

26:960:575, Introduction to Probability

Fall 2023; Wednesday 1pm~3:50pm, 1WP-303

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Office Hours: Wednesday 10am~11am

COURSE DESCRIPTION

This is a first course in probability that does not assume any prior knowledge on the subject. It will provide an introduction to mathematical concepts and methods that find extensive use in many fields of modern Data Science and Operations Research. The course will have a theoretical focus, but theory will be motivated and illustrated with examples from areas such as business and engineering. The course will broadly follow Ross's *A First Course in Probability*.

Course Delivery Mode: in-person.

Learning Management System: Canvas.

Hardware and software requirements: A desktop or laptop with standard Microsoft software. Students should be able to download most needed software from RU software portal:

<https://it.rutgers.edu/software-portal/>

COURSE MATERIALS (texts to be referenced)

Text: Ross, S.M. 2019. *A First Course in Probability*, 10th Edition.

Recommended: Feller, W. 1967. *An Introduction to Probability Theory and Its Applications*, 3rd Edition.

LEARNING GOALS AND OBJECTIVES

This course will introduce students to some of the important probability concepts. These include random variables, independence, sums of independent random variables, laws of large numbers, central limit problem, conditional probability and expectation.

PREQUISITES

Graduate students who have finished a basic course in calculus are allowed to take the course. In particular, students are expected to know

Basic differentiation and partial differentiation of standard functions and how to use the chain rule and product rule - Definite and indefinite integrals using integration by parts and substitution

- How to evaluate a basic double integral

- L'Hôpital's rule

ACADEMIC INTEGRITY

I do NOT tolerate cheating. Students are responsible for understanding the RU Academic Integrity Policy (https://slwordpress.rutgers.edu/academicintegrity/wp-content/uploads/sites/41/2014/11/AI_Policy_2013.pdf)

I will strongly enforce this Policy and pursue *all* violations. On all examinations and assignments, students must sign the RU Honor Pledge, which states, "On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment." Don't let cheating destroy your hard-earned opportunity to learn. See business.rutgers.edu/ai for more details.

ATTENDANCE AND PREPARATION POLICY

Expect me to attend all class sessions. I expect the same of you. If I am to be absent, my department chair or I will send you notice via email and Blackboard as far in advance as possible. If you are to be absent, report your absence in advance at <https://sims.rutgers.edu/ssra/>. If your absence is due to religious observance, a Rutgers-approved activity, illness, or family emergency/death and you seek makeup work, also send me an email with full details and supporting documentation one week ahead of the occurrence.

For weather emergencies, consult the campus home page. If the campus is open, class will be held. Expect me to arrive on time for each class session. I expect the same of you. Expect me to remain for the entirety of each class session. I expect the same of you. Expect me to prepare properly for each class session. I expect the same of you. Complete all background reading and assignments. You cannot learn if you are not prepared. Expect me to participate fully in each class session. I expect the same of you. Stay focused and involved. You cannot learn if you are not paying attention.

CLASSROOM CONDUCT

Cell phones or any other course-unrelated electronic devices are banned from class.

EXAM DATES AND POLICIES

There are two exams. During exams, the following rules apply:

- You are allowed a one-page cram sheet (letter size, front and back) of your own handwriting.
 - If you have a disability that influences testing procedures, provide me an official letter from the Office of Disability Services at the start of the semester.
 - No cell phones or other electronics are allowed in the testing room.
 - Alternate seating; I reserve the right to decide your seating arrangements. In general, do not sit next to another student or in your usual seat.
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GRADING POLICY

Attendance records at 4 points (each regular lecture counts as 0.4 points and attendance of the 11th lecture as a bonus)

Two homework assignments at 19 points each (38 points in total)

Two exams at 29 points each (58 points in total)

The proposed letter grade assignment is as follows:

F	0—29.999
D	30—49.999
C	50—64.999
C⁺	65—69.999
B	70—84.999
B⁺	85—89.999
A	90—100

Please turn in a hard copy of your answers in class on the due date of your assignment. Late assignments will be penalized 20 points (on the 100 point scale) if turned in up to ONE week late. Assignments in excess of ONE week late will not be accepted. There will be no makeup exam, nor extra credit. Your final grade is not subject to negotiation.

COURSE SCHEDULE (Tentative Course Progress)

Date	Coverage
September 6	1. Chap1: Combinatorial Analysis
September 13	2. Chap2: Axioms of Probability
September 20	3. Chap3: Conditional Probability and Independence
September 27	4. Chap4a: Random Variables and Expectation
October 4	5. Chap4b: Various Discrete Random Variables
October 11	6. Chap5: Various Continuous Random Variables
October 18	Review and HW1 due
October 25	MID-TERM EXAM
November 1	7. Chap6: Jointly Distributed Random Variables
November 8	8. Chap7a: Properties of Expectation
November 15	9. Chap7b: Conditional Expectation and Prediction
November 22	<i>No class due to Thanksgiving class change</i>
November 29	10. Chap8: Limit Theorems

December 6	11. Chap9: Markov Chains and Information Theory
December 13	Review and HW2 due
December 20	FINAL EXAM

SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. More information can be found at ods.rutgers.edu.

