Math 571: Advanced Probability — Spring 2026

Binghamton University

Instructor: Vladislav Kargin
Office: WH-136
Meeting time and location: TR 8:00–9:30 AM, WH 329
Office hours: TR 10:00–11:00 AM

This course is a 4-credit course, which means that in addition to the scheduled lectures/discussions, students are expected to do at least 9.5 hours of course-related work each week during the semester. This includes things like: completing assigned readings, participating in lab sessions, studying for tests and examinations, preparing written assignments, and other tasks that must be completed to earn credit in the course.

Prerequisite

Probability Theory (MATH 501)

Description

This course is an introduction to the advanced concepts of probability theory. It covers topics such as: Measure theory, Probability spaces, Random variables, Conditional Expectations, Stochastic processes, Martingales, Limit Theorems, Large deviations.

The course is intended for students who have a strong foundation in probability theory.

Recommended Text

Durrett, *Probability: Theory and Examples*, 5th edition. PDF available at PTE

Lecture Notes

Instructor's lecture notes will be provided and posted on Piazza.

Communication

We will use Piazza (piazza.com) for communication. All announcements will be sent to the class using Piazza.

Class Structure and Participation

Each class session is divided into two parts:

Student-led segment (30–45 minutes): Students take on rotating roles to present and critically examine the day's material.

Lecture segment (45–60 minutes): Instructor extends the material, addresses misconceptions, and covers additional applications.

Roles

Each session involves:

- **Presenters (2 students):** One states definitions, notation, and theorem statements; the other outlines the proof and provides an example.
- **Skeptics (2 students):** One checks correctness and catches errors; the other proposes counterexamples when assumptions are weakened.
- **Scribe (1 student):** Records theorem statements, key proof steps, questions raised, and instructor additions. Notes should NOT include names—they are learning material, not meeting minutes. Submit within 24–48 hours; instructor reviews and shares with everyone.
- **Observers (3 students):** Participate in discussion and ask questions; may be called on for examples or perspectives.

Role Assignments

- Sunday evening: Instructor announces which pairs are presenters and skeptics for Tuesday and Thursday, and which results will be covered.
- Within-pair role assignment: Students decide among themselves or flip a coin at the start of class.

Students are expected to pre-read the assigned material before each class.

Homework Policies

Weekly problem sets. I fully grade two or three problems (announced after submission); the others count for completion. Solutions must be concise (≤1 page per problem) and list the named results used (e.g., "DCT + UI").

Format: Starting HW 3, solutions must be typeset in LaTeX and submitted as PDF. Non-LaTeX submissions will be returned without grading.

LaTeX resources: Homework templates will be posted on Overleaf. Students should create a free account at Overleaf.

Submission: Submit via Gradescope as PDF by the due date.

Late policy: 3 late-day tokens total for the term; beyond that, late work is not accepted.

Rubric:

- 4 = correct & clear
- 3 = essentially correct (minor gap)
- 2 = right idea with major gap
- 1 = meaningful progress
- 0 = off-track
- +0.5 exposition bonus possible (capped at 4)

I may invite you to brief board checks on your own solutions; these verify understanding and may adjust the HW score slightly.

You may discuss ideas, but write your own solutions.

Exams

Midterm: One in-class exam (open-book, no internet). Thursday, March 5, 2026.

Final: Take-home exam with a brief (10–12 minutes) oral follow-up. I will choose one of your solutions and ask "why does this step hold?" / "where does the hypothesis matter?" questions. The final is cumulative.

Grading

Component	Weight
Homework	40%
Participation (presenter/skeptic/scribe)	10%
Midterm exam	15%
Final write-up	25%
Final oral follow-up	10%

Schedule

Event	Date
Classes begin	Tuesday, January 20

Midterm	Thursday, March 5
Spring break	March 28 – April 6
Last day of classes	Wednesday, May 6
Final exam	As scheduled by the University

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