# Math 186.01 – Fall 2025
# Applied Statistics

## Overview:

An introductory course emphasizing standard methods and reasoning used in analyzing data. Topics include exploratory data analysis, design of experiments, least squares analysis, probability, sampling distributions and methods of inferential statistics. Students will also be introduced to the statistical computing package R.

## Learning Objectives

This course will enable you to:

- explore data by describing patterns and departures from patterns;
- organize and summarize data graphically and numerically
- consider the roles of sampling and experimentation in study design and implementation;
- explore random phenomena using probability and simulation; and
- estimate population parameters and testing hypotheses through methods of statistical inference.

## Basic Information

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| **Instructor** | Andrew Ackerman (Andy)<br>Email: ackermat@lafayette.edu<br>Student Hours: M noon-2 pm, W 3-5 pm (or by appointment); Pardee 222 |
| **Contacting Me** | When emailing me, please simply call me Andy, and include "186." 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=30458 |
| **Lecture** | MWF 8-9:15 am in Pardee 28 |
| **Course materials** | There is no *required* text in this course. However, the lectures and homeworks will be motivated from three different texts that you can view as supplementary material. These are: *Engineering Statistics* 5e by Montgomery, Runger, and Hubele; *OpenIntro Statistics* 4e by Diez, Cetinkaya-Rundel, and Barr; and *Mind on Statistics* 5e by Utts and Heckard. At minimum, the latter two texts can be found open source.<br><br>We will also be regularly 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. |

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| | Windows<br><br>Mac<br><br>Studio |
| **Credit hours** | 4 |
| **Prerequisites** | Math 161 (calculus 1) or equivalent |
| **Mentored Study Group** | We are lucky enough to have a mentored study leader assigned to our section! Cameron Kratz (kratzc@lafayette.edu) will be hosting sessions aimed at supplementing lecture. Look for information from Cameron on what time sessions will be held. |
| **Target Audience** | Introductory math and math/econ students, as well as any student needing an introductory course in statistics. A semester of calculus, the equivalent, or instructor permission is expected to enroll in this course. |
| **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.<br>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 |
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| Homework | Weekly | 15% |
| Midterm 1 | 12-Sept | 15% |
| Midterm 2 | 17-Oct | 15% |
| Midterm 3 | 12-Nov | 15% |
| Labs | Posted Below | 10% |
| Course Project | 24-Nov | 10% |
| Final Exam | | 20% |

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

## Course Assessments

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| **Homework** | Homework will be assigned on a weekly basis to be submitted for grading.<br><br>Late assignments will not be accepted and will receive a grade of 0, and no extensions will be granted except for University Excused Absences. This is to ensure that you stay up to date on your assignments. |

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| | 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.<br><br>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. |
| **Computer Labs** | As part of the class, students will be required to perform certain analyses using statistical software, primarily R, on the computers. Points will be awarded for correct completion of the assigned labs. It is not guaranteed that we will have a lab during every lecture, nor will any lab occupy more than a fraction of the lecture time. However, they will occur regularly, and as completing the lab requires being in class, this constitutes another reason to regularly attend lecture. More information regarding the computer sessions will be forthcoming. |
| **Course Project** | Probability and statistics are not only a study of mathematics, but an exercise in communicating mathematical results to others. Thus, in addition to the weekly homework assignments, there will also be a final project. Its intention is to give you practice assessing and critiquing statistical information disseminated to the general public. Additional information regarding the project can be found on the project rubric pdf on the course website. |
| **Exams** | There will be three 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.**<br><br>Unexcused missed exams will result in a zero for that assignment. 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.<br><br>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

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| **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.<br>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.<br>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 |

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| | performance in Math 186– 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.<br><br>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.<br><br>More specific to this course, collaboration is not only permitted but *encouraged* 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 *personal* understanding. Insofar as individual exams serve this purpose, they will be preferred.<br>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 except on exam or lab days. These assessments are done in person, so attendance is mandated on these days. However, class participation is fundamental to success in this class. Any work missed, such as a computer lab, during an unexcused absence will be counted as a zero. Dean's Absence Verification is a necessary first step towards getting an absence excused. 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.<br>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 Sakai. 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 an introductory course aimed at establishing many fundamental concepts, the use of generative AI, such as chat gpt, will be prohibited in many situations.<br><br>For example, using chat-gpt to write code (or debug code) for your labs or answer your homework questions is strictly forbidden. Using gpt in any capacity on your exam or final project is also not permitted.<br><br>However, there are instances where generative AI is permitted. For example, using gpt to explain concepts is permitted. However, beware that gpt is prone to err and |

