MA 585-1D INTRO TO PROBABILITY
SYLLABUS

Semester: Spring 2025
Course Instructor: Keren Li, PhD
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Office: University Hall 4041
Office Hours: By appointment

Course Info

Meeting times: Lectures: Mon/Wed/Fri 11:15 am - 12:05 pm
Meeting location: Heritage Hall Building 526
Prerequisite: Undergraduate level MA 227 Minimum Grade of C and Undergraduate level MA 260 Minimum Grade of C
Credits: 3 semester hours
Required Textbooks: First Course in Probability, A, 10th edition, 2019. E-Book comes with UAB Opt-In through Pearson.

Course Description

Combinatorics, probability spaces, combinatorics, conditional probabilities and independence, Bayes rule, discrete and continuous distributions, mean value and variance, random variables, joint distributions, correlation, Law of Large Numbers, Central Limit Theorem.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Apply combinatorial methods to solve problems involving permutations, combinations, and other counting principles.
- Understand and use the axioms of probability to calculate probabilities in finite and infinite sample spaces.
- Analyze events involving conditional probabilities and determine independence of events.
- Use Bayes' theorem to compute posterior probabilities in relevant contexts.
- Describe, analyze, and compute probabilities for discrete and continuous random variables using probability mass functions, density functions, and cumulative distribution functions.
- Compute and interpret the expected value, variance, and higher moments of random variables.
- Analyze joint distributions of multiple random variables, including marginal and conditional distributions.
- Evaluate and interpret the correlation and covariance between random variables.
- Apply the Law of Large Numbers and Central Limit Theorem to approximate probabilities and analyze the behavior of sums of random variables.

Course Content

The course will cover the following chapters:

(1) **Combinatorial Analysis:** Fundamental principles of counting, permutations, combinations, and their applications in probability.
(2) **Axioms of Probability:** Probability spaces, axioms, and properties of probability measures.
(3) **Conditional Probability and Independence:** Conditional probability, rules of probability, independence of events, and Bayes' theorem.
(4) **Discrete Random Variables:**
   - Part 1: Definitions, probability mass functions, cumulative distribution functions, and examples.
   - Part 2: Mean, variance, and common discrete distributions (e.g., Binomial, Poisson, and Geometric).
(5) **Continuous Random Variables:** Probability density functions, cumulative distribution functions, expected value, variance, and common continuous distributions (e.g., Uniform, Normal, and Exponential).
(6) **Jointly Distributed Random Variables:** Joint probability distributions, marginal and conditional distributions, independence, and joint moments.
(7) **Properties of Expectation:**
   - Part 1: Linearity, properties, and applications of expectation.
   - Part 2: Variance decomposition, covariance, and correlation.
(8) **Limit Theorems:** Weak and Strong Laws of Large Numbers, Central Limit Theorem, and their applications.

Course Grade

Your grade in this course is determined by the points earned through various assessments and activities throughout the semester.

Quizzes: (30% total): Quizzes will be administered for each chapter, covering the following topics:
- Chapter 1: Combinatorial Analysis.
- Chapter 2: Axioms of Probability.
- Chapter 3: Conditional Probability and Independence.
- Chapter 4 (Part 1): Discrete Random Variables.
- Chapter 4 (Part 2): Discrete Random Variables.
- Chapter 5: Continuous Random Variables.
- Chapter 6: Jointly Distributed Random Variables.
- Chapter 7 (Part 1): Properties of Expectation.
- Chapter 7 (Part 2): Properties of Expectation.
- Chapter 8: Limit Theorems.

Tests: (60%): Four tests will be administered during the semester:
- **Test 1:** Covers Chapters 1-3.
- **Test 2:** Covers Chapter 4 (Parts 1 and 2).
- **Test 3:** Covers Chapters 5-6.
- **Test 4:** Covers Chapters 7-8.

Attendance and Participation: (10%): egular attendance and active participation in class discussions and activities are essential for success in this course.
- All students begin with the maximum participation score.

- Points may be deducted for unexcused absences or lack of engagement.

Bonus Reflection Assignment: (Optional, up to 10% extra credit):

During the semester, students will have the opportunity to complete optional reflection assignments for extra credit. Each assignment will ask students to:

- Reflect on the concepts covered in class.
- Relate the material to real-world examples or personal experiences.

Students can complete one or more assignments to earn up to 10% extra credit. These assignments are optional and will not negatively impact your grade.

Points earned	Grade
85-100+	A
70-84	B
55-69	C
40-54	D
0-39	F

Course Policies

Email: Information about the course (changes to assignments, reminders, schedules, etc.) will be distributed to students using their BlazerID email address or Canvas. Each student is required to access their UAB email account daily, as these communications represent official university business. This is a requirement for all UAB students. For UAB email account assistance, send an email to userservices@uab.edu, or call 934-3540.

Extended Absences: Attendance is fundamental to course objectives and to the integrity of this course. Courses in the Mathematics Department require a variety of activities that involve interaction with the instructor and/or interaction with other students. Excessive absences and missed assignments (more than 2 weeks) seriously jeopardize a student's ability to successfully complete the course. In the event of excessive absences, students should be prepared to officially withdraw from the course through the Registrar's Office. In cases involving medical hardships, military duty, or other serious personal situations after the withdrawal date for a course, the student may participate in the Academic Policy Appeal (accessed and submitted through Blazernet Links/Forms).

Disability support Services (DSS): UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services for information on accommodations, registration and procedures. If you are registered with Disability Support Services, please contact DSS to discuss accommodations that may be necessary in this course. Disability Support Services can be reached at 934-4205 or www.uab.edu/dss or in the Hill Center Suite 409.

Title IX Statement: UAB is committed to providing an environment that is free from sexual misconduct, which includes gender-based assault, harassment, exploitation, dating and domestic violence, stalking, as well as discrimination based on sex, sexual orientation, gender identity, and gender expression. If you have experienced any of the aforementioned conduct we encourage you to report the incident. For more information about Title IX, policy, reporting, protections, resources and supports, please visit http://www.uab.edu/titleix for UAB's Title IX Policy, UAB's Equal Opportunity, Anti Harassment Policy and Duty to Report and Non-Retaliation Policy.

Academic Misconduct: UAB Faculty expects all members of its academic community to function according to the highest ethical and professional standards. You are expected to be aware of, and rigorously adhere to, the UAB code of conduct with regard to academic honesty and inter-personal relations.

Academic dishonesty and misconduct includes, but is not limited to, acts of abetting, cheating, plagiarism, copying homework, fabrication, and misrepresentation. Candidates are expected to honor the UAB Academic Code of Conduct as detailed in the most current UAB Student Catalog.

Add/Drop and Course Withdrawal: Drop/Add: Deadlines for adding, dropping, or withdrawing from a course and for paying tuition are published in the Academic Calendar available online. Review the Institutional Refund Policy for information on refunds for dropped courses. Withdrawal: To avoid academic penalty, a student must withdraw from a course by the withdrawal deadline shown in the academic calendar and receive a grade of W (withdrawn). Failure to attend class does not constitute a formal drop or withdrawal. Syllabus: This syllabus is subject to changes announced in class.