ST 515 Course Syllabus

ST 515 – Experimental Statistics for Engineers I

Section 001

Fall 2021

3 Credit Hours

Course Description

General statistical concepts and techniques useful to research in engineering. Probability distributions, measurement of precision, estimation, intervals, tests of significance, analysis of variance and simple regression.

Learning Outcomes

Upon completion of this course students will be able to:

1. Graphically describe data distributions,and understand proability 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 Structure

Lectures: 2 per week, MW 8:30am-9:45am ET with recordings available via Panopto.

Homework: 11 total assignments (roughly weekly); solutions submitted electronically via Moodle.

Exams: two midterms -- one in-class and one take home -- and one final; solutions for take home exams submitted electronically via Moodle.

Course Policies

There will be no late work accepted as a general policy. One homework assignment will be dropped to help mitigate unforeseen circumstances that may impact your ability to turn in an assignment on time. In certain instances an extension may be granted if the instructor is contacted at least 24 hours prior to the assignment due date and time.

Instructors

Dr Dan Harris (doharris) - *Instructor*
Email: doharris@ncsu.edu
Phone: (828) 446-3635
Office Location: 5118 SAS Hall
Office Hours:

My office hours are offered in-person in SAS 5118 or may be accessed via Zoom
M 1:00pm-3:00pm ET
Th 10:30am-12:30pm ET

Yuqi Su (ysu25) - *Teaching Assistant*
Email: ysu25@ncsu.edu
Phone: N/A
Office Location: Yuqi will offer office hours via Zoom
Office Hours:
Tu 11:30am-12:30pm ET W 4:30pm-5:30pm ET

Course Meetings

Lecture

Days: MW
Time: 8:30am - 9:45am
Campus: Main
Location: Riddick 451
This meeting is required.

Meeting Notes

All lectures will be recorded and archived on Panopto for students to review. Please be advised this course is being recorded for current and potential future educational purposes. By your continued participation in this recorded course, you are providing your permission to be recorded. Please be aware that the situation regarding COVID-19 is frequently changing, and the delivery mode of this course may need to change accordingly. Regardless of the delivery method, we will strive to provide a high-quality learning experience.

Course Materials

Textbooks

Probability and Statistics for Engineering and Sciences - *Devore, Jay*
Edition: 9th
ISBN: 9781305684164
Cost: eBook: $40 (rent, included with Cengage "All In"), hardcover $150-$200 new
This textbook is required.

Expenses

None.

Materials

None.

Requisites and Restrictions

Prerequisites

None.

Co-requisites

None.

Restrictions

Graduate Students inside the Engineering Program

Transportation

This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

Safety & Risk Assumptions

None.

Grading

Grade Components

Component	Weight	Details
Homework	**200**	There will be 11 homework assignments worth 20 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 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.

Component	Weight	Details
Two Take Home Midterm Exams	**100 points each**	Midterm Exam 1: in-class 9/29/2021; Midterm Exam 2: take home posted 11/8/2021, due 11/11/2021. Midterm Exam 1 is closed book and notes, but a basic calculator (such as TI-XX) and a single page of notes may be used. Midterm Exam 2 exams is 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. Requests for re-grading of exams must be made in writing. These requests should contain a complete description of the reason for grade adjustment and the student's name. The request should be attached to the exam and submitted to the instructor within two weeks of the day graded exams are made available to the students on Moodle.
Final Exam	**200**	Final Exam: posted 11/29/2021, due 12/02/2021. The Final Exam is open book & note. Basic calculators (such as TI-XX3) 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.Requests for re-grading of exams must be made in writing. These requests should contain a complete description of the reason for grade adjustment and the student's name. The request should be attached to the exam and submitted to the instructor within two weeks of the day graded exams are made available to the students on Moodle.
Options Related to COVID-19	**N/A**	NC State returned to normal class grading beginning Summer 2021. The "enhanced S/U grading" and "late drop" options are no longer available. For more information, visit https://studentservices.ncsu.edu/your-resources/covid-19/spring2020-sat-grading/#return.