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| | can hallucinate. As a result, if you are using gpt to provide alternative explanations, you should always check that the explanation given is at least consistent with both the lecture notes and textbook. If it is unclear if this is the case, feel free to ask me.<br><br>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

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| **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.<br><br>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 6/25/25)

| Class | Day | Date | Topics | Reading[1] | Due |
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| 1 | M | 25-Aug | Introduction, Data Basics, Introduction to R | | |

[1] These readings are supplemental and come from the Utts and Heckard, *Mind on Statistics.*

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| 2 | W | 27-Aug | Types of Variables, Graphical Representations | 2.1-2.4 | |
| 3 | F | 29-Aug | Numerical Summaries and Boxplots | 2.5-2.6 | HW 1 |
| 4 | M | 1-Sept | Categorical Data and Better Graphics | 2.3 | Lab 1 |
| 5 | W | 3-Sept | Sampling Strategies and Experimental Design | 5.3-5.5 | |
| 6 | F | 5-Sept | Chi-Squared Tests | 4.3-4.4 | |
| 7 | M | 8-Sept | Chi-Squared Tests in R | | Lab 2 |
| 8 | W | 10-Sept | Review for Exam 1 | | HW 2 |
| **9** | **F** | **12-Sept** | **Exam 1** | | |
| 10 | M | 15-Sept | Basic Probability, Axioms and Counting Techniques | 7.1-7.4 | |
| 11 | W | 17-Sept | Conditional Probability | 7.5 | |
| 12 | F | 19-Sept | Sampling (with and without replacement) | | HW 3 |
| 13 | M | 22-Sept | Random Variables | 8.1-8.2 | |
| 14 | W | 24-Sept | Expectations and variances | 8.3 | Lab 3 |
| 15 | F | 26-Sept | Introduction to Programming | | HW 4 |
| 16 | M | 29-Sept | Introduction to Programming 2 | | Lab 4 |
| 17 | W | 1-Oct | Normal Distribution | 2.7 | |
| 18 | F | 3-Oct | Normal Distribution | 8.5-8.7 | |
| 19 | M | 6-Oct | Binomial Distribution | 8.4 | HW 5 |
| 20 | W | 8-Oct | R and the Binomial Distribution | | Lab 5 |
| 21 | F | 10-Oct | Geometric Distribution | | |
| | *M* | *13-Oct* | *No class – Fall Break* | | |
| 22 | W | 15-Oct | Review for Exam 2 | | HW 6 |
| **23** | **F** | **17-Oct** | **Exam 2** | | |
| 24 | M | 20-Oct | Introduction to Inference (Single Proportion) | 9.4 | |
| 25 | W | 22-Oct | Confidence Intervals (Single Proportion) | 10.1-10.2 | Lab 6 |
| 26 | F | 24-Oct | Hypothesis Tests (Single Proportion) | 12.1-12.2 | HW 7 |
| 27 | M | 27-Oct | Inference for a Difference in Proportions | 10.3 | |
| 28 | W | 29-Oct | Inference for a Difference in Proportions | 12.3 | |
| 29 | F | 31-Oct | T-distribution and Inference for One Mean | 9.6, 13.1-13.2 | HW 8 |
| 30 | M | 3-Nov | Paired Data | 11.3-11.4 | |

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| 31 | W | 5-Nov | Inference for Difference in Means | 13.3-13.4 | |
| 32 | F | 7-Nov | Hypothesis Tests in R | | HW 9, Lab 7 |
| 33 | M | 10-Nov | Review for Exam 3 | | |
| **34** | **W** | **12-Nov** | **Exam 3** | | |
| 35 | F | 14-Nov | Correlation | 3.3-3.4 | |
| 36 | M | 17-Nov | Introduction to Regression | 3.2,14.1 | |
| 37 | W | 19-Nov | Inference for Regression, Leverage and Influence | 14.2, 14.3 | |
| 38 | F | 21-Nov | Regression in R/Data Ethics | | HW 10, Lab 8 |
| **39** | **M** | **24-Nov** | **Project Presentations** | | **Due Sunday Nov 23** |
| | *W* | *26-Nov* | *No Class – Thanksgiving Recess* | | |
| | *F* | *28-Nov* | *No Class – Thanksgiving Recess* | | |
| **40** | **M** | **1-Dec** | **Project Presentations** | | Final Project Papers |
| 41 | W | 3-Dec | Review for Final Exam | | |
| 42 | F | 5-Dec | Review for Final Exam | | |
| | | | **Final Exam** | | |