Satisfactory"

If you are taking this course for credit only (S/U), your grade will be reported as S (Satisfactory) when coursework is equivalent to a C- or better or U (Unsatisfactory) when coursework is equivalent to less than a C-. For more information, see the Credit Only Courses regulation.

Requirements and procedures for auditing this course

Auditing this course is approved on a case-by-case basis. Please contact the course instructor to attain approval. Refer to the Audit regulation for more information and links to required forms.

Course Schedule

Please note: the course schedule is subject to change.

Week	Tuesday	Thursday
Week 1:	8/19: Intro. Sh1.3,2.1-2.3, Vz2.3,5.1-5.3 graphs, location, variability	8/21: Sh3.0-3.4 probability, counting; assign HW1
Week 2:	8/26: Sh4.0-4.9 conditional probability, independence	8/28: Sh5.0-5.1, Vz6.1 discrete RVs; HW1 due, assign HW2

Week 3:	9/2: Sh5.4-5.5,6.1-6.2, Vz6.1-6.2 expected values, Binomial	9/4: Sh6.3-6.6 Hyper, NegBin, Poisson RVs; HW2 due, assign HW3
Week 4:	9/9: Sh5.2,5.4, Vz6.1 continuous RVs	9/11: Sh7.1-7.3, Vz6.2 Normal, Exp/ Gamma RVs; HW3 due, assign HW4
Week 5:	9/16: **Wellness Day** – No Class	9/18: Sh6.3, Vz2.3 Beta, other RVs, probability plots
Week 6:	9/23: Sh8.1-8.5 joint distributions; assign HW5; HW4 due	9/25: Sh8.7-8.8, ,9.3.2, Vz6.1-6.3 sampling distributions
Week 7:	9/30: Sh9.3-9.4 estimation; HW5 due, assign HW6	10/2: Sh10.1-10.2 MOM, MLE
Week 8:	10/7: **Exam 1** HW1-HW5	10/9: Sh10.2-10.3, Vz7.4 MLE, Bayesian; Sh11.1-11.3, Vz8.1-8.2 large sample CIs
Week 9:	10/14: **Fall Break** – No Class	10/16: Sh11.1-11.3, Vz8.1 large sample CIs; Sh11.4, Vz8.2 CIs for mean from Normal pop; HW6 due, assign HW7
Week 10:	10/21: Vz8.3 CIs for variance from Normal pop; Vz7.3 Bootstrap	10/23: Sh12.1-12.3 hypothesis test, z-test, error types; HW7 due, assign HW8
Week 11:	10/28: Sh12.2, Vz9.1-9.2 one sample t-test for mean, proportion	10/30: Sh12.5-12.6, Vz9.5-9.6 z-test for diff in means, two sample t-test; HW8 due assign HW9
Week12:	11/4: Sh12.5, Vz9.5-9.6 two sample t-test	11/6: Sh19.1-19.4, Vz12.1-12 ANOVA; Class notes multiple comparisons; HW9 due, assign HW10
Week 13:	11/11: Class notes random effects; Vz12.4 two-factor ANOVA	11/13: **Exam 2** HW6-HW9
Week14:	11/18: Vz12.4 Interactions; Class notes mixed effects models	11/20: Class notes three-factor ANOVA, Sh17.1-17.4, Vz11.1 simple regression; HW10 due assign HW 11
Week 15:	11/25: Sh17.5-17.7,17.13, Vz11.2 simple regression inference, confidence and prediction intervals; Sh19.5-19.6, Vz12.2-12.3 categorical predictors	11/27: **Thanksgiving** - No Class
Week 16:	12/2: Sh17.10,17.14-17.16, Vz11.2 model adequacy; variable transformations HW11 due	12/9: **Exam 3** due by 11:00am

ShX = Sahu, *Introduction to Probability, Statistics & R*, Chapter X

VzX = Verzani, *Using R for Introductory Statistics*, 2nd edition, Chapter X

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Course Policies

Proctored exams

In-class portions of the midterm exams will be proctored by DELTA Testing Services. You must make an appointment online using this appointment link at least 48 hours prior to the date and time you wish to take the exam (see testing dates above). *Students should make appointments well in advance of the scheduled exam date since seats at the DELTA testing centers are limited.*

Late assignments

Late assignments will not be accepted without approval from the instructor at least 24 hours prior to the submission date and time.

Incomplete grades, withdrawals

Information on incomplete grades can be found at REG 02.50.03 – Grades and Grade Point Average. If you encounter a serious disruption to your work not caused by you and you would have otherwise completed the course, contact your instructor as soon as you can to discuss the possibility of earning an incomplete in the course for the semester, including an agreement on when the remaining work must be done to change the grade to the appropriate letter grade.

If you must drop a course or withdraw from the University due to hardship beyond their control, see Withdrawal Process and Timeline | Student Services Center for information and instructions.

Attendance

- Attendance at in-person class meetings is encouraged so that students can interact and ask questions of the instructor but is not required.

Related NC State Policy: REG 02.20.03 – Attendance Regulations

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University Policies

Academic integrity and honesty

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct 11.35.01 sections 8 and 9. Therefore, students are required to uphold the Pack Pledge: "I have neither given nor received unauthorized aid on this test or assignment." Violations of academic integrity will be handled in accordance with the Student Discipline Procedures.

Please refer to the Academic Integrity web page for a detailed explanation of the University's policies on academic integrity and some of the common understandings related to those policies.

Student privacy

Originality Checking Software

Software is not used in this course to detect the originality of student submissions.

Class recording statement:

In-class sessions are recorded in such a way that they might also record students in this course. These recordings MAY be used beyond the current semester or in any other setting outside of the course. Contact your instructor if you have concerns.

Class privacy statement:

This course requires online exchanges among students and the instructor, but NOT with people outside the course. Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web postings, where relevant to the course. Examples include online discussions of class topics and posting of student coursework. All students are expected to respect each other's privacy by not sharing or using such information outside the course.

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Other Policies

Students are responsible for reviewing the NC State University PRR's which pertain to their course rights and responsibilities:

- Equal Opportunity and Non-Discrimination Policy Statement and additional references

- Code of Student Conduct

- Grades and Grade Point Average

- Credit-Only Courses

- Audits

Student Resources

Academic and Student Affairs maintains a website with links for student support on campus, including academic support, community support, health and wellness, financial hardship or insecurity, and more. Find Help on Campus.

Disability resources

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office (DRO). For more information on NC State's policy on working with students with disabilities, please see the Policies, Rules and Regulations page maintained by the DRO and REG 02.20.01 Academic Accommodations for Students with Disabilities.

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Safe at NC State

At NC State, we take the health and safety of students, faculty and staff seriously. [The Office of Equal Opportunity](#) supports the university community by providing services and resources to support and guide individuals in obtaining the help they need. See the [Safe at NC State webpage](#) for resources.

Supporting Fellow Students in Distress

As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remain a healthy and safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you, either for the classmate's well-being or yours. If you feel this way, I would encourage you to report this behavior to the [NC State CARES website](#). Although you can report anonymously, it is preferred that you share your contact information so they can follow up with you personally.

Course Evaluations

ClassEval is the end-of-semester survey for students to evaluate the instruction of all university classes. The current survey is administered online and includes 12 closed-ended questions and 3 open-ended questions. Deans, department heads, and instructors may add a limited number of their own questions to these 15 common-core questions.

Each semester students' responses are compiled into a ClassEval report for every instructor and class. Instructors use the evaluations to improve instruction and include them in their promotion and tenure dossiers, while department heads use them in annual reviews. The reports are included in instructors' personnel files and are considered confidential.

Online class evaluations will be available for students to complete during the last two weeks of the semester for full-semester courses and the last week of shorter sessions. Students will receive an email directing them to a website to complete class evaluations. These are available at 8 am on the first day of finals.

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- Contact ClassEval Help Desk: classeval@ncsu.edu

- ClassEval website

- More information about ClassEval

Syllabus Modification Statement

Our syllabus represents a flexible agreement. It outlines the topics we will cover and the order in which we will cover them. Dates for assignments represent the earliest possible time they would be due. The pace of the class depends on student mastery and interests. Thus, minor changes in the syllabus can occur if we need to slow down or speed up the pace of instruction.