

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF TEXAS AT AUSTIN

M385C/CSE384K: Theory of Probability I

First-day Handout

Fall 2022

Course number: 55680/65475

Class meets: MWF 1:00pm-2:00pm, RLM 12.166

Instructor: Gordan Žitković

Instruction's Office Hours: By appointment; on Zoom.

Instructor's E-mail: gordanz@math.utexas.edu

Course Description: M385C / CSE384K *Theory of Probability I* is the first part of a two-semester “prelim” graduate course in probability theory. Its aim is to develop a modern and mathematically rigorous theory of probability

Topic Covered:

1. *Foundations of measure theory:* measurability and measures, Lebesgue integration, \mathbb{L}^p -spaces, theorems of Fubini-Tonelli and Radon-Nikodym
2. *Basic notions of probability:* probability spaces, sigma-algebras and information, modes of convergence, characteristic functions, law(s) of large numbers, central limit theorems
3. *Discrete-time martingales:* conditional expectation, filtrations, martingales, convergence theorems, martingale inequalities, optional sampling theorems

Prerequisites: Knowledge of multi-variable calculus (as in a typical calculus sequence), basic notions of elementary probability (as in Pittman’s “Probability”), real analysis (a thorough understanding the level of first 7 chapters of Rudin’s “Principles of Real Analysis”) and linear algebra (as in Lay’s “Linear Algebra and its Applications”) are assumed. Some exposure to elementary stochastic processes (as in Ross’s “Introduction to Probability Models”) would be beneficial, but is not strictly required. All the measure theory needed will be developed, so measure theory is not a prerequisite

Textbook: There is no required textbook. Instructor’s [lecture notes](#) will be followed closely. The following books are also recommended as a supplement:

[Dur19] R. Durrett, *Probability: Theory and Examples*, [web preprint](#), 2019.

[Kal21] Olav Kallenberg, *Foundations of Modern Probability*, 3rd edition, 2021.

[Wil91] D. Williams, *Probability with Martingales*, 1991.

[Dur19] is an excellent textbook, widely used for graduate courses in probability across the country. [Wil91] is a beautiful introduction to martingale theory. [Kal21] is an encyclopedic treatment of all many things probabilistic.

Course webpage: The course-management system *Canvas* will be used in this course.

Homework: Homework will be assigned bi-weekly; the assignments and their due dates will be posted on Canvas (no other notification will be given). The submission will be **electronic**, through Canvas. No paper submissions will be accepted. Your submission does not have to be typed - you can scan your hand-written work if you want (using your phone to take photo is fine). However, you need to upload your file in the **pdf** format. Submit well before the deadline - the system has been known to get “overwhelmed” close to it. If everything else fails, send your pdf file directly to the instructor (before the deadline, of course!).

Exams: There will be two exams, a midterm and a final. Details will be given in class.