

Data Analysis for Industrial Applications

ESI3215C Section xxxx

Class Periods: TBD

Location: TBD

Academic Term: Spring 2021

Instructor

TBD

Office Hours: TBD

Teaching Assistants

Please contact through the Canvas website

- Name, email address, office location, office hours
- Name, email address, office location, office hours

Course Description

Focuses on analysis of data encountered in ISE applications including system reliability, demand forecasting and inventory control, simulation, and quality control. Specific engineering applications are discussed through case studies. The introduction and use of computational tools to implement various data analysis techniques is also an important component of this course.

Course Pre-Requisite

MAC2312 (Calculus 2) with a minimum grade of C.

Course Objectives

At the end of this course, students will be able to:

- Use R to model appropriate distributions for common ISE applications (for example, in modeling the remaining lifetime of a product, in monitoring the quality of a product, and in evaluating the effectiveness of a gauge, etc.)
- Understanding simple inventory control models by analyzing discrete and continuous random variables
- Examine control charts and other visual tools to determine central tendency and variation
- Develop methods to identify quality control deviations and infer quality conformance to specifications using hypothesis test procedures, compute and evaluate test statistics
- Formulate acceptance sampling plans for quality inspections using inferences regarding P-values
- Assess simulation results using confidence intervals
- Model demand forecasts with simple linear regression models and determine if these models hold
- Design quality control experiments using ANOVA procedures
- Utilize R throughout homework and case studies to statistically model systems, design experiments, and understand the basics of quality control

Materials and Supply Fees

None

Professional Component (ABET):

This course supports the ISE undergraduate program educational objectives of producing graduates who

- “will be successful professionals using industrial and systems engineering skills”,
- “can acquire advanced knowledge through continuing education or advanced degree programs”
- “can become active leaders in their profession and/or community”

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	
4. 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
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

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 R 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)

Course Structure

This course consists of 3 one-period (MWF 3) lecture sessions and 1 two-period (T 3-4) lab session. 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

Case studies will be group (3-4 students), 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

Week	Lecture Topic for the Week	Chaps.	Lab Topic (Case Study/R Session)	Assignments
1	Introduction to ISE and the Role of Statistics in ISE	1		
2	Discrete time Markov Chains using Probability Rules	2	R Session Homework 1 (Chap 2)	Homework 1 Due/Case Study 1 Assigned
3	Modeling Queuing Systems with Discreate Distributions	3	Case Study 1 Session	
4	Analyzing sampling plans and probability nonconforming	3/4	R Session Homework 2 (Chap 3)	Homework 2 Due
5	Modeling Inter-arrival times for Simulation Models	4	Case Study 1 Session	Case Study 1 Due
6	Exam 1 Multinomial Probability Distributions	5	R Session Homework 3 (Chap 4)	Homework 3 Due Evening Exam 1 (covers chaps 1-4)
7	Moment Generating Functions and Data Visualization and Interpretation	5/6	R Session Homework 4 (Chap 5)	Homework 4 Due/Case Study 2 Assigned
8	Point Estimation and Sampling Distributions	7	Case Study 2 Session	
9	Statistical Fundamentals for Specification Limits	8/9	R Session Homework 5 (Chap 6/7)	Homework 5 Due
10	Conformance to Designer Specifications	8/9	Case Study 2 Session	Case Study 2 Due
11	Exam 2 Statistical Fundamentals for Quality Deviations	10	R Session Homework 6 (Chap 8/9)	Homework 6 Due Evening Exam 2 (covers chaps 5-9)
12	Identifying Quality Deviations	10	Case Study 3 Session	Case Study Assigned
13	Demand Modeling with Linear Regression	11	R Session Homework 7 (Chap 10)	Homework 7 Due
14	Design for Human Experimentation using Linear Modeling and ANOVA	11/13	Case Study 3 Session	
15	Off-line Quality Control	13/15	R Session Homework 8 (Chap 11/13)	Case Study 3 Due Homework 8 Due

Attendance Policy and Class Expectations

Attendance is required and will be taken using attendance quizzes that counts for 5% of the grade. These quizzes will be based on a few questions that will have been covered during the lecture. Attendance quizzes are randomly taken, and the lowest two quiz grades will be dropped. It will be to your benefit to attend all lectures. The instructor will not repeat material in office hours just because you chose not to attend class.

Lectures are there to facilitate efficient learning, not chatting with friends, surfing the net, or sleeping. You should be focused on the course material and the in-class exercises assigned, not on activities that do not involve coursework. Those who behave inappropriately will be asked to leave. If you cannot follow the lecture anymore, you can leave the class quietly; I will not be offended.

Make-Up Policy

Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Evaluation of Grades

Your grade will be based on three exams, several homework assignments, and attendance quizzes.

In each exam, I will include a few challenging tasks, which only the best students will be able to answer. These are the questions that distinguish the A students.

Exam grade disputes must be made to the instructor within one week after grades are posted. Any grade dispute after the specified period will not be considered.

Assignment	Percentage of Final Grade
Exam 1	20%
Exam 2	20%
Final Exam	20%
Attendance Quizzes	5%
Case Studies (3)	20%
Homework	15%

Grade Scale

There may or may not be a curve at the end of the semester. This depends on the overall performance of the class throughout the semester.

Please keep in mind that this is a challenging and time-consuming class, and the percentage of As has historically been in the 10% range. You must study hard and perform well in every class activity in order to deserve an A.

Please note that this is a required course for ISE students. **This means that you must earn, at a minimum, a C in order to satisfy the requirement.**

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Grade	Range	Grade Points
A	(93-100)	4.00
A-	(90-92.9)	3.67
B+	(87-89.9)	3.33
B	(83-86.9)	3.00
B-	(80-82.9)	2.67
C+	(77-79.9)	2.33
C	(73-76.9)	2.00
C-	(70-72.9)	1.67
D+	(65-69.9)	1.33
D	(60-64.9)	1.00
D-	(55-59.9)	0.67

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 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/>.

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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

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

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: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

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 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

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 support, 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://care.dso.ufl.edu>.

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