Math 3160
Probability

Course Instructor

Guojun Gan, PhD, FSA
Office: MONT 438
Email: Guojun.Gan@uconn.edu
Office hours: Monday 9:00am - 10:00am, Wednesday 9am-10am, or by appointment

Course Description

This course provides an introduction to the theory of probability. Sets and counting, probability axioms, conditional probabilities, random variables, limit theorems.

Learning Objectives

Upon successful completion of this course, students will be able to understand and apply the following concepts:

- Combinatorics: product rule and permutations; combinations.
- Axioms of Probability: sample spaces, events and set operations; probability axioms.
- Conditional Probability and Independence: conditional probability and Bayes' rule; probability trees; independent events.
- Discrete Random Variables: probability mass function (PMF), cumulative distribution function (CDF); expectation; variance, moments, moment generating function (MGF). Uniform, Bernoulli, Binomial, Poisson, Geometric, Hypergeometric distributions; expectation, variance, MGF of these RVs.
- Continuous Univariate Random Variables: probability density function (PDF), CDF, expectation, variance, moments, MGF. Uniform, Exponential, Gamma, Normal distributions; expectation, variance, MGF of these RVs. Transformations (functions) of continuous RVs.
- Jointly Distributed Random Variables: joint PMF/PDF, and CDF; marginal distributions; conditional PMF/PDF; conditional expectation and variance; covariance and correlation coefficients.
- Limit Theorems: Weak Law of Large Numbers, Central Limit Theorem, Normal approximations.

Prerequisites

- MATH 2110Q or 2130Q or 2143Q.

- Cannot be taken for credit after passing MATH 3165, 3610, 3621, 3634, 4735.

Textbooks

No textbook is necessary for this class. However, the following references are useful:

- Open source educational materials are provided at the url `https://probability.oer.math.uconn.edu/3160-oer/`
- Guojun Gan, Computational Probability with Python: Theory, Simulation, and Actuarial Applications, CRC Press, 2026 (Code: `https://github.com/ganml/probpython`)

Homework and quizzes

A set of problems will be provided. Each week, you are expected to work on the problems corresponding to that week's lectures. Homework will not be collected; however, there will be ten 15-minute quizzes administered during Wednesday classes. Quiz questions will be very similar to the assigned problems.

Exams

This course has two midterm exams and a final exam. For midterm exams, you can prepare a piece of paper (letter size) with notes on both sides and bring the notes to exams. For the final exam, you can have a 4-page cheatshet.

Course Assessment

Ten Quizzes	20%
Exam 1	20%
Exam 2	20%
Final exam	40%

Quizzes cannot be made up. Of the ten quizzes, the three lowest scores will be replaced by full quiz scores.

Your final grade is determined as follows:

Grade	A	A-	B+	B	B-	C+
Points	[93, 100)	[90, 93)	[87, 90)	[83, 87)	[80, 83)	[77, 80)
Grade	C	C-	D+	D	D-	F
Points	[73, 77)	[70, 73)	[67, 70)	[63, 67)	[60, 63)	[0, 60)

Tentative Schedule

Week	Date	Lecture	Quiz

1	31-Aug-26	Set theory	
1	2-Sep-26	Combinations and permutations	
2	7-Sep-26	No class	
2	9-Sep-26	Probability	Quiz 1
3	14-Sep-26	Conditional probability	
3	16-Sep-26	Random variable	Quiz 2
4	21-Sep-26	Expectation and variance	
4	23-Sep-26	Expectation and variance	Quiz 3
5	28-Sep-26	Review	
5	30-Sep-26	Exam 1	
6	5-Oct-26	Discrete distributions	
6	7-Oct-26	Discrete distributions	Quiz 4
7	12-Oct-26	Continuous distributions	
7	14-Oct-26	Continuous distributions	Quiz 5
8	19-Oct-26	Continuous distributions	
8	21-Oct-26	Joint distributions	Quiz 6
9	26-Oct-26	Joint distributions	
9	28-Oct-26	Joint distributions	
10	2-Nov-26	Collections of random variables	
10	4-Nov-26	Convergence	Quiz 7
11	9-Nov-26	Review	
11	11-Nov-26	Exam 2	
12	16-Nov-26	Convergence	
12	18-Nov-26	Convergence	Quiz 8
13	23-Nov-26	Thanksgiving break	
13	25-Nov-26	Thanksgiving break	Quiz 9
14	30-Nov-26	Limiting theorems	
14	2-Dec-26	Limiting theorems	Quiz 10
15	7-Dec-26	Limiting theorems	
15	9-Dec-26	Review	
16	TBD	Final exam	

Missed Assessment Policy

I expect students to be present for all course assessments. If a midterm assessment is missed, the grade of the missed assessment will be made up by one of the following options:

- Scaling the grades of the remaining assessments to cover the missed assessment.
- A make-up assessment that is different from the original assessment.

For the final exam, the university rules (see `https://registrar.uconn.edu/undergraduate-final-exam-information/`) will be followed.

Academic, Scholarly, and Professional Integrity and Misconduct (ASPIM)

See `https://policy.uconn.edu/2023/07/11/academic-scholarly-and-professional-integrity-and-misconduct-aspim-policy-on/`