Letter Grades

This Course uses Standard NCSU Letter Grading:

97	≤	**A+**	≤	100
93	≤	**A**	<	97
90	≤	**A-**	<	93
87	≤	**B+**	<	90
83	≤	**B**	<	87
80	≤	**B-**	<	83
77	≤	**C+**	<	80
73	≤	**C**	<	77
70	≤	**C-**	<	73
67	≤	**D+**	<	70
63	≤	**D**	<	67
60	≤	**D-**	<	63
0	≤	**F**	<	60

Requirements for Credit-Only (S/U) Grading

Performance in research, seminar and independent study types of courses (6xx and 8xx) is evaluated as either "S" (Satisfactory) or "U" (Unsatisfactory), and these grades are not used in computing the grade point average. For credit only courses (S/U) the requirements necessary to obtain the grade of "S" must be clearly outlined.

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at http://policies.ncsu.edu/regulation/reg-02-20-04.

Policies on Incomplete Grades

If an extended deadline is not authorized by the Graduate School, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at http://policies.ncsu.edu/regulation/reg-02-50-03. Additional information relative to incomplete grades for graduate students can be found in the Graduate Administrative Handbook in Section 3.17.G at http://www.ncsu.edu/grad/handbook/index.php

Late Assignments

All due dates are firm and no late work will be accepted, unless arrangements are made with the instructor prior to the time assignments are due. Computer failures, lost files, and sickness (other than COVID-19) or other difficulties are not generally valid excuses for submitting an assignment late. Exceptions to this policy may be made in the event a student is quarantined because of COVID-19; please inform the instructor as soon as possible to make arrangements for any necessary alterations to assignment schedules.

Attendance Policy

For complete attendance and excused absence policies, please see http://policies.ncsu.edu/regulation/reg-02-20-03

Attendance Policy

Attendance is not generally required, but students are responsible for all information communicated during lectures. Students are strongly encouraged to attend live lecture sessions, and when that is not possible, to review lecture recordings.

If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, please work with the instructor on health accommodations and follow other university guidelines, including self-reporting (Coronavirus Self Reporting): Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus. If you are in quarantine, have been notified that you may have been exposed to COVID-19, or have a personal or family situation related to COVID-19 that prevents you from attending this course synchronously, please connect with the instructor to discuss the situation and make alternative plans, as necessary.

Absences Policy

Since attendance is not generally required, there is no excused absence policy.

Makeup Work Policy

There is no make up for homework assignments unless arranged in advance (see Late Assignments Policy). Students who are unable to attend an exam for a legitimate unavoidable reason may take a make-up exam only if they provide suitable documentation. According to university policy, a student must notify the instructor in advance if s/he will miss an exam. If it is not possible to notify the instructor in advance, the instructor must be given notice as soon as possible after the exam. Suitable documentation of an absence: examples include a physician's note in case of illness or letter from the University or a student's advisor. Students who have a personal emergency (extreme family illness or death, etc.) should contact the Division of Academic & Student Affairs (515-2446; http://dasa.ncsu.edu/) to obtain documentation.

Additional Excuses Policy

If you are quarantined or otherwise need to miss class because you have been advised that you may have been exposed to COVID-19, you should not be penalized regarding attendance or class participation. However, you will be expected to develop a plan to keep up with your coursework during any such absences. If you become ill with COVID-19, you should follow the steps outlined in the Attendance Policy section above. COVID 19-related absences will be considered excused; documentation need only involve communication with your instructor.

Academic Integrity

Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01

Basic calculators (such as TI-XX) or computer software (such as R) may be used in conjunction with any resources posted to Moodle (lecture recordings, lecture slides, previous assignments, practice exams) or the Internet to complete all homework assignments. Students may form groups to collaborate on homework, but every student must submit their own solutions. Rules for exams are provided in the Grading section above. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02).

Academic Honesty

See http://policies.ncsu.edu/policy/pol-11-35-01 for a detailed explanation of academic honesty.

None.

Honor Pledge

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Digital Course Components

Students may be required to disclose personally identifiable information to other students in the course, via digital tools, such as 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 the privacy of each other by not sharing or using such information outside the course.

Digital Course Components:

Moodle: you will need a computer and reliable Internet access.
Panopto: you will need a computer and reliable Internet access with adequate bandwidth for video streaming.
Zoom (office hours only): you will need a computer and reliable Internet access with adequate bandwidth for video streaming, plus web camera, headphones, and microphone.

