

How Chance Changes the World

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Office hours: Friday, 9:30-11 AM Central

Class Time: Monday and Wednesday, 9:30-11 AM Central, from July 6th to July 29th

Course Website: <https://canvas.uchicago.edu/courses/29083>

Course description: This course is designed as an introduction to probability while also taking space to reflect on the historical, material, and social context of the relevant concepts. We will grapple with some classic paradoxes on the human road to developing probability, draw important lessons for living life in an uncertain world, and explore how embracing randomness can help to solve some of our hardest problems. Simultaneously, we will also discuss how mathematics and statistics, combined with various forms of power, have shaped the world that we live in today.

This course will have a considerable component of in-class discussion, as well as weekly homework. Since this is an online course, classes will be conducted primarily over Zoom. A Slack channel will also be created for questions and discussion outside of the scheduled class time.

Learning objectives. Upon completion of the class, students will be able to:

- Define experiment, outcome, event, and probability.
- Rigorously state and use Bayes' theorem to compute probability based on prior knowledge.
- Qualitatively describe the uniform, normal, exponential, and Erlang distributions.
 - Understand the differences in how these distributions predict real-world events.
- Explain some of the uses of probability and statistics that shape modern life, like search engines, cryptography, dating apps, and gerrymandering.
- Challenge the perceived notions of objectivity and neutrality attached to mathematics and statistics.

Grading: This class will be graded on a Pass/No Pass scheme. Your grade will be weighted evenly between:

1. Participation in discussions of the readings
2. Participation of in-class activities
3. Completion of the homework

As students ourselves, we understand that now is a particularly hard time to be in school. The point of this class is to be fun, to challenge the way we think, and to grow together through shared problem solving and group discussions—we aren't looking to burden your summers with anxieties about not passing a class. If you encounter any of these feelings, or even if you don't and just have suggestions or thoughts, please talk to us!

Approximate course schedule:

Week 0	The conditions in which we learn	
Reading	Excerpt from chapter 2 of <i>Pedagogy of the Oppressed</i> , Freire.	
Week 1	Introduction to probability	
Topic	What is probability?	What is random?
Activity #1	Intros; codes of conduct; flipping coins.	Rolling dice and probability distributions.
Activity #2	Birthdays and the Monty Hall problem.	Random chords.
Homework	Bertrand's paradox, Catalan numbers, and the hat-check problem	
Reading	"What does randomness look like?" Aatish Bhatia.	
Week 2	Bayesian thinking	
Topic	Conditional probability	Seeing the future?
Activity #1	Bertrand's ballot theorem.	Reading discussion.
Activity #2	Toilet problem and the 1/e-law of best choice.	Power laws, Erlang, and normal distributions
Homework	German tanks, apartment hunting, and false positives.	
Reading	Excerpts from <i>Weapons of Math Destruction</i> , O'Neil.	
Week 3	Probability in our lives	
Topic	Math shaping the world.	Embracing randomness.
Activity #1	Bayes theorem and prediction rules.	Reading discussion.
Activity #2	PageRank.	Traveling salesmen.
Homework	Power laws in the real world and gaming the YouTube algorithm	
Reading	"A Society, Searching" from <i>Algorithms of Oppression</i> , Noble.	
Week 4	Monte Carlo methods	
Topic	Math shaping the world, redux.	
Activity #1	Markov chains, a history.	Reading discussion.
Activity #2	Codebreaking	Gerrymandering.
Reading	"Geometry of gerrymandering," by Duchin and https://mggg.org/metagraph/ .	

All readings and activities are subject to change based on student feedback.

During Class

This course will take place on Zoom. We ask that you leave your camera on when possible. This is a discussion-based class, and it is much easier to talk to faces than to blank screens, and to feel a part of a discussion when your camera is on. We also ask that you mute yourself when you aren't talking.

Homework

Homework will be uploaded on Canvas. Students can type up answers (through, for example, Google Docs, which has an "insert equations" feature, or LaTeX), or hand write homework to scan and upload. You are always encouraged to work together, though please make sure to cite when you do so!

Quizzes and Exams

Quizzes will occur regularly and may be given at any time during class, but count only for a participation grade. This class will have no exams.

Late Assignments

My (Claudio's) usual late policy is this: Every student starts the class with 5 free late days. A "late day" begins immediately after the assignment is due. Turning in an assignment anytime during the 24 hour period following the assignment due date counts as one late day, regardless of the time the assignment is submitted. Submitting 24 - 48 hours after the assignment is due is considered two days late, etc. You may use late days anyway that you choose. After you exhaust your late days, assignments will be considered late and a 10% penalty per day it is late will be assessed to your work. In cases of emergencies, medical or otherwise, extensions may be granted.

For this summer: Please, just contact us if you think you can't finish an assignment on time—odds are, you aren't alone. We are here to help and aren't looking to dock points from students in the middle of a pandemic. Times are tough and we trust you are putting in the work you can, when you can, just like we are.

Participation, Late Attendance/Absence, & Grade Contestation Policy

There will be many opportunities to participate in the class, including vocal (participating in discussions and activities), as well as through written work (short reflections, worksheets, and others), and ungraded quizzes. For this reason, presence in the class is of utmost importance. If you are late, it could also hurt your participation grade. If there are any emergencies or issues that may get in the way of full participation, please let us know!

Pre- & Post-Course Surveys

The pre-course survey will focus on ways in which the classroom can be a welcoming environment to you and your classmates while identifying best practices for your learning style and interests. The post-course survey asks you to evaluate the ways in which your understanding of and relationship with math and computer science have changed while identifying the strengths and failures of group-work within the class.

Resources & Accommodations

Institutions of higher education are often decentralized and, as such, can be hard to navigate. If there are any issues you'd like to discuss or resources you may need, please do not hesitate to reach out to us. We would be happy to offer support in any way that we can! Your ability to do classwork interacts with the rest of your life, and we are here to support you in this academic endeavor.

If you require any accommodations for this course, please let us know as early as possible so that we can discuss how to best implement them. If you need help accessing Zoom, Canvas, or any other remote-learning material, or have a need for other accommodations, please let us know. You will also have an opportunity to make any of these particularities known in the pre-course survey, and we will try our best to adjust the course to these needs. In short: do not hesitate to contact us!

Academic Honesty & Plagiarism

This course is for you. If you are submitting other people's work as your own, you are also making it harder for you to participate fully in the course. If it is hard for you to complete an assignment, please come to me before submitting other people's work. Plagiarism, [as detailed in the University of Chicago Handbook for Academics](#), will not be tolerated.

That said, working together is good and encouraged! But please remember: ideas are shaped by historical, material, and social context—that is what this course is about. As such, please cite and acknowledge appropriately. If you have any reservations or concerns, please talk them through with me.