



Probability and Statistics for Data Scientists – DATA 501

Syllabus

Spring Semester 2024

I. Instructor Information

Instructor's name: Dr. Jason Elsinger (Dr. E; him/his/he)

Office hours: Office hours are available each day Monday – Friday. Just send me a message over Discord to arrange a day and time to meet with me.

Lewis email address: jelsinger@lewisu.edu

To make appointment, send me a message over Discord and we can schedule a time to meet virtually.

Who is Jason Elsinger?

Quick biography:

I have always enjoyed mathematics from an early age, and I became fascinated at how equations on a piece of paper could predict the reality around us. Sometime in high school I took a liking to physics and I found enjoyment in helping others understand mathematical concepts. That is when I decided to become a high-school teacher. In 2005, I went to Bloomsburg University in Pennsylvania as a dual major in mathematics and physics. Some of the recreational things I did as an undergrad include joining the school's dance ensemble (where I learned east-coast swing, breakdance, line dance, and Irish hard-shoe) and I sang bass with the choir. My desire to teach was enhanced during my time as an undergraduate, and I made the decision to teach at the college level instead of high school.

After I graduated, I got accepted to the doctoral program in mathematics at North Carolina State University. As a graduate student, I was the sole instructor for 7 courses, including a senior-level course called abstract algebra. It was during these years I began developing my teaching philosophy. On another note, I tried my hand at meeting girls through Match.com. Working toward a Ph.D. is time consuming, and I hoped this could be a way to meet someone. I eventually did meet a girl named Erika, who wound up becoming my future wife. In 2014, I graduated and accepted my first professorship at Spring Hill College in Mobile, Alabama; Erika came with me.

During my 3 years at Spring Hill College, I was introduced to the concept of mastery grading, which incorporates a growth mindset rather than collecting points. I found it to be a better way to use grading to help motivate and learn from one's mistakes. I now use mastery grading with all my classes. Aside from academics, Erika and I got married in October 2016, and the year after that I joined the mathematics department at Florida Southern College. I changed locations so that I could be more

involved with students outside the classroom and have more support for research opportunities with students. Currently my wife and I are looking to move to North Carolina to be closer to family and friends. Until then, I have taken up teaching for Lewis University in Indiana.

Aside from school and reading textbooks, some other things I enjoy doing are bowling, playing disc golf, [Dance Dance Revolution](#), retro video games (NES and SNES; [Zelda](#) and [Mega Man](#) series are two favorites), playing electric guitar, and playing with our cat Brando. What kind of things do you like to do? Tell me about them when we meet!



Glacier Hiking in Norway

The Parthenon in Athens, Greece

Brando

What is it like in my classroom?

I work hard to create a comfortable classroom environment where you can ask questions and not be worried about being wrong but rather thrive on it to work toward a better answer. Sometimes I start class with a review game.

I incorporate many engaged learning activities in my lectures. The only way to learn mathematics is to *do* mathematics, and I encourage you to consistently practice in and out of class. Every semester, I collect feedback from my students so that I can improve these techniques and get input when I incorporate new teaching ideas.

Note to the Student (and my teaching philosophy in a nutshell):

Welcome to my class! I am excited to be sharing with you some of the coolest applications of mathematics you likely have not seen before. I believe every student is entitled to and capable of experiencing success and joy in math. Too often, people have poor experiences with mathematics and miss out on some of the most powerful tools human beings have created.

I enjoy the following description of teaching and agree with its sentiment:

“It is not so much what my students know but what they can do; likewise, teaching is not what I know but I enable others to do.”

–Phelps (2008)

I also find the following to be very powerful motivators behind excellence in teaching.

These thoughts from [Federico Ardila](#):

1. Mathematical potential is distributed equally among different groups, irrespective of geographic, demographic, and economic boundaries.
2. Everyone can have joyful, meaningful, and empowering mathematical experiences.
3. Mathematics is a powerful, malleable tool that can be shaped and used differently by various communities to serve their needs.
4. Every student deserves to be treated with dignity and respect.

