

Math 335 – Spring 2026

Probability Theory

Overview:

This course will develop basic probability theory including the axioms, random variables, expected value, the law of large numbers and the central limit theorem. In addition, other topics will include distribution functions and generating functions. This course will set the groundwork for the application of statistical methods to data.

Learning Objectives

At the conclusion of this class, students will be able to:

- Apply the basic axioms of probability to real life situations.
- Define the basic objects of study in mathematical probability, and perform computations and critical reasoning using them.
- Identify various probability distributions and be able to appropriately use these to perform probability calculations.
- Use set theory and calculus to mathematically derive and prove relevant probability formulas.
- Identify random processes in the world around you and model them mathematically.

Basic Information

Instructor	Andrew Ackerman (Andy) Email: atackermat@lafayette.edu Office Hours: M 2-3 pm, W 11:30-1:30 pm, F 8-9 am or by appointment
Contacting Me	When emailing me, please simply call me Andy, and include “335” in the subject line. You may include screenshots or photos of your scratch work.
Course Mode	In-Person unless otherwise advised. In the case of a transition to purely virtual instruction, lectures will continue synchronously via zoom and exam policies will be made explicit.
Moodle link	https://moodle.lafayette.edu/course/view.php?id=32480
Lecture	MWF 9:30-10:20 am Pardee 401
Course materials	The supplemental text will be <i>Modern Mathematical Statistics with Applications (3rd edition)</i> by Devore, Berk, and Carlton. I write my own lectures, homework, and exams, so this is strictly an additional resource, should you choose to purchase it. You also have free access to a digital copy through the library. We will also periodically be using the software package R in this class, so you will need to download and install both R and R Studio. Links to each of these, for both Mac and Windows devices, can be found below. Windows

	Mac
	Studio
Credit hours	4
Prerequisites	Math 263 (Calc 3)
Office hours	Office hours are your time to ask me anything you want. My sole stipulation is that you should have attempted a homework problem before you ask me about it. My hope is that holding multiple office hours on three different days will accommodate the diversity of schedules inherent to such a class. That said, if you find yourself unable to attend office hours, feel free to email me and set up an appointment.

Final Grade Computation

Assessments	Date	Percent
Homework	Roughly Weekly	15%
Midterm 1	Mar 2	20%
Midterm 2	Apr 17	20%
Quizzes	5 (listed below)	10%
Course Project	May 1	10%
Final Exam	Registrar's Website	25%

A	90 or above
B	89.99 to 80
C	79.99 to 70
D	69.99 to 60
F	59.99 or below

Pluses and minuses will be distributed within each range by instructor discretion.

Course Assessments

Homework	Homework will be assigned on a (roughly) weekly basis as scheduled below. Late assignments will not be accepted and will receive a grade of 0, and no extensions will be granted except for University Excused Absences (dean's verification). This is to ensure that you stay up to date on your assignments. The lowest homework score will be dropped. Students may discuss the assignment with classmates, and students may also come to office hours to ask questions on homework problems. However, the submitted material must be each student's own work. Any dispute regarding the grading of a homework assignment should be brought to my attention no more than 1 week after the deadline of an assignment.
-----------------	--

Quizzes	You will have 5 quizzes in this course, scheduled as listed below. These are closed book-closed notes, completed individually. These are meant to be low-stakes warm ups for the exams. If you are keeping up with the lectures, the questions should not look surprising. These quizzes will be short – usually one or two questions completed in the last 10 minutes of class time. Consistent with the attendance policy, no make-ups are given without a university excused absence (dean’s verification). Because I realize life happens (you may be sick and miss a quiz or may simply not do as well on a quiz as you had hoped) your lowest quiz will be dropped.
Course Project	Probability is not only a study of mathematics, but an exercise in communicating your understanding of the world around you to others. Therefore, you should prepare a single 10-minute lesson communicating your understanding of a concept from the class. The particular concept is left to your choosing, but make sure examples are as relevant to your own life as possible. Students will deliver these lessons to me during office hours and also submit a written lesson plan by the due date (below). More information about the specifics of the project (and rubric) can be found on the Moodle page.
Exams	There will be two midterms and a final exam to be taken in person. These are required and no make-up exams will be granted unless your absence is approved by the university. In the instance, of an approved absence, the exam must be made up within a week of the student’s return to class. The final is cumulative. Unexcused missed exams will be given a zero. Exams will be done during the scheduled class time. If you work with any classmate or another student at Lafayette on your exam, you will receive a 0% and be reported to the university. You cannot have three finals within a 24-hour period, and therefore you will need to be excused from the regularly scheduled final exam. In this scenario, you must obtain a dean’s excuse and discuss the situation with me at least two weeks before the regularly scheduled final exam so that an alternative arrangement can be made.

