



# STA 408 Probability Theory and Applications

Winter 2024

**Course Credits:** 4

**Contact Hours:** 56 hours

**Instructor:** TBA

**Email:** TBA

## **COURSE OBJECTIVES**

Probability theory is a fundamental branch of mathematics that deals with uncertainty, randomness, and chance. This course explores the theoretical foundations of probability and equips students with the knowledge and skills necessary to analyze, model, and make informed decisions in the presence of uncertainty. Modules include elements of combinatorial analysis, conditional probability, stochastic independence and so on.

Upon Completion of this Course, students will be able to:

1. Have a solid foundation in the fundamental principles of probability theory, including concepts such as sample spaces, events, and probability measures;
2. Be able to apply probability theory to practical, real-world problems and scenarios, including risk assessment, decision-making, and statistical analysis;
3. Learn how to calculate probabilities of various events using mathematical techniques, including combinatorics, conditional probability, and Bayes' theorem;
4. Develop practical skills in applying probability theory to fields such as statistics, economics and engineering;
5. Be able to make informed and rational decisions in situations involving uncertainty and risk, with a solid understanding of the associated probabilities.

## **PREREQUISITES**

STA 310 Probability and Stochastic Processes

## **GRADING**



Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
3 Homework	30 Points
2 Exercises	20 Points
Midterm Test	20 Points
Final Exam	30 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F.$$

We reserve the right to make adjustments to the overall grading policy.

## COURSE MATERIALS

### Required Texts:

1. Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, 9th Edition, Cengage Learning, 2016.
2. David F. Anderson; Timo Seppäläinen; Benedek Valkó, *Introduction to Probability*, Cambridge University Press, 1st Edition, 2018.

### Recommended (Optional) Texts or Other Materials:

None

## COURSE TOPICS

MODULE	TASKS
Module 1	<p><b>Topics:</b>  Topic 1: Sample Spaces and Events  Topic 2: Axioms, Interpretations, and Properties of Probability  Topic 3: Conditional Probability  Topic 4: The Binomial Probability Distribution</p> <p><b>Assessments:</b>  Homework#1</p>



Module 2	<b>Topics:</b> Topic 5: Continuous Random Variables and Probability Distributions Topic 6: Cumulative Distribution Functions and Expected Values Topic 7: Joint Probability Distributions and Random Samples Topic 8: Expected Values, Covariance, and Correlation <b>Assessments:</b> Homework#2 Exercise#1
Module 3	<b>Topics:</b> Topic 9: Probability Distributions for Discrete Random Variables Topic 10: Continuous Random Variables and Probability Distributions Topic 11: Random Variables Topic 12: The Analysis of Variance <b>Assessments:</b> Homework#3 Midterm Test
Module 4	<b>Topics:</b> Topic 13: Single-Factor ANOVA Topic 14: Bayes' formula Topic 15: Independent trials Topic 16: Further topics on sampling and independence <b>Assessments:</b> Exercise#2
Module 5	<b>Topics:</b> Topic 17: Sums and symmetry Topic 18: Transforms and transformations Topic 19: Moment generating function Topic 20: Tail bounds and limit theorems <b>Assessments:</b> Final Exam

## ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning



and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

### **LEARNING REQUIREMENTS**

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- 1) Late assignments are not acceptable and are subjected to grade deductions.
- 2) Assignments submitted in the wrong format will be counted as not submitted.
- 3) Failure to submit or fulfill any required course component results in failure of the class.
- 4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
- 5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

### **TECHNOLOGY POLICY**

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The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

### **ACADEMIC INTEGRITY POLICY**

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Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.



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## **DISABILITY ACCOMMODATION**

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.