SDS 321 (Unique # 57404)

Introduction to Probability and Statistics

Fall 2024, MW 3:00-4:30pm

Instructor:	Bindu Viswanathan, Ph.D.	**Office**	MW 11:30-12:30 @ GDC 7.509,
Email:	bindu@austin.utexas.edu	**hours:**	or by appointment

Course Description

This course provides an introduction to probability and statistics. The first part of the course covers the fundamentals of probability theory, including discrete and continuous random variables, multiple random variables, and limit theorems. This section of the course will also cover the application of probability to counting problems. The second part of the course will focus on classical statistical inference, covering parameter estimation, hypothesis testing, and confidence intervals.

Prerequisites: Students are expected to have a good familiarity with Calculus I. No previous experience with probability or statistics is assumed.

Learning Objectives

At the end of this class, you should be well-versed with the following concepts, tools and techniques, and be able to

- Use the basic tools of counting techniques to calculate probabilities, compute probability mass functions, probability density functions, and cumulative density functions.
- Know to work with commonly used discrete distributions such as Binomial, Poisson and Geometric, and common continuous distributions such as uniform, exponential, and normal, and be able to compute their expected values, variances, density and distribution functions.
- Understand the properties of independence in random variables.
- Compute joint and conditional probability distributions, distributions of functions of random variables, and Convolutions. Compute covariances and correlations.
- Be familiar with limit theorems, Markov and Chebychev inequalities, WLLN and CLT.

Grading

Your course grade will be determined based on your performance on two in-class exams, a comprehensive in-class final exam, and weekly homework. Eleven HW sets (worth 10 points each) will be assigned, and you will be allowed to drop one of them. All HWs will be posted on Fridays and due the next Friday at 11:59pm on Canvas.

Exam 1:	100 points
Exam 2:	100 points
Comprehensive Final:	100 points
Homework:	100 points
Total:	**400 points**

Grade Distribution:

376 - 400	A	304 - <320	C+
360 - <376	A-	292 - <304	C
344 - <360	B+	280 - <292	C-
332 - <344	B	240 - <280	D
320 - <332	B-	Below 240	F

Optional Textbook
Introduction to Probability. Dimitri P. Bertsekas and John N. Tsitsiklis, 2nd edition. Athena Scientific. Note that the first edition does not cover the statistics portion of the course.

Example Textbooks for Reference:
Mathematical Statistics with Resampling and R by Chihara and Hesterberg
Foundations and Applications of Statistics by Pruim

Online Resource:
MIT Open CourseWare: Introduction to Probability and Statistics
https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/

Homework
I will post weekly homework assignments: Eleven sets of which I will drop your lowest grade. Homework will be posted on Fridays, and will be due a minute before midnight (11:59pm) on Canvas one week later, on the next Friday night.

You are encouraged to work together on HWs but each student must write up the HW in their own words and show all work; see also the section on academic integrity, below. HW are to be turned in on Canvas by the date and time due. HW turned in any other way won't be accepted, e.g., emailed to me or the TA, left under someone's office door, or in the SDS office.

Requests for Re-grade: Re-grading requests must be submitted in writing (via email) within one week (7 days) of the HW/exam's return. Comments made on Canvas during HW submissions may not get a response – so if you want to contact the professor or the TA, email us directly.

Quantitative Reasoning: This course carries the Quantitative Reasoning flag. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.

Attendance: A student who misses classes or other required activities, including examinations, for the observance of a religious holy day should inform the instructor as far in advance of the absence as possible, so that arrangements can be made to complete an assignment within a reasonable time after the absence.

Students with Disabilities: The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Disability and Access (D&A). Please refer to D&A's website for contact and more information: http://disability.utexas.edu/. If you are already registered with D&A, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.

Academic Integrity: As mentioned above, during in-class work and on homework, unless specified otherwise, you are encouraged to work together but must write up your assignment in your own words. Students who violate these or University rules on academic misconduct are subject to the student conduct process and potential disciplinary action. A student found responsible for academic misconduct may be assigned both a status sanction and a grade impact for the course. The grade impact could range from a zero on the assignment in question up to a failing grade in the course. A status sanction can range from probation, deferred suspension and/or dismissal from the University. To learn more about academic integrity standards, tips for avoiding a potential academic misconduct violation, and the overall conduct process, please visit the Student Conduct and Academic Integrity website at http://deanofstudents.utexas.edu/conduct.

Sharing of Course Materials is Prohibited: No materials used in this class, (including, but not limited to, lecture notes or hand-outs, videos, assessments [quizzes, exams, papers, projects, home- work assignments], review sheets, sample code, solutions, and additional problem sets) may be shared online or with anyone outside of the class without explicit, written permission of the instructor. Unauthorized sharing of materials promotes cheating. The University is aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in initiation of the student conduct process and include charge(s) for academic misconduct, potentially resulting in sanctions, including a grade impact.

AI/ Chat GPT: See https://security.utexas.edu/ai-tools for acceptable use of AI tools at UT Austin.

SDS 321 Calendar – Fall 2024

Please note this calendar is subject to flexibility- as long as you come to class you will always know where we are in the progression.

Week	Day	Date	Topics	Chapters
1	Mon	8/26	Overview, logistics and axioms of probability	1.1
	Wed	8/28	Axioms of probability and conditional probability	1.2
2	***Labor Day, Mon 9/2***			
	Wed	9/4	Conditional probability & Bayes Rule	1.3, 1.4
3	Mon	9/9	Statistical Independence	1.5
	Wed	9/11	Conditional independence and intro to counting	1.6
4	Mon	9/16	Counting	1.6
	Wed	9/18	Counting	
5	Mon	9/23	Counting and discrete random variables	1.6, 2.1
	Wed	9/25	More discrete random variables	2.1-2.2
6	Mon	9/30	Functions of Random Variables and CDF	2.3
	Wed	**10/2**	**Exam 1**	2.4
7	Mon	10/7	Expectation and variance	2.5-2.8
	Wed	10/9	Joint, Marginal and Conditional PMFs etc.	2.5-2.8
8	Mon	10/14	Joint, Marginal and Conditional PMFs etc.	2.5-2.8
	Wed	10/16	Mean and Variance of Common Discrete Distributions	
9	Mon	10/21	Continuous RVs: Common Continuous Distributions	3.1-3.2
	Wed	10/23	Continuous RVs: Normal Distribution	3.3
10	Mon	10/28	Continuous RVs: joint distribution, marginal and conditional distributions	3.4-3.5
	Wed	10/30	Continuous RVs: joint, marginal and conditional PDFs	3.4-3.5
11	Mon	11/4	Bayes Theorem for Random Variables	3.6
	Wed	11/6	Derived distributions	4.1
12	Mon	11/11	Derived Distributions	4.1
	Wed	**11/13**	**Exam 2**	
13	Mon	11/18	Covariance and Correlation	4.2
	Wed	11/20	Conditional Expectation and Conditional Variance	4.3
Thanksgiving, Nov 25-30				
14	Mon	12/2	Conditional Expectation and Conditional Variance	4.5
	Wed	12/4	Markov & Chebychev Inequalities, WLLN, CLT	5.1-5.4
15	Mon	12/9	Markov & Chebychev Inequalities, WLLN, CLT	

Comprehensive Final Exam: Saturday Dec 14th 7-9pm