STA 3032

Summer B 2024

Engineering Statistics

MTWRF 12:30 PM - 1:45 PM in CSE E119

Course Overview

Instructor: Dhanashree Somani

Office Hours:	T : 3:00-4:00 PM and R: 10:30-11:30 AM (In person meetings upon request)
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Teaching Assistant: Matias Shedden

Office Hours:	MW : 11:00 AM - 12:00 PM Meeting ID: 367 386 8563
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Course Description: A survey of the basic concepts in probability and statistics with engineering applications. Topics include probability, discrete and continuous random variables, confidence interval estimation, hypothesis testing, correlation, regression, and analysis of variance.

Prerequisite: MAC 2311

Course Objectives:

1. Access, manipulate, and analyze data using statistical software.
2. Produce appropriate graphs and descriptive statistics for one and two variables, for both categorical and continuous data.
3. Interpret graphs and descriptive statistics for one and two variables, for both categorical and continuous data.
4. Know and apply the basic probability rules, the concepts of expected value and variance for discrete and continuous variables.
5. Know and apply the Central Limit Theorem, which is crucial for inference.
6. Understand confidence intervals and hypothesis tests.
7. Carry out and interpret one-sample and two-sample analyses for means and proportions.
8. Carry out and interpret statistical modeling using multiple regression and analysis of variance.
9. Know and apply basic quality control procedures.

Student Learning Outcomes At the end of this course, students will be expected to have achieved the following learning outcomes:
Content

- Identify, describe, and explain the basic concepts, theories, and terminology of natural science and the scientific method, and apply them to analyze various systems
- Demonstrate proficiency in accessing, manipulating, and analyzing data using statistical software, and producing appropriate graphs and descriptive statistics for one and two variables, across both categorical and continuous data.
- Interpret graphs and descriptive statistics for one and two variables, drawing meaningful insights from the data. Understand and apply the basic probability rules, as well as concepts of expected value and variance for both discrete and continuous variables.
- Apply the Central Limit Theorem effectively for inference, providing a foundation for statistical reasoning.
- Formulate mathematical models and arguments, utilizing statistical models to address real-world situations and provide effective solutions.
- Assessments will be made with textbook based assignments, coding assignments, quizzes, and exams.

Critical Thinking

- Formulate empirically-testable hypotheses derived from the study of physical processes or living things, demonstrating a capacity for scientific inquiry and logical reasoning.
- Apply logical reasoning skills effectively through scientific criticism and argument, enabling rigorous evaluation of scientific ideas and theories.
- Apply techniques of discovery and critical thinking effectively to solve scientific problems and evaluate outcomes, demonstrating analytical skills in problem-solving.
- Assessments will be made with textbook based assignments, quizzes, and exams.

Communication

- Communicate scientific knowledge, thoughts, and reasoning clearly and effectively, both in written and verbal form.
- Report on statistical analysis of people's attitudes towards choices based on the framing of the choices, presenting findings with clarity and precision.
- Report on statistical analyses of global warming, employing numeric and graphical presentation to effectively convey information.
- Assessments will be made with textbook based assignments.

Required Text:

Probability & Statistics for Engineers & Scientists, 9$^{\text{th}}$ Edition available via UF All Access. **Author(s):** Walpole, Myers, Myers, Ye; **ISBN-13:** 978-0134115856

Materials and Supplies Fees: This course is participating in UF's All Access Textbook Affordability Program. Students will OPT IN to receive digital access to your text at a reduced price and pay for those materials via your UF Student Account. The ebook will be accessed directly through Canvas. There is a deadline to opt in within a few days of the start of class in order to receive the discount. There are hardback textbooks in the bookstore on campus (and other retailers online) if you wish to have a printed resource. Opt in at https://www.bsd.ufl.edu/G1CO/IPay1f/start.aspx?TASK=INCLUDED.

Course Website: e-Learning

Course Communication:

- Use e-mail to contact the instructor regarding administrative matters. Please include **STA 3032** in the subject line.
- For questions regarding course content, please see the instructor or TAs during office hours.

Software: We may use R, a free statistical computer language. It is also highly recommended to run R through the free-of-charge Desktop version of the Rstudio IDE.

Syllabus Changes: The instructor reserves the right to update any part of this syllabus as necessary. Students will be notified of any changes.

Course Policies

Assignments

Homework: There will be 4-5 homework assignments which will have to be turned in on Canvas as one file. Students are expected to work independently on homework assignments unless otherwise specified in writing.

Exams: You can bring your own formula sheet hand-written in a A4 paper (you can use both side of that). A scientific calculator may be used. No other aids (physical, electronic or otherwise) will be permitted. Only one make-up exam will be offered and you must either let the instructor know well before the scheduled day of the exam which you need to be excused from (for a non-emergency reason), or produce a proof of emergency (or medical problem) as soon after the missed exam as possible.