[Rutgers University-New Brunswick ODS phone (848)445-6800 or email dsoffice@echo.rutgers.edu]

[Rutgers University-Newark ODS phone (973)353-5375 or email ods@newark.rutgers.edu]

If you are *pregnant*, the Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy.

[Rutgers University-New Brunswick Title IX Coordinator phone (848)932-8200 or email jackie.moran@rutgers.edu]

[Rutgers University-Newark Office of Title IX and ADA Compliance phone (973)353-1906 or email TitleIX@newark.rutgers.edu]

If you seek *religious accommodations*, the Office of the Dean of Students is available to verify absences for religious observance, as needed.

[Rutgers University-New Brunswick Dean of Students phone (848)932-2300 or email deanofstudents@echo.rutgers.edu]

[Rutgers University-Newark Dean of Students phone (973)353-5063 or email DeanofStudents@newark.rutgers.edu]

If you have experienced any form of *gender or sex-based discrimination or harassment*, including sexual assault, sexual harassment, relationship violence, or stalking, the Office for Violence Prevention and Victim Assistance provides help and support. More information can be found at <http://vpva.rutgers.edu/>.

[Rutgers University-New Brunswick incident report link: <http://studentconduct.rutgers.edu/concern/>. You may contact the Office for Violence Prevention and Victim Assistance at (848)932-1181]

[Rutgers University-Newark incident report link: https://cm.maxient.com/reportingform.php?RutgersUniv&layout_id=7 . You may also contact the Office of Title IX and ADA Compliance at (973)353-1906 or email at TitleIX@newark.rutgers.edu. If you wish to speak with a staff member who is confidential and

does **not** have a reporting responsibility, you may contact the Office for Violence Prevention and Victim Assistance at (973)353-1918 or email run.vpva@rutgers.edu]

If students who have experienced a temporary condition or injury that is adversely affecting their ability to fully participate, you should submit a request via <https://temporaryconditions.rutgers.edu>.

If you are a military **veteran** or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. <http://veterans.rutgers.edu/>

If you are in need of **mental health** services, please use our readily available services.
[Rutgers University-Newark Counseling Center: <http://counseling.newark.rutgers.edu/>]
[Rutgers Counseling and Psychological Services–New Brunswick: <http://rhscaps.rutgers.edu/>]

If you are in need of **physical health** services, please use our readily available services.
[Rutgers Health Services – Newark: <http://health.newark.rutgers.edu/>]
[Rutgers Health Services – New Brunswick: <http://health.rutgers.edu/>]

If you are in need of **legal** services, please use our readily available services:
<http://rusls.rutgers.edu/>

Students experiencing difficulty in courses due to **English as a second language (ESL)** should contact the Program in American Language Studies for supports.
[Rutgers–Newark: PALS@newark.rutgers.edu]
[Rutgers–New Brunswick: eslpals@english.rutgers.edu]

If you are in need of additional **academic assistance**, please use our readily available services.
[Rutgers University-Newark Learning Center: <http://www.ncas.rutgers.edu/rlc>]
[Rutgers University-Newark Writing Center: <http://www.ncas.rutgers.edu/writingcenter>]
[Rutgers University-New Brunswick Learning Center: <https://rlc.rutgers.edu/>]

[Optional items that many faculty include:

- Students must sign, date, and return a statement declaring that they understand the RU Academic Integrity Policy.
- Students must sign, date, and return a statement declaring that they understand this syllabus.]

CODE OF PROFESSIONAL CONDUCT

[If you prefer to direct students to the conduct policy online instead, please use the following link and place it beneath the header above:
<https://myrbs.business.rutgers.edu/students/code-professional-conduct>]

Rutgers Business School is recognized for its high-quality education. To that end, maintaining the caliber of classroom excellence requires students to adhere to the same behaviors that are expected in professional career environments. These include the following principles:

Discussion and Correspondence

- Each student is encouraged to take an active part in class discussions and activities. Substantive dialogue requires a degree of mutual respect, willingness to listen, and tolerance of opposing points of view. Disagreement and the challenging of ideas must happen in a supportive and sensitive manner. Hostility and disrespectful behavior will not be tolerated.
- In both correspondence and the classroom, students should demonstrate respect in the way they address instructors. Students should use proper titles in addressing instructors unless there is an explicit understanding that the instructor accepts less formal address. Similarly, appropriate formