MATH 3305: INTRO TO PROBABILITY AND STATISTICS

FALL 2025

MEETING TIME & LOCATION:

- Section **007**: TR 3:30 - 4:50 PM, Ingram Hall 3204
- Section **011**: TR 9:30 - 10:50 AM, Jowers Center A204

INSTRUCTOR: Qiang Zhao, Ph.D.   **OFFICE**: MCS 481

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OFFICE HOURS: TR 11:30 AM - 12:30 PM, 1:00 - 3:00 PM (MCS 481 or on Zoom), and by appointment.

PREREQUISITES: MATH 2472 (Calculus II) with a grade of C or above. You are expected to be able to differentiate and integrate functions.

TOPICS: This is a calculus-based probability and statistics course. Topics include probability, conditional probability, discrete and continuous random variables, univariate and bivariate distributions of random variables, mathematical expectations, moment-generating functions, and distributions of functions of random variables.

GOAL AND OBJECTIVES: The goal of this course is to introduce the concepts and properties of probability, random variables and their probability distributions and help students develop skills to apply them to solve practical problems. After successful completion of the course, students will be able to:

- Determine sample spaces of random experiments and solve probabilities using permutation/combination techniques and the complement, addition, and multiplication rules.
- Understand and determine independent events and mutually exclusive events.
- Distinguish discrete and continuous random variables and their probability distributions, compute probabilities using the distributional functions, and derive the mathematical expectations of an arbitrary function of random variable(s).
- Identify, formulate, and solve real-world problems using appropriate common distributional models, both discrete (binomial, negative binomial, and Poisson) and continuous (uniform, gamma, normal).
- Handle joint distributions when two or more random variables are involved.
- Transform random variables and derive their distributions using transformation techniques.

REQUIRED TEXT: *Probability: An Introduction with Statistical Applications*, 2nd ed. by John J. Kinney published by Wiley. ISBN 978-1-118-94708-1. A free e-book is available at Alkek library, but the page numbers may differ.

CANVAS: Students are expected to check the course Canvas site frequently for announcements, assignments, solutions, grades, etc., which will be updated regularly. In addition, you are strongly encouraged to use *Discussions* to post any questions or comments you may have about a topic, assignment, or technical issue.
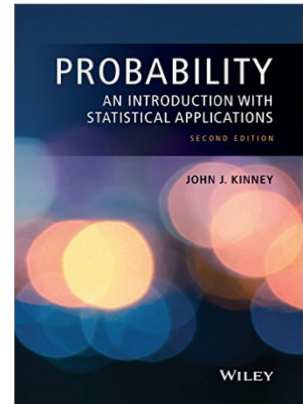
CALCULATOR: A basic scientific calculator that will add, subtract, multiply, divide, compute factorials, and raise numbers to powers is required although a TI-83/84 graphing calculator is strongly recommended due to their built-in statistical functions. You will be allowed to use a calculator on all exams and quizzes, but you are not allowed to share a calculator or use wireless devices such as a cell phone as a calculator.

HOMEWORK: *Practice makes perfect*. Homework will be assigned regularly. Homework problems may be more challenging than class examples. To gain understanding of the topics, do not use answers directly from artificial intelligence tools such as ChatGPT, Gemini, Co-Pilot, etc. Show work to receive full/partial credit. Only providing answers is not enough. Submit your homework electronically by uploading a single PDF file to Canvas. A free phone app (e.g., *Adobe Scan*) can help create such a file. No late homework will be accepted. However, the lowest score will be dropped in determining your homework total. All or a subset of the assigned problems will be graded. It is very important that you complete all problems of an assignment. Solutions will be posted after homework is collected or returned in Canvas under *Files > solutions*. Be sure to check your work with the solutions.

EXAMS: Two exams and a comprehensive final exam will be given in class. All exams MUST be taken as scheduled except in extreme situations, in which valid documentation must be provided.

ATTENDANCE & QUIZZES: Class attendance is expected and participation in and outside of class is encouraged. If you have to miss a class, be sure to get notes from someone in class and make up the missed content. Good attendance and participation may be taken into consideration in case of a borderline grade. To encourage class attendance and participation, several quizzes will given. Most problems on the quizzes are based on review of basics, materials newly covered, or concepts emphasized. In general, there is NO make-

up for quizzes even if you have excuses, but the lowest quiz score will be dropped when determining your quiz total.

EVALUATION: Students will be evaluated based on their performance on exams, homework and participation as illustrated below.

Component	Date	Points
Exam 1	Tue 9/23 (tentative)	100
Exam 2	Tue 11/04 (tentative)	100
Final	Section 007: 2:00-4:30 PM, Tue Dec. 9 Section 011: 8:00-10:30 AM, Tue Dec. 9	120
Homework	Various	120
Quizzes	Various	60
Total		**500**

A curve may be given for each exam depending on overall performance. If no curve is given, A: 450-500, B: 400-449, , C: 350-399, D: 300-349, and F: < 300.

EXTRA CREDIT:

- Two bonus points for posting or replying ≥ 5 messages in the Canvas *Discussions*.
- One point for visiting your instructor's office hours.

NO extra credit will be given to individual students. Your grade in this course is basically based on the two mid-term exams, final exam, homework, and quizzes.

DROP DEADLINES:
- Sept. 10, Wednesday: Last day to drop with No Record on Transcript.
- Oct. 27, Monday: Last day to drop with an Automatic W Grade.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES: If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at 245-3451 or ods@txstate.edu, to obtain an accommodations letter. Please share the accommodations letter with me during the first two weeks of the class.

RESOURCES:

- Your instructor
- Tutor.com: Canvas > Tutor.com 24/7 Online Tutoring :-)
- Math CATS: Derrick Hall 238
  https://www.math.txst.edu/resources-forms/student-resources/mathcats.html
- Collaborative Learning Center: Ingram Hall 3202
  https://hlsamp.cose.txstate.edu/clc.html
- Student Learning Assistance Center: 4th floor of Alkek Library
  https://www.txstate.edu/slac/

COMPUTE YOUR GRADE IN CASE OF CURVES

Component	Low A	Low B	Low C	Low D
Exam 1	a_1	b_1	c_1	d_1
Exam 2	a_2	b_2	c_2	d_2
Final	a_f	b_f	c_f	d_f
Homework	$a_h = 108$	$b_h = 96$	$c_h = 84$	$d_h = 72$
Quiz	$a_q = 54$	$b_q = 48$	$c_q = 42$	$d_q = 36$

1. Compute your course total, T, by adding the following scores you receive:

    (a) Exam 1 score

    (b) Exam 2 score

    (c) Final exam score

    (d) Converted homework score (to a maximum of 120): compute a percentage for each assignment, average the percentages after dropping the lowest one, and then multiply the average by 1.2. For example, if your average is 85% after dropping the lowest, your converted homework score is $85\% \times 120 = 102$.

    (e) Converted quiz score (to a maximum of 60)

2. Compare T with the sum of the A cutoffs. You get an "A" if $T \geq (a_1+a_2+a_f+a_h+a_q)$. Otherwise, you compare T with the sum of the B cutoffs. You get a "B" if $T \geq (b_1 + b_2 + b_f + b_h + b_q)$. It will be similar to check for "C" or "D".

TEACHING SCHEDULE (tentative):

Week	Day	Sections	Topics
1	08/26 T	1.1	Syllabus; Introduction; Experiments; Sample Space
	08/28 R	1.2	Events; Axioms of Probability
2	09/02 T		Labor Day (no class)
	09/04 R	1.3	Probability Theorems
3	09/09 T	1.7	Counting Techniques
	09/11 R	1.4	Conditional Probability; Multiplication Rule; Independent events
4	09/16 T	1.4	Law of Total Probability; Bayes's Theorem
	09/18 R	1.5-1.6	Some Examples; Reliability of Systems
5	09/23 T		Exam 1 (tentative)
	09/25 R	2.1	Discrete Random Variables (R.V.'s); Probability Mass Function
6	09/30 T	2.2	(Cumulative) Distribution Function
	10/02 R	2.3	Expected Values, Mean, Variance, and Standard Deviation of Discrete R.V.'s
7	10/07 T	2.1, 2.10	Discrete Uniform Distribution; Hypergeometric Distribution
	10/09 R	2.4	Bernoulli Trials; Bernoulli Distribution; Binomial Distribution
8	10/14 T	4.8	Moment Generating Functions
	10/16 R	2.5	Mean and Variance of Binomial Distribution
9	10/21 T	2.9	Geometric and Negative Binomial Distributions
	10/23 R	2.13	Poisson Distribution
10	10/28 T	3.1	Continuous R.V.'s; Probability Density Function; Distribution Function
	10/30 R	3.1	Percentiles; Expected Values, Mean and Variance of Continuous R.V.'s
11	11/04 T		Exam 2 (tentative)
	11/06 R	3.2-3.4	Uniform Distribution; Exponential Distribution
12	11/11 T	3.7	Gamma and Chi-Square Distributions*
	11/13 R	3.5	Normal Distribution
13	11/18 T	4.11	Central Limit Theorem*
	11/20 R	5.1-5.3	Joint and Marginal Probability Distributions; Probabilities
14	11/25 T	5.1-5.3	Conditional Distributions and Densities; Independence
	11/27 R		Thanksgiving (no class)
15	12/02 T	5.4, 5.6	Expected Values; Correlation Coefficient; Bivariate Normal Distribution
	12/04 R	4.3	Distributions of Functions of Random Variables*
16	12/09 T		Final Exam - Section 007: 2:00 - 4:30 PM
			- Section 011: 8:00 - 10:30 AM

Note: (1) Some topics may require more time, therefore the pace of the class may vary. (2) Exam dates may change. (3) Starred topics are optional and covered only when time permits.

Important Messages from the University

Our Mission and Our Shared Values

Mission
Texas State University is a doctoral-granting, student-centered institution dedicated to excellence and innovation in teaching, research, including creative expression, and service. The university strives to create new knowledge, to embrace a diversity of people and ideas, to foster cultural and economic development, and to prepare its graduates to participate fully and freely as citizens of Texas, the nation, and the world.

Shared Values
In pursuing our mission, we, the faculty, staff, and students of Texas State University, are guided by a shared collection of values:

- Teaching and learning based on research, student involvement, and the free exchange of ideas in a supportive environment;
- Research and creative activities that encompass the full range of academic disciplines - research with relevance, from the sciences to the arts, from the theoretical to the applied;
- The cultivation of character, integrity, honesty, civility, compassion, fairness, respect, and ethical behavior in all members of our university community;
- A diversity of people and ideas, a spirit of inclusiveness, a global perspective, and a sense of community as essential conditions for campus life;
- A commitment to service and leadership for the public good;
- Responsible stewardship of our resources and environment; and
- Continued reflection and evaluation to ensure that our strengths as a community always benefit those we serve

Academic Honesty Statement
Learning and teaching take place best in an atmosphere of intellectual fair-minded openness. All members of the academic community are responsible for supporting freedom and openness through rigorous personal standards of honesty and fairness. Plagiarism and other forms of academic dishonesty undermine the very purpose are outlined in the student handbook. All academic dishonesty issues will be taken quite seriously. Please be sure that you are familiar with the University Honor Code: UPPS 07.10.01

Sexual Misconduct Reporting (SB 212)
Effective January 2, 2020, state law (SB 212) requires all university employees, acting in the course and scope of employment, who witness or receive information concerning an incident of sexual misconduct involving an enrolled student or employee to report all relevant information known about the incident to the university's Title IX Coordinator or Deputy Title IX coordinator. According to SB 212, employees who knowingly fail to report or knowingly file a false report shall be terminated in accordance with university policy and The Texas State University System Rules and Regulations.