Course Policies

Teaching Philosophy	My general approach aims to make two principles abundantly clear: there are no (sincere) bad questions, and education is only one facet of your life. To the first point, if you ask me a question out of genuine curiosity or confusion, I guarantee to respect and attend to it regardless of the level of complexity. Note, I do not claim to always have the answer, and certain questions may require an outside (office hours) conversation. But my guarantee is to provide an answer when I am able and search with you when unable. The flip side of this guarantee is your willingness to keep me accountable. Ask questions. If you are confused, please reach out for help. If in-class questions are too daunting, take advantage of office hours, tutorial sessions, or electronic communication. As to the second point, while I am ultimately a very ardent advocate of the merits of education, I want to reiterate that no single facet of your life – perhaps least of which performance in Math 335– fully defines you as a person. This is not to say that this, or any class, is unimportant, rather that this class is meant to enable and instruct not to define.
----------------------------	---

Honor Code	It is my aim to make my expectations for acceptable and original work as clear and explicit as possible. Gray areas frustrated me as a student, so I aim to prevent them as an instructor. To that end, students are bound by Lafayette's honor code in taking exams and in written work, and the submission of said work signifies understanding and acceptance of those requirements. More specific to this course, collaboration is not only permitted but <i>encouraged</i> on homework, labs and the project. Exams, by contrast, will be completed individually. I recognize that exams can be immensely stressful, and I do not intend to add to that burden. That said, my job is to cultivate and assess your <i>personal</i> understanding. Insofar as individual exams serve this purpose, they will be preferred. Please consult with me if you have any questions about the honor code. Asking for clarification in advance is far preferred to asking for forgiveness post-facto.
Attendance Policy	I do not take attendance for lecture. However, class participation is fundamental to success in this class. Any graded assignments (quizzes, exams, etc.) missed during an unexcused absence will earn a grade of zero, and any work done during this period (lecture examples, notes) becomes the responsibility of the student to make-up. Posted notes and lecture examples are not a substitute for being in class, but rather a starting point for seeing what material was covered in a given class. Often solutions are not included in these materials, as students missing class should attend office hours to ask questions on examples provided. Consistent with the homework and quiz sections above, the lowest assignment in each of the above categories will be dropped. This is intended, in part, to accommodate unforeseen absences that do not warrant a dean's verification. While I understand there are situations that may prevent your presence at times, if you have numerous absences, expect to find a message from me.
Technology Use	You are welcome to bring a calculator to class. We will also use R on your laptops frequently. Technology can support student learning, but it can also become a distraction. You should not use laptops or other devices for entertainment during class and should not display any material on the laptop which may be distracting or offensive to your fellow students. Laptops should only be used for legitimate classroom purposes, such as coding, taking notes, or downloading class information from Moodle. E-mail, messaging, surfing the Internet, reading the news, or playing games are not considered legitimate classroom purposes. Such inappropriate laptop use is distracting to those seated around you and is unprofessional.
Statement on Generative AI	Generative AI is an incredibly powerful and (at times) useful tool. However, if relied upon too heavily, it can become more of an intellectual crutch than an occasional aid. Therefore, since this course is a course aimed at establishing many fundamental concepts, the use of generative AI, such as chat gpt, will be prohibited in many situations. For example, using chat-gpt to write code for or answer questions on your homework, quizzes, or exams is strictly forbidden. Using a generative AI on any such assignment in any such capacity is not permitted.

	However, there are instances where generative AI is permitted. For example, using gpt to generate ideas for your lesson plans is permitted. You do however still have the responsibility to check that the ideas generated are relevant and correct. Moreover, you must properly cite the generative AI as in: “Chat-GPT-3. (YYYY, Month DD of query). “Text of your query.” The quotation of your query should also make plain that you are asking for help on an assignment that is permitted by this syllabus (i.e. not an exam, homework or quiz). Likewise, you are permitted to use generative to <i>revise</i> the communication of your final project. You should still cite the AI in this capacity and make it clear to me that you have written the original draft (to be revised) yourself. Finally, you may use generative AI as a tutor of sorts, to reexplain course material or design extra practice problems. Even so, you assume the risk of any mistakes the generative AI makes in communicating the material to you. Any use of generative AI that falls within the prohibited category will be treated as academic dishonesty. If you are ever unclear about whether a particular use of generative AI is permitted, as with the rest of the honor code, please simply ask me.
Syllabus changes	I reserve the right to make changes to the syllabus, including test dates and grade computation. These changes will be announced as early as possible so that students can adjust their schedules.