The “Rights of the learner” adopted from [C. Kalinec-Craig](#):

1. I expect that you will be confused
2. I expect that you will claim your mistakes
3. You Have the right to speak, listen and be heard (e.g., engage in conversations, ask questions, share ideas, and listen to the thinking of others)
4. I expect that you will write, do, and represent only what makes sense to you

To promote equity in the mathematics classroom, the rights of the learner assumes that you can take more explicit ownership of your learning, both in writing and in oral communication. I aim to create a space that welcomes and serves everyone. I believe the only way to learn mathematics is to *do* mathematics. If you put in the effort, I am confident you will be rewarded with growth, and I want to help you along your path.

Asking questions is *strongly* encouraged and frankly *necessary* to learn science and mathematics on a deep level. If I have not explained an idea fully, I am happy to back up and try another explanation. One of the biggest missed opportunities is *not asking questions!* Never feel dumb asking questions for you have the *Right* to be confused. I am happy to discuss your thoughts, questions, or concerns at any time—just send me a message.

II. Course Information

Probability and Statistics for Data Scientists, DATA 501, Section 002:

Course Credit Hours: 3 hours

Course description: This course covers aspects of probability theory and statistical analysis used in data science. Students will study elementary probability theory, basic combinatorics, conditional probability and independence, Bayes' rule, random variables, mathematical expectation, discrete and continuous distributions, estimation theory, and tests of hypotheses. This course requires the use of statistical computing with the R programming language for solving sample problems.

Course meeting times, days, and location:

This course is set up to have an online and asynchronous format. However, we will schedule several times throughout the week meet every in which students can join lectures in real time. The lectures will be recorded and made available to online students and for those that are not able to join.

Student Learning Outcomes:

Course student learning outcomes:

On the successful completion of this course students will be able to:

- Use statistical software, like R, to solve complex statistical problems.
- Relate concepts of probability theory to statistics.
- Use random variables, probability distributions, and mathematical expectation to solve real-world statistical applications.
- Identify various discrete and continuous probability distributions.
- Apply sampling techniques.
- Estimate values and perform hypothesis testing.

Program student learning outcomes:

- Apply the tools of calculus, linear algebra, optimization, probability and statistics to identify likely characteristics and trends buried in large data sets so that reasonable conclusions about the data may be drawn.
- Write software that implements the mathematical techniques required to extract meaning from large data sets, primarily using off-the-shelf mathematical software tools.
- Choose appropriate data science techniques for solving problems in disciplines that produce accurate, timely insights from large quantities of data.

Graduate Student Learning Outcomes:

- Synthesize theoretical and research concepts from multiple perspectives to inform inquiry and practice.
- Formulate creative responses to complex issues through critical analysis.

III. University Mission Statement

Lewis University, guided by its Catholic and Lasallian heritage, provides to a diverse student population program for a liberal and professional education grounded in the interaction of knowledge and fidelity in the search for truth.

Lewis promotes the development of the complete person through the pursuit of wisdom and justice. Fundamental to its Mission is a spirit of association, which fosters community in all teaching, learning and service.

IV. Required Course Materials

Textbook(s):

Title: *Probability and Statistics for Engineers & Scientists*

Edition: 9th edition

Authors: Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying E. Ye, Pearson

Publisher: Pearson

Publication date: 2011

ISBN: 978-0134115856

Note: This textbook is required

Supplemental readings, videos, online materials: Supplemental videos will be posted on Blackboard during the semester.

Hardware and software requirements: For this semester we will be using the statistical software package R. We will give further instructions at the start of the semester about its download. Thus, you will either need to install this software in your own computer or gain access to a computer that has R.

V. Instructional Methods and Activities

Modality of Instruction: *Online asynchronous*

Success in a class like this one requires that you communicate with me whenever you have questions. If you have general questions that are of interest to the entire group, you should post them on Discord and I will answer them there. If a general question arrives by email, I will redirect it to the Forum.

- If you are having problems with either the technology or the course content, you need to let me know as soon as possible. Without feedback I will never know what is wrong.
- Remember that many of the nonverbal cues that you use in the classroom to show frustration, boredom, or confusion are not possible in an online class.
- You must keep me up to date on any problems you are encountering.

VI. Tentative Course Schedule

Week 1:	Readings: Textbook, Chapter 1 Lecture Notes/Media: Install R for Mac 3 0 3 HD or Windows 7, R - Reading in CSV Files Written Assignments: Reading in CSV data in R and some basic R commands Discussion Questions: Giving an example of statistic and parameter
Week 2:	Readings: Textbook, Chapter 2

	Lecture Notes/Media: Khan Academy Conditional Probability warmup, Bayes' Theorem and Cancer Screening Written Assignments: Probability Assignment, Week 2 Quiz Discussion Questions: Bayes' Rule Discussion
Week 3:	Readings: Textbook, Chapter 3 & 4 Lecture Notes/Media: Chebyshev's Theorem Written Assignments: Variables, Distributions, and Expectation, Week 3 Quiz Discussion Questions: Applying Random Variables and Distributions in R
Week 4:	Readings: Textbook, Chapter 5 Lecture Notes/Media: An Introduction to the Binomial Distribution, An Introduction to the Hypergeometric Distribution Written Assignments: Discrete Probability Distributions, Week 4 Quiz Discussion Questions: Plotting Poisson Distributions with Differing Sample Sizes
Week 5:	Readings: Textbook, Chapter 6 Lecture Notes/Media: An Introduction to the Uniform Distribution, An Introduction to the Normal Distribution, An Introduction to the Chi-Square Distribution Written Assignments: Continuous Probability Distributions, Week 5 Quiz Discussion Questions: Plotting Continuous Distributions in R
Week 6:	Readings: Textbook, Chapter 8 Lecture Notes/Media: Introduction to the Central Limit Theorem, Introduction to the t Distribution (non-technical) Written Assignments: Sampling, Week 6 Quiz Discussion Questions: Applying the Central Limit Theorem in R
Week 7:	Readings: Textbook, Chapter 9 Lecture Notes/Media: Introduction to Confidence Intervals, Deriving a Confidence Interval for the Mean (The Rationale Behind the Confidence Interval Formula) Written Assignments: Estimation, Week 7 Quiz

	Discussion Questions: Applying Confidence Intervals in R
Week 8:	Readings: Textbook, Chapter 10 Lecture Notes/Media: An Introduction to Hypothesis Testing Written Assignments: Hypothesis Testing Discussion Questions: Applying Hypothesis Testing in R

Schedule Changes: You are required to periodically check BlackBoard for any new announcements or changes to the course. I may post an announcement about the exam, the programming assignment, changes in the course, etc. Such announcements will usually also go in Discord, so if you check that at least once a day, you should be fine.

VII. Grading Criteria and Course Policies

Lecture videos, assignments and other course materials will be posted on the course's Blackboard site (<http://lewisuniversity.blackboard.com>) throughout the semester.

Readings and Lecture Recordings:

Each week, you are required to attend or view any lecture recordings that are posted. However, before viewing the recordings, you should read the required chapter of the book as specified in the course schedule section above.

Discussion Posts:

You will have to answer a question or comment on a topic based on the readings. You will be required to post this to the corresponding forum in BlackBoard. Your answer should be complete, detailed, and make use of examples or references when appropriate. The grading will be binary: 1 point for a completed, satisfactory posting, and 0 points for an incomplete or an unsatisfactory posting. You are encouraged to reply to each other's postings. Although the grading is binary, I expect that some effort (little bit of research if necessary) be put in on the responses.

Quizzes:

There will be around 6 quizzes given in weeks 2 through 7 and 6 reassessment quizzes. These will contain the learning outcomes from each chapter separately. The questions are essay-based for you to type your work and rationale. You can also take pictures of your work to submit with your quiz. Please use a scanning app like CamScanner to do so. You will have about 40 minutes for each quiz. Each quiz is worth the same percentage of the grade and each question within each quiz is also worth the same number of points.

Written Assignments:

These will be given every week (eight in total). Each assignment is worth the same percentage of the grade. There will be approximately 3-6 questions in each assignment, with each question worth the same number of points.

Midterm Exam:

The Midterm Exam will be given in week 4. It will consist of all questions based on quizzes from weeks 1 through 3, and any new material covered in week 4. You will have about 120 minutes to complete the midterm exam. Each question is worth the same number of points.

Final Exam:

The Final Exam will be given in week 8. It will consist of all questions based on all quizzes, the midterm exam, and any material covered up to the time of the final exam. You will have 120 minutes to complete the final exam. Each question is worth the same number of points.

VIII. Assessment and Grading

Final Grades

“Knowledge points” refer to your progress on individual problems from any assessment.

“Homework points” can be obtained by doing any combination of the following:

- Every turn-in homework assignment can earn up to 5 points, and there will be up to 8 total.
- Every discussion post can earn up to 5 points, and there will be around 8 total.

Knowledge points and homework points do not average, but rather are kept separate. The following table outlines how many of each you need for the letter grade you desire.

To earn a...	...earn at least the following point totals (~150 total KP and ~55 total HP)
A	120 points from individual problems, and 50 points from homework, discussions, and Discord participation
B	102 points from individual problems, and 43 points from homework, discussions, and Discord participation

C	72 points from individual problems, and 30 points from homework, discussions, and Discord participation
D	39 points from individual problems, and 20 points from homework, discussions, and Discord participation
Not a D Yet	Do not fit in the above categories

Every problem can earn up to 3 points

The following table describes the feedback associated to the points.

3 points	You have demonstrated full understanding of the topic by getting the problem completely correct and with sufficient explanation or interpretation.
Revision Needed	You have demonstrated full understanding of the topic but something is unclear or amiss (e.g. misuse of symbols, arithmetic error, clarity needed). Make the corrections and explain it to the professor to earn full credit for that problem. If left unattended, or if the revision is incorrect, the problem will receive 2 points.
1 – 2 points	You have demonstrated partial understanding, but a crucial aspect of the problem needs revision or is missing. You need to rework this problem to figure out the correct solution to gain a deeper understanding of the topic. You may use your notes to review the topic or ask the professor questions concerning the revision you need to make. Once you have learned the topic better, you may attempt another version later in order to achieve a higher score.
0 points	It is unclear that you understand the concept. You need to rework this problem to figure out the correct solution, and you will benefit greatly by asking questions. Once you have learned the topic better, you may attempt another version later in order to achieve a higher score.

If you get a problem wrong, you can try it again for a higher score!

In this class, you have multiple opportunities to demonstrate full understanding of every topic. Students who have already achieved their desired letter grade by the last day of class do not need to take the final.

I have no expectations that you will reattempt problems outside of class time. However, if you do not do well on an assessment, I may contact you via email to set up an appointment to go over those problems and offer you an opportunity to reattempt a similar version of them during office hours. *Office hour reassessments are given at the discretion of the professor and are not guaranteed opportunities.*

Every problem attempted can earn up to 3 points. For any problem which earns less than 3 points, another version of that problem may be attempted at a later time for a grade replacement using the highest score. Replacing grades in this fashion rewards effort, growth, and deeper understanding of the material.

Once a problem has been mastered (and receives 3 points), you may repeat the process for an additional 3 points. This is regardless of the number of attempts needed to master the problem once. The maximum for any single topic is 6 points, meaning 2 correct problems completed on the same topic. Being able to relearn a topic when needed in the future is a valuable skill, and correctly completing a second problem at a later time may have you practice this skill.

Celebration of Your Knowledge Days (i.e., Quizzes and Exams):

In-class assessments are opportunities to demonstrate your knowledge on any of the topics. An “exam” will represent the entire class dedicated to taking assessments. Unexcused absences (oversleeping, car trouble, alarm dysfunction, etc.) will only be considered for make-up if the student contacts the instructor *within 24 hours* of the exam.

Plagiarism

Any form of plagiarism will result in a severe consequence for all parties involved. Please see the “Lewis University Copyright and Intellectual Property Guidelines” document, which is posted at <http://www.lewisu.edu/academics/library/index.htm>. Specifically for this course, the policy is that you are not allowed for anybody to look at your code or for you to look at someone else’s code. I reserve the right to use code plagiarism detection software to check for plagiarism occurrences. In any situation in which I have reason to believe that you have copied program code or allowed anyone else to use your code, you will receive, at the minimum, a grade of zero for that particular assignment and possibly an F grade for the entire course. So while you may and in fact are encouraged to discuss the assignments with other students, you need to be careful to make sure you write your own code.

Changes to Course Assignments or Grades:

You are required to periodically check BlackBoard for any new announcements or changes to the course. I may post an announcement about the exam, the programming assignment, changes in the course, etc. Such announcements will usually also go on Discord, so if you check that at least once a day, you should be fine.

IX. Information for Students

Requests for Reasonable Accommodations

Lewis University is committed to providing equal access and opportunity for participation in all programs, services and activities. If you are a student with a disability who would like to request a reasonable accommodation, please speak with the Learning Access Coordinator at the Center for Academic Success and Enrichment (CASE). Please make an appointment by calling 815-836-5593 or emailing learningaccess@lewisu.edu. Since accommodations require early planning and are not provided retroactively, it is recommended that you make your request prior to or during the first week of class. It

is not necessary to disclose the nature of your disability to your instructor. For more information about academic support services, visit the website at: www.lewisu.edu/CASE.

Lewis University has adopted Blackboard Ally providing alternative formats for files uploaded by instructors. Students can click the down arrow next to any file, and select *Alternative Formats*.

Sanctified Zone

Guided by its Catholic and Lasallian heritage, Lewis University is firmly committed to fostering a campus atmosphere that is permeated by its Mission values of Fidelity, Wisdom, Knowledge, Justice, and Association. Accordingly, we have declared the University campus to be a Sanctified Zone, a place and a people *United in Diversity*. The active promotion of diversity and the opposition to all forms of prejudice and bias are a powerful and healing expression of our desire to be Signs of Faith (Signum Fidei) to each other. To learn more about the Sanctified Zone, please visit: <http://www.lewisu.edu/sanctified-zone>

As a Sanctified Zone, Lewis University affirms the importance of diverse spiritual and value-based identities, worldviews, and expressions, including the observance of religious and cultural traditions. To learn more about the rich diversity of spiritual and cultural holidays celebrated within the Lewis community, please see the [Interfaith Calendar](#). Please note that this calendar is *not* a designation of spiritual and cultural holidays officially recognized or observed by Lewis University; rather, it is intended as an educational resource for the Lewis community.

Lewis University is committed to inclusion “together and by association” on our campus and in our classrooms. At the beginning of the semester, you should carefully review this course syllabus and requirements. If you have religious or cultural observances that reasonably conflict with attendance or submission of assignments in this class, please let the instructor know as soon as possible so that alternative arrangements may be discussed at the instructor’s discretion.

Academic Integrity

Scholastic integrity lies at the heart of Lewis University. Plagiarism, collusion and other forms of cheating or scholastic dishonesty are incompatible with the principles of the University. Students engaging in such activities are subject to loss of credit and expulsion from the University. Cases involving academic dishonesty are initially considered and determined at the instructor level. If the student is not satisfied with the instructor’s explanation, the student may appeal at the department/program level. Appeal of the department /program decision must be made to the Dean of the college/school. The Dean reviews the appeal and makes the final decision in all cases except those in which suspension or expulsion is recommended, and in these cases the Provost makes the final decision.

[University Student Complaint Policy](#)

The University Student Complaint Policy can be found at lewisu.edu/studentcomplaints

[University Grade Appeal Policy](#)

The University Grade Appeal Policy can be found at lewisu.edu/studentcomplaints

[University Copyright and Intellectual Property Guidelines](#)

The University Copyright and Intellectual Property Guidelines can be found at <https://www.lewisu.edu/osp/pdf/Intellectual%20Property%20Rights%20Policy.pdf>

Additional policies and handbooks for this program, department, and college and where they can be found (list policies or handbooks and where they can be found, or provide a link to the web location – delete if this does not apply)

Center for Health & Counseling Services

To support student success, all Lewis students are eligible for free health and mental health services on the Romeoville campus. This includes commuters and those living on campus, part-time and full-time students, graduate and undergraduate students, and those taking Lewis classes at other locations. For more information, visit the Center for Health & Counseling website at www.lewisu.edu/student-services/health or call (815)836-5455.