Data Analysis for Industrial Applications
ESI3243C
Class Periods: M 1:55-3:50, W 1:55-2:45, F 1:55-3:55 pm
Location: Weil 406 or via Zoom
Academic Term: Spring 2021
Zoom Link: https://ufl.zoom.us/j/5026293394

Instructor:
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Office Hours: W 3-4 pm, F 4-5 pm or by appointment

Teaching Assistants:
Please contact through the Canvas website
- N/A
- N/A

Course Description
4 credits (5 contact hours). Focuses on analysis of data encountered in ISE applications using applied statistics methods. Specific engineering applications are discussed through case studies and mini projects. The introduction and use of computational tools to implement various data analysis techniques is also an important component of this course. Students will be introduced to the R programming language, at the "exposure level" (run code, recognize, observer that it's doing, and interpret the output)

Course Pre-Requisites / Co-Requisites
MAC2312 (Calculus 2) with a minimum grade of C.

Course Objectives
At the end of this course, students will be able to:
- Identify the role that statistics can play in the engineering problem-solving process
- Understanding discrete and continuous random variables, probability distributions, joint probability distributions and independence
- Treatment of statistical methods, interval estimation, hypothesis tests for one and two samples
- Simple linear regression models and determine if these models hold
- Design experiments using ANOVA procedures
- Utilize R throughout homework and case studies to statistically model systems, design experiments, and use R to model appropriate distributions for common ISE applications

Materials and Supply Fees
N/A

Required Textbooks and Software
- "Applied Statistics and Probability for Engineers," Wiley (2017) 7th edition D. Montgomery
  ISBN:978-1119409533

Previous editions of the textbook are useful; however, the numbering of problem sets used for homework are likely to differ book by book and you will be required to solve these discrepancies.
- Lecture notes and coding tutorials (posted online in Canvas)
- RStudio (a free and open-source integrated development environment (IDE) for R, which is a programming language for statistical computing and graphics)

Recommended Materials
- Extra learning materials will be sent throughout the semester

Relation to Program Outcomes (ABET):

Outcome	Coverage*
• An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	High
• An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
• An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
• An ability to communicate effectively with a range of audiences	
• An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Medium
• An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	
• An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	

Course Structure
This course consists of 3 contact hour lecture (MW) sessions and 1 two-period (F) lab and coding session (this is the tentative plan, each week's schedule might be different and will be announced in advance). During the lecture sessions, the weekly lecture topics will be covered. The lab session pertains to either case study sessions or R sessions (detailed below in the course schedule).

Case Studies and mini projects
Case studies will be open-ended small engineering projects. They will be data-driven projects, focusing on the computational and conceptual aspects of probability and statistics theory pertaining to the ISE discipline. Programming in R will be a significant part of these projects. Due

to their open scope nature, students are required to study and research the topic more in depth, run their hypothesis, and be able to derive meaningful results from their implementations. Student should be able to present their results in class and answer relevant questions with regard to their work. A report will be submitted for each case study.

Course Schedule (tentative)

Week	Monday (2 hour)	Wednesday (1 hour)	Friday (2 hour)
1	Syllabus description, expectation, benchmark, etc. Introduction to ISE and the Role of Statistics in ISE Review of Calculus, Exponents and Logarithms (Face to Face)	Assessment test – **No influence on final grade** (Face to Face)	- R introduction lecture (installation, setup, etc.) - Other software introduction (Python, Minitab, etc.) (Online)
2	**Holiday**	Probability - Sample spaces and events - Counting techniques - Axioms of probability - Unions of Events and Addition Rules (Online)	Probability - Conditional Probability - Independence - Bayes' Theorem - Random Variables - Exercises and Examples - Coding session (Online) HW 1 (**All HWs will be due in 7 days**)
3	Discrete Random Variables - P. distribution and PMF - CDF - Mean and Variance of a discrete random variable - Discrete Uniform Dist. - Binomial Dist. - Geometric Dist. (Face to Face)	Discrete Random Variables - Hypergeometric Dist. - Poisson Dist. (Online)	Discrete Random Variables - Poisson Dist. - Exercises and Examples - Coding session (Online) HW 2
4	Continuous Random Variables - P. dist. And PDF - CDF - Mean and Variance of a continuous random variable	Continuous Random Variables - Normal approximation to the Binomial and Poisson Dist. - Exponential Dist. (Online)	Continuous Random Variables - Other continuous Dist. (Erlang, Gamma, Weibull, etc.) - Exercises and Examples - Coding session

	- Continuous Uniform Dist. - Normal Dist. (Face to Face)		(Online) HW 3
5	Joint Probability Distributions - for two random variables - Conditional probability distributions and independence - Covariance and correlation (Face to Face)	Joint Probability Distributions - Common joint Dist. - Multinomial probability Dist. - Bivariate Normal Dist. (Online) HW 4	Joint Probability Distributions - Linear functions of random variables - Moment-Generating Functions - Exercises and Examples - Descriptive Statistics - Coding session (Online)
6	Exam 1 (Face to Face)	Point Estimation of Parameters and Sampling Dist. - Sampling Dist. And the Central Limit Theorem - General concepts of point estimation (Online)	Point Estimation of Parameters and Sampling Dist. - Sampling Dist. And the Central Limit Theorem - General concepts of point estimation - Methods of point estimation - Exercises and Examples - Coding session (Online) HW 5
7	Statistical Intervals for a Single Sample - Confidence Interval (CI) on the Mean of a Normal Dist., Variance known - CI on the Mean of a Normal Dist., Variance unknown (Face to Face)	Statistical Intervals for a Single Sample - CI on the Variance and SD of a Normal Dist. - Large-Sample CI for a population proportion (Online)	Statistical Intervals for a Single Sample - Exercises and Examples - Coding session (Face to Face) HW 6
8	Tests of Hypotheses for a Single Sample - Hypothesis testing - Tests on the mean of a Normal Dist., Variance known - Tests on the mean of a Normal Dist., Variance unknown	Tests of Hypotheses for a Single Sample - Tests on the Variance and SD of a Normal Dist. - Tests on a population proportion - Testing for goodness of fit (Online)	Tests of Hypotheses for a Single Sample - Contingency table tests - Nonparametric procedures - Exercises and Examples - Coding session (Online)

	(Face to Face)		HW 7
9	Statistical Inference for Two samples - Inference of the Difference in Means of two Normal Dist., Variances known - Inference of the Difference in Means of two Normal Dist., Variances unknown - A nonparametric test for the difference in two means (Face to Face)	Statistical Inference for Two samples - Paired t-Test - Inference on the Variances of two Normal Dist. (Online)	Statistical Inference for Two samples - Inference on two population proportions - Summary table and road map for inference procedures for two samples - Exercises and Examples - Coding session (Online) HW 8
10	Exam 2 (Face to Face)	Simple Linear Regression and Correlation - Simple linear regression - Properties of the Least Squares Estimators (Online)	Simple Linear Regression and Correlation - Hypothesis tests in SLR - Confidence Intervals - Prediction of new observations (Face to Face) HW 9
11	Simple Linear Regression and Correlation - Adequacy of the regression model - Correlation - Regression on transformed variables (Face to Face)	**Recharge Day No Class**	Simple Linear Regression and Correlation - Logistic Regression - Exercises and Examples (Online) HW 10
12	Simple Linear Regression and Correlation - Coding session and Project (Face to Face)	Simple Linear Regression and Correlation - Coding session and Project (Online)	Design and Analysis of Single-Factor Experiments: The Analysis of Variance - Designing Engineering Experiments - Completely randomized single-factor experiment (Face to Face) HW 11
13	Design and Analysis of Single-Factor	Design and Analysis of Single-Factor	Design and Analysis of Single-Factor Experiments: The Analysis of Variance

	Experiments: The Analysis of Variance - The random-effects model (Face to Face)	Experiments: The Analysis of Variance - Randomized complete block design (Online)	- Exercises and Examples - Coding and Examples (Face to Face) HW 12
14	Design and Analysis of Single-Factor Experiments: The Analysis of Variance - Exercises and Examples - Coding and Examples (Face to Face)	Final Review (Online)	

Attendance Policy, Class Expectations, and Make-Up Policy
Attendance is not required, but strongly recommended. It will be to your benefit to attend all lectures. You will be responsible for everything covered in class. Those who behave inappropriately will be asked to leave. Please turn your cell phone into silent mode. Excused absences are consistent with university policies in the undergraduate catalog (http://gradcatalog.ufl.edu/content.php?catoid=10 HYPERLINK "http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020"& HYPERLINK "http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020"navoid=2020#attendance) and require appropriate documentation.

Evaluation of Grades

Assignment	Percentage of Final Grade
Exam 1	15%
Exam 2	15%
Final Exam	25%
Homework	20%
Case Studies and Mini Projects	20%
Attendance Quizzes	5%

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 77.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33

63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10 HYPERLINK
"http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020"& HYPERLINK
"http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020"navoid=2020#grades

Students Requiring Accommodations
Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation
Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:

Health and Wellness
   U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.

Commitment to a safe and inclusive learning environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination.

It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl. HYPERLINK "mailto:taylor@eng.ufl.edu"edu

- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@ufl.edu

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu