PROBABILITY THEORY

MATH 154

Unit 0: Syllabus

Administrative

0.1. Here are some administrative parts:

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Instructor: Oliver Knill, Office SC 432
Course assistants:
Henry Weiland           henryweiland at college
Reade Park              readepark at college
Class hours:   TTh  1:30-2:45 ,  SC 310
Office hours Oliver:   TBA
Weakly homework, individually written. Submitted on Canvas
A midterm and final in class quiz, a midterm assignment and final exam paper.
Grades: HW 50 percent, midterm 20 (where 5 percent is quiz), final 30 (where 5
percent is quiz). While Bersekas-Tsitsiklis had been a popular choice in the past
we explore an independent self-contained path and do much more proofs.
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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. Preliminary class schedule. The minimum is to reaching the mountain peaks "Law of large numbers" and "central limit theorem". The organization of the course is similar to Math 136 from Fall 2024 (which has also a public website).

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W1    1 Tuesday  January 28th:    What is probability theory?
      2 Thursday January 30th:    Paradoxa in probability theory.

W2    3 Tuesday  February 3:      The Boolean algebra of sets
      4 Thursday February 5:      Probability spaces, Conditional probability

W3    5 Tuesday  February 11:     Random variables and its Moments
      6 Thursday  February 13:    Distributions and Lebesgue decomposition

W4    7 Tuesday  February 18:     Independent random variables
      8 Thursday February 20:     Characteristic Functions
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W5	9 Tuesday	February 25:	Kolmogorov law and Borel-Cantelli
	10 Thursday	February 27:	Problem seminar similar as midterm
W6	Tuesday	March 3:	Review for quiz on Thursday
	Thursday	March 5:	Midterm: in class quiz
W6	11 Tuesday	March 10:	Jensen inequality
	12 Thursday	March 12:	Chebychev-Markov inequality

March 15- Mar 23 Spring Break

W8	13 Tuesday	March 25:	Notions of convergence
	14 Thursday	March 27:	Weak law of large numbers
W9	15 Tuesday	April 1:	Strong law of large numbers
	16 Wedneday	April 3:	Birkhoff ergodic theorem
W10	17 Tuesday	April 8:	Ergodicity Recurrence
	18 Thursday	April 10:	Mixing, decay of correlations
W12	19 Tuesday	April 15:	Central Limit Theorem
	20 Thursday	April 17:	De Moivre Laplace and Poisson
W11	21 Tuesday	April 22:	Random walk and recurrence
	22 Thursday	April 24:	Markov Chains, Perron-Frobenius
W12	23 Tuesday	April 29:	Global review
	24 Tuesday	April 31:	Final: in class quiz

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