ECE 3077: Intro to Probability and Statistics for ECEs
Fall 2026 Syllabus

Summary

ECE 3077 is a foundational course in probability and statistics.

The central theme of the course is the development of mathematical methods for understanding and modeling uncertainty.

Prerequisites

I will assume that you are comfortable with the fundamentals in calculus (calculating integrals, understanding limits, Taylor series expansions, etc) and linear algebra (matrix-vector multiplication, solving systems of equations, dimension, rank, etc). I will also assume basic proficiency in MATLAB or Python.

Instructor

Emad Abukhousa
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Office: Van Leer Building, Room C249
Office Hours: TBD. These will likely be held after class on Wednesdays in Van Leer.

Teaching Assistant

TBD

Grading

Your grade will be assigned based on the following factors:

- **Homework (20%)**: There will be ≈ 12 homework assignments. See further detail below.
- **In-class exercises (10%)**: There will be daily in-class exercises to be completed (on Gradescope) during the second portion of class.
- **Quiz 1 (20%)**: Tentatively scheduled for September 21 (in class). Quiz 1 will cover the same material as the homeworks submitted before the quiz.
- **Quiz 2 (20%)**: Tentatively scheduled for October 26 (in class). Quiz 2 will cover the same material as the homeworks submitted between quiz 1 and 2.
- **Final exam (25%)**: The date and time will follow the official Georgia Tech final exam schedule and will be posted in Canvas on the first day of class. The final exam will be comprehensive and will cover material from the homework assignments and class discussions throughout the semester.
- **Participation (5%)**

Your final grade will be assigned as a letter grade according to the scale:

A: 90-100% B: 80-89% C: 70-79% D: 60-69% F: $\leq 59\%$

I may exercise the option to "curve" individual components or cumulative scores (by adjusting the grades higher, but not lower) at my discretion if I feel that it is warranted.

Homework

Homework will be assigned weekly (approximately) and will typically be due on Wednesday night. **Homework will be turned in via Gradescope. Unless you have made prior arrangements with me, late submissions will not be accepted.** Each homework assignment will be graded out of 100 points.

The homework assignments will be hard; many of them will require significant amounts of time and effort to complete. But this is really where most of the learning takes place. You will get out of the assignments what you put into them. Students who complete all of the assignments in full will develop a deep understanding of the role that probability and statistics play in electrical and computer engineering, as well as in everyday life. Effectively, homework is worth much more than 20% of your grade. In teaching many courses over the years, **I have never seen a case where a student does not put effort into the homework assignments but does well on the exams, and I have never seen a student who puts effort into the homeworks get lower than a "B"**.

Students are *strongly* encouraged to discuss homework problems with one another. However, **each student must write up and turn in their own solutions written in their own words**.

Cases where solutions appear to be identical or nearly identical will be immediately referred to the Office of Student Integrity.

Students are *strongly discouraged* from consulting ChatGPT or similar tools on homeworks. This is mainly for your own protection as ChatGPT is great at producing responses that are totally wrong but certainly look like they might be solutions. Unless you really know the material, you are likely to get fooled, and the way to learn the material is to actually do the homeworks. If you want to "check your answers" you can always try, just remember to use this feedback with caution. And of course, ChatGPT won't be there for the quizzes.

In-class exercises

We will spend approximately one third to half of each class period solving problems together. There will be a set of required exercises for each session that must be completed in class using Gradescope.

There will be no makeup dates for these problem solving sessions, **so you will need to bring your laptop or phone to class every day.** The exercises are not supposed to be a test, they are meant to help solidify your understanding of the material through low-stakes practice. Each assignment will count equally in computing your overall grade, although some assignments may have more exercises than others. You are encouraged to discuss these exercises with your classmates.

Participation

I am excited about teaching this course and want everyone to succeed. However, your learning is ultimately up to you. We have very limited time together this semester, and your active participation in the course makes the best use of that time for both yourself and your fellow students. Thus, a portion of your grade will be based on your active participation in all facets of the class.
At a minimum, you should show up on time, be prepared, and be engaged. Please avoid distractions such as phones, side conversations, or unrelated work during class, since they reduce the value of the class time for you and for others. Equally important is making a good faith effort on the in-class exercises and engaging with the course outside of the classroom, such as actively engaging with the homework, attending office hours, and/or contributing to the online discussions in Piazza. All of this will factor into your participation grade.
That being said, a student will not pass the class based on attendance, participation, or effort alone. Part of my job is to assess whether each student has achieved a deep and thorough understanding of the material. If you find that you are studying an extreme amount but still not performing well, I am happy to discuss possible changes to the way you study that may be of benefit.

Canvas, Gradescope, and Piazza

General course information, lecture notes, and course grades will be posted in Canvas. Homework assignments and in-class exercises will be submitted in Gradescope.

We will also use Piazza to make announcements and for you to post questions about the course,

lectures, and homework assignments. All questions that are not personal should be posted here rather than emailed to me so that everyone can benefit from the discussion and you can get quicker feedback than you might get from me alone. Posts I make to Piazza will be considered official announcements that you are expected to be aware of, so please make sure that you check it often and/or receive email notifications. Also, you are encouraged to answer questions for other students on Piazza. Notable Piazza contributors will be rewarded in their participation grade.

Textbook and other resources

The required text for the course is

- Bertsekas and Tsitsiklis: *Introduction to Probability*
  http://tinyurl.com/2muztshb

Here are several other books that I can recommend for learning the material in this class. You couldn't possibly read them all over the next few months, but if you take the time to read any of them you will find it worthwhile.

- Durrett: *Elementary Probability for Applications*
  http://tinyurl.com/34c43mcc
  This is an excellent introduction to probability. It is not specifically focused on applications in ECE and is less comprehensive than Bertsekas and Tsitsiklis, but has a great treatment of the material for roughly the first 2/3 of the course.

- Yates: *Probability and Stochastic Processes: A Friendly Introduction for Electrical and Computer Engineers*
  http://tinyurl.com/5tu392n7
  Yates is very good, especially for ECE majors. This was a candidate for the course's official text, but its focus on random processes makes it more appropriate for a second course (i.e., ECE 4260, Random Signals and Applications).

- Feller: *An Introduction to Probability Theory and its Applications*
  Volume 1: http://tinyurl.com/2y2xubmu
  Volume 2: http://tinyurl.com/3wzb8u9b
  This book is an absolute classic written by one of the greatest probabilists of the 20th century. It was first published in 1950, but the writing style is so clear that it has held up perfectly. This book is a little more advanced mathematically than this course will be, but it is still very accessible. The material covered in Volume 1 is particularly relevant. I cannot recommend it enough as a supplement to the material in this course.

- Hamming: *The Art of Probability*
  http://tinyurl.com/j9s6wrke
  This book is another classic. Hamming (of the Hamming window, Hamming code, Hamming distance, etc.) was trained as a mathematician, but spent much of his life at Bell Labs working with engineers. This book is a little different than Feller in that Hamming takes a strong position on various philosophical issues related to *what probability really is* and devotes a fair bit of discussion to these issues. If you're interested, this can be fascinating, but even if you're

not, Hamming does an excellent job of giving lots of examples *and* trying to develop intuition for how to approach these problems to find the most elegant (i.e., easiest and fastest) solution. Chapter 4 is particularly good in this respect.

- Wasserman: *All of Statistics*
  http://tinyurl.com/5yj26txy
  If you like the material at the end of this course, check this out. Wasserman provides a fairly concise overview of, well, all of statistics. If you want to go get a job doing something related to "big data" or "data science," read this book.

- Mlodinow: *The Drunkard's Walk: How Randomness Rules our Lives*
  http://tinyurl.com/3zmu5j8c
  An easy read which has interesting tidbits about some of the historical figures in the development of probability theory, and modern experiments that show how bad human intuition is at judging probabilities.

- Bernstein: *Against the Gods: The Remarkable Story of Risk*
  http://tinyurl.com/3nv97kpc
  This is a fascinating history of the development of probability theory from the 16th century to the present, with a bit more emphasis on applications in business and finance.

- Taleb: *Fooled by Randomness*
  http://tinyurl.com/mw939v8m
  The theme of this book is how terrible humans are in general about understanding the role randomness plays in our lives (especially in finance).

- Silver: *The Signal and the Noise*
  http://tinyurl.com/4edyuw6s
  Nate Silver got a lot of attention for his accurate predictions in the 2008, 2010, and 2012 elections. This book examines how experts predict uncertain events (i.e., the weather, earthquakes, an athlete's performance, etc.) using probabilistic models.

You may also want to take advantage of some of the following online resources:

- MIT OpenCourseware: 6.041 Probabilistic Systems Analysis And Applied Probability
  http://tinyurl.com/yc2nffa8
  This course used the same book, and will match our course pretty closely, at least through the first few weeks. There are alternative lecture notes, homework assignments (with solutions), and other materials at the website above.

- Harvard Statistics 110: Probability
  http://tinyurl.com/3jar9e8p
  Harvard also has a similar course with a free textbook and video lectures on YouTube.

- Khan Academy lectures on probability
  http://tinyurl.com/43zc4n2p
  The Khan Academy has some fantastic (shortish) lectures available for many of the topics in this course. Many of them are centered on working specific problems.

Course Expectations and Guidelines

Academic integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit www.catalog.gatech.edu/policies/honor-code. Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Unauthorized use of any previous semester course materials, such as tests, quizzes, and homework, is prohibited in this course. Using these materials will be considered a direct violation of the GT Academic Honor Code. Furthermore, redistributing materials from this course and/or using external sites for assistance (e.g., contributing to test banks, CourseHero, Chegg, or similar sites) is prohibited.

Collaboration and group work

Students are *strongly* encouraged to discuss homework problems with one another. However, **each student must write up and turn in their own solutions written in their own words**. **Cases where solutions appear to be identical or nearly identical will be immediately referred to the Office of Student Integrity.**

Absences, late assignments, and missed exams

Active participation in the class discussions is expected. Please attend class (either in person or online) unless you have a compelling reason not to do so. However, you will not be penalized for any excused absences (e.g., due to illnesses, religious observances, career fairs, job interviews, etc.) **Late assignments cannot be accepted** in the absence of prior approval. In the event that an excused absence prevents you from submitting an assignment, your homework grade will be calculated on a pro-rated basis. **Exams will be completed in-person. If you expect to miss an exam, please contact me as soon as you realize this so we can make alternative arrangements.** We may consider options to take the exam at an alternate time or instead may adjust the grading allocation to place more emphasis on other exams, depending on the circumstances.

Accommodations for students with disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or disabilityservices.gatech.edu, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty expectations agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class. See www.catalog.gatech.edu/rules/22 for an articulation of some basic expectation that you can have of me and that I have of you.

Outline

We will start the course by following the book fairly closely for the first 5 chapters. After that, the material will overlap, but we will be choosing a more customized list of topics. The ordering of subjects in this outline is rough and subject to change.

1. Introduction to probability
   (a) simple probability models, the Kolmogorov axioms, the uniform law
   (b) independence
   (c) conditional probability and Bayes rule
   (d) basic combinatorics
2. Discrete random variables
   (a) probability mass functions (pmfs)
   (b) expectation, variance, and moments
   (c) multiple discrete random variables, joint pmfs
   (d) conditional pmfs
   (e) example distributions: Bernoulli, Binomial, Geometric, Poisson, etc.
   (f) entropy and source coding
3. Continuous random variables
   (a) probability distributions and probability density functions (pdfs)
   (b) expectation, variance, and moments
   (c) example distributions: Uniform, Exponential, Gaussian/Normal, etc.
   (d) multiple continuous random variables, joint pdfs
   (e) conditional pdfs
   (f) independence, correlation, and covariance
4. Learning from data: Basics of Statistics and Machine Learning
   (a) sample mean, weak law of large numbers, confidence intervals
   (b) fitting a density to data, parameter estimation
   (c) fitting a function to data, regression
   (d) fitting a decision rule to data, classification and logistic regression