

PROBABILITY THEORY

MATH 154

Unit 0: Syllabus

ADMINISTRATIVE

0.1. Here are some administrative parts:

Instructor: Oliver Knill, Office SC 432

Course assistants:

Faris Doughan farisdoughan at college

Oscar Melendez omelendez at college

Class hours: MW 9-10:15 , SC 412

Office hours Oliver: TBA

Weakly homework: submitted on Canvas

Midterm: in class and take home part

Final: in class and final paper

Grades: HW 40 percent,
 Midterm 30 (split inclass/takehome),
 Final 30 (split inclass/paper)

0.2. This is a rigorous mathematical introduction to probability theory. We will focus on a few theorems and use them to understand applications. Theorems are proven. The subject is an active area of mathematics with many open problems. Much of the theory deals with stochastic processes and in particular with adding up independent random variables. Probability theory is also at the core of modern technologies like artificial intelligence and the language of the quantum world.

0.3. The time line is similar to Math 154 from Spring 2025

W1	1 Monday	January 26th:	What is probability theory?
	2 Wednesday	January 28th:	Paradoxa in probability theory.
W2	3 Monday	February 2:	The Boolean algebra of sets
	4 Wednesday	February 4:	Probability spaces, Conditional probability
W3	5 Monday	February 9:	Random variables and its Moments
	6 Wednesday	February 11:	Distributions and Lebesgue decomposition
W4	7 Wednesday	February 16:	Presidents Day
	8 Wednesday	February 18:	Independent random variables

Probability Theory

W5	9 Monday	February 23:	Characteristic Functions
	10 Wednesday	February 25:	Borel-Cantelli and start of midterm review
W6	Monday	March 2:	Review.
	Wednesday	March 4:	Midterm: in class
W6	11 Monday	March 9:	Jensen inequality
	12 Wednesday	March 11:	Chebychev-Markov inequality
March 15- Mar 22 Spring Break			
W8	13 Monday	March 23:	Notions of convergence
	14 Wednesday	March 25:	Weak law of large numbers
W9	15 Monday	March 30:	Strong law of large numbers
	16 Wednesday	April 1:	Birkhoff ergodic theorem
W10	17 Monday	April 6:	Ergodicity Recurrence
	18 Wednesday	April 8:	Mixing, decay of correlations
W12	19 Monday	April 13:	Central Limit Theorem
	20 Wednesday	April 15:	De Moivre Laplace and Poisson
W11	21 Monday	April 20:	Random walk and recurrence
	22 Wednesday	April 22:	Markov Chains, Perron-Frobenius
W12	23 Monday	April 27:	Global review
	24 Monday	April 29:	Final: in class part