Exam Dates (tentative):

Exam #1 ..... July 12^{th}
Exam #2 ..... July 26^{th}
Exam #3 ..... August 09^{th}

Grade Corrections: If you believe there was a mistake made in the grading of your homework assignment or exam, please see the instructor within *one week* after the grade has been posted. Questions regarding homework assignments should be first sent to the TA who graded it.

Grading

Grade distribution:

Homework	25%
Exams 1, 2, and 3	75% (35% best, 25% second best, 15% lowest)

Letter grade assignment:

The following grade cutoffs are adopted and may be relaxed.

		A	93 to 100	A-	90 to $<$ 93
B+	87 to $<$ 90	B	83 to $<$ 87	B-	80 to $<$ 83
C+	77 to $<$ 80	C	73 to $<$ 77	C-	70 to $<$ 73
D+	67 to $<$ 70	D	63 to $<$ 67	D-	60 to $<$ 63
E	$<$ 60				

This course has been designated a General Education course. Note that the minimum passing grade for General Education credits is a C. All grades are final and non-negotiable. Information on current UF grading policies for assigning grade points: grading policies

Attendance and Missed Assignments

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. For further information, refer to the university attendance policies.

Every effort should be made to attend the exam on the specified exam dates. Makeup exams are warranted only under exceptional circumstances. Contact the instructor as soon as you realize you will be unable to take the exam at the scheduled time. Each case will be reviewed individually. Valid and detailed documentation is required for scheduling a makeup.

UF and CLAS Policies

Academic Misconduct: You are required to abide by the Student Honor Code. Any violation of the academic integrity expected of you on an assignment or exam will result in a minimum academic sanction of a failing grade on the assignment or exam.

Accommodation for Students with Disabilities: Students requesting accommodation for disabilities must first register with the Disability Resource Center (DRC). The DRC will provide documentation to the students who must then provide this documentation to the instructor. A request must be made to the instructor at least one week prior to the date for which the accommodation is requested. Accommodations will not be made retroactively.

Dropping Courses and Withdrawal: For questions relating dropping courses and withdrawals, please refer to the UF catalog.

Evaluations: Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Incomplete Grade: An incomplete grade may be assigned at the discretion of the instructor as an interim grade for a course in which the student has completed a major portion of the course with a passing grade, been unable to complete course requirements before the end of the term because of extenuating circumstances, and obtained agreement from the instructor and arranged for resolution of the incomplete grade. Instructors are not required to assign incomplete grades. For further detail, please refer to the CLAS Academic Advising Center page on incomplete grades.

Health and wellness resources

- UMatter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress.
- Counseling and Wellness Center: Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services as well as non-crisis services.
- Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website.
- University Police Department: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).
- UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website.

Academic resources

- Statistics Department: E-mail at staff@stat.ufl.edu for general inquiries or contact on 352-292-1941.
- E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu.
- Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.
- Library Support: Various ways to receive assistance with respect to using the libraries or finding resources.
- Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352-392-6420. General study skills and tutoring.

- Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.
- Student Complaints On-Campus: Visit the Student Honor Code and Student Conduct Code webpage for more information.

Tentative Course Outline

Module	Week	Content	Textbook Section
1	1	Summary Statistics: Location and Spread	1.1-1.5
		Graphical Summaries	1.6
2	1-2	Sample Space, Events, and Probability	2.1-2.2, 2.4-2.5
		Counting Methods: Permutations and Combinations	2.3
		Conditional Probabilities and Independence	2.6-2.7
		Random Variables	3.1-3.4, 4.1-4.4
		Discrete Probability Distributions	5.1-5.2, 5.4-5.5
		Continuous Probability Distributions	6.1-6.4, 6.7, 8.6-8.7
		Central Limit Theorem	8.3-8.4
Exam 1			
3	3	Inference on Population Mean: Confidence Intervals	9.1-9.5
		Inference on Population Mean: Hypothesis Tests	10.1-10.4
		Inference on Population Proportion	9.10, 10.8
		Inference on Population Variance	9.12, 10.10
		Signed-Rank Test	16.1-16.2
4	4	Inference on Two Population Means: Confidence Intervals	9.8, 9.11
		Inference on Two Population Means: Hypothesis Tests	10.5, 10.9
		Inference on Two Population Variances	9.13, 10.10
		Contingency Tables: Test for Independence	10.12
		Wilcoxon Rank-Sum Test	16.3
Exam 2			
5	5-6	Simple Linear Regression	11.1-11.6, 11.8
		Checking Regression Assumptions and Transforming Data	11.10
		Quantile and Probability Plots	8.8
		Multiple Regression	12.1-12.2, 12.4-12.6
		Qualitative Predictors	12.8-12.9
6	6	One-Way ANOVA: Completely Randomized Design	13.1-13.3
		Multiple Comparisons	13.6
		Randomized Complete Block Designs	13.7-13.8, 13.11
Exam 3			