University Resources for Students

Accessibility Resources	Lafayette is committed to providing support and reasonable accommodations for students with disabilities who self-identify with Accessibility Services. Students requesting accommodations to alleviate the impact of their disability should register their needs as soon as possible with the Accessibility Services Office, which is housed in the Academic Resource Hub (resourcehub@lafayette.edu). Once registered, students should request their accommodation letters to provide notification of their needs to their professors, on a semester-by-semester basis. If you have questions or concerns pertaining specifically to your accommodations within this course, please contact me to discuss them. Note that it is your responsibility to make any necessary arrangements with me regarding changes for testing procedures or other accommodations. Please be sure that these changes are made with sufficient time to be implemented.
Counseling and Psychological Services	CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://counselingcenter.lafayette.edu/ for more information.

Title IX	Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance, Report and Response Coordinators in the Equal Opportunity and Compliance Office, Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators to discuss your specific needs. Additional resources are available at https://spaces.lafayette.edu/enrol/index.php?id=1276 .
-----------------	--

Rough Course Outline (updated 1/12/26)

Class	Day	Date	Topics	Due
1	M	Jan 26	Introduction, R Markdown, Syllabus	
2	W	Jan 28	Set Theory	
3	F	Jan 30	Probability Axioms	Syllabus ack.
4	M	Feb 2	Counting Methods	Quiz 1
5	W	Feb 4	Conditional Probability	HW 1
6	F	Feb 6	Independence	
7	M	Feb 9	Bayes' Theorem\LOTP	
8	W	Feb 11	Discrete R.Vs and PMF's	
9	F	Feb 13	Expected Value	HW 2
10	M	Feb 16	Variance and Associated Properties	
11	W	Feb 18	Moments and MGF's	
12	F	Feb 20	Bernoulli/Binomial Distribution	HW 3
13	M	Feb 23	Negative Binomial and Geometric Distributions	Quiz 2
14	W	Feb 25	Poisson Distribution	
15	F	Feb 27	Review for Exam 1	HW 4
16	M	Mar 2	Exam 1	Exam 1
17	W	Mar 4	Continuous Distributions and PDFs	
18	F	Mar 6	Expected Value and Variances of Continuous RVs	
19	M	Mar 9	MGFs of Continuous RV	
20	W	Mar 11	Normal Distribution	HW 5
21	F	Mar 13	Normal Distribution	
	<i>M</i>	<i>Mar 16</i>	<i>No class – Spring Break</i>	

	<i>W</i>	<i>Mar 18</i>	<i>No class – Spring Break</i>	
	<i>F</i>	<i>Mar 20</i>	<i>No class – Spring Break</i>	
22	M	Mar 23	Computer Lab (Normal Approximation to Binomial)	Quiz 3
23	W	Mar 25	Gamma and Exponential Distributions	HW 6
24	F	Mar 27	Gamma and Exponential Distributions	
25	M	Mar 30	Log-Normal and Beta Distributions	
26	W	Apr 1	Multivariate Distributions	
27	F	Apr 3	Covariance, Correlation, Linear Combinations	
28	M	Apr 6	Marginal Distributions	HW 7
29	W	Apr 8	Conditional Distributions	
30	F	Apr 10	Conditional Distributions	Quiz 4
31	M	Apr 13	Bivariate Normal Distribution	
32	W	Apr 15	Review for Exam 3	HW 8
33	F	Apr 17	Exam 2	Exam 2
34	M	Apr 20	Transformations of Random Variables	
35	W	Apr 22	Transformations of Random Variables	
36	F	Apr 24	Using the MGF	
37	M	Apr 27	Law of Large Numbers	HW 9
38	W	Apr 29	Central Limit Theorem	
39	F	May 1	Central Limit Theorem	Course Project
40	M	May 4	Computer Lab (CLT and LLN)	Quiz 5
41	W	May 6	Dispelling Common Fallacies/Spillover	
42	F	May 8	Review for Final Exam	HW 10
			Final Exam	Final Exam