If you need access to additional technological support, please see the NC State Libraries Technology Lending program at https://www.lib.ncsu.edu/devices.

Accommodations for Disabilities

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 at Holmes Hall, Suite 304, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01) (https://policies.ncsu.edu/regulation/reg-02-20-01/).

Non-Discrimination Policy

NC State provides equal opportunity and affirmative action efforts, and prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status"). Additional information as to each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or https://oied.ncsu.edu/divweb/. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

Course Schedule

NOTE: The course schedule is subject to change.

Lecture MW 8:30am - 9:45am — Week 1 — 08/15/2021 - 08/21/2021

Devore chs. 1.1-1.4: course introduction, R, plots, location, variability

Devore: chs. 2.1-2.3: probability, counting

Lecture MW 8:30am - 9:45am — Week 2 — 08/22/2021 - 08/28/2021

Devore chs. 2.2.4-2.5: conditional probability, independence

Devore chs. 3.1-3.2: discrete random variables

Lecture MW 8:30am - 9:45am — Week 3 — 08/29/2021 - 09/04/2021

Devore chs. 3.3-3.4: expected values, binomial distribution

Devore chs. 3.4-3.6: hypergeometric, negtive binomial, and Poisson distributions

Lecture MW 8:30am - 9:45am — Week 4 — 09/05/2021 - 09/11/2021

Labor Day

Devore chs. 4.1-4.2: continuous random variables

Lecture MW 8:30am - 9:45am — Week 5 — 09/12/2021 - 09/18/2021

Devore chs. 4.3-4.4: normal, gamma, exponential random variables

Devore chs. 4.5-4.6: beta, other continuous distributions

Lecture MW 8:30am - 9:45am — Week 6 — 09/19/2021 - 09/25/2021

Devore chs. 5.1-5.2: joint distributions

Devore: chs. 5.3-5.4: sampling distributions

Lecture MW 8:30am - 9:45am — Week 7 — 09/26/2021 - 10/02/2021

Devore: ch. 6.1: estimation

Midterm 1 (in-class, 9/29)

Lecture MW 8:30am - 9:45am — Week 8 — 10/03/2021 - 10/09/2021

Fall Break

Devore: ch. 6.2: method of moments, maximum likelihood

Lecture MW 8:30am - 9:45am — Week 9 — 10/10/2021 - 10/16/2021

Devore: chs. 7.1-7.2: large sample confidence intervals

Devore chs. 7.3-7.4: confidence intervals for mean, variance from normal samples

Lecture MW 8:30am - 9:45am — Week 10 — 10/17/2021 - 10/23/2021

Notes: bootstrap confidence intervals

Devore chs. 8.1-8.2: hypothesis testing, error types

Lecture MW 8:30am - 9:45am — Week 11 — 10/24/2021 - 10/30/2021

Devore chs. 8.3-8.5: one-sample t-test for means, proportions

Devore chs. 9.1-9.2: z-test for difference in means

Lecture MW 8:30am - 9:45am — Week 12 — 10/31/2021 - 11/06/2021

Devore chs. 9.1-9.2: two-sample t-test

Devore chs. 10.1-10.2: analysis of variance (ANOVA), multiple comparisons

Lecture MW 8:30am - 9:45am — Week 13 — 11/07/2021 - 11/13/2021

Devore chs. 10.2-10.3: random effects, mixed models

Devore ch. 11.1: two-factor ANOVA

Midterm 2 (take home distributed 11/8, due 11/11)

Lecture MW 8:30am - 9:45am — Week 14 — 11/14/2021 - 11/20/2021

Devore ch. 11.2: interactions

Devore chs. 12.1-12.2, 12.5: simple linear regression, inference

Lecture MW 8:30am - 9:45am — Week 15 — 11/21/2021 - 11/27/2021

Devore chs. 12.3-12.4: categorical predictors, prediction intervals

Thanksgiving

Lecture MW 8:30am - 9:45am — Week 16 — 11/28/2021 - 12/04/2021

Devore ch. 13.1-13.2: model adequacy, variable transformations

Final Exam (take home distributed 11/29, due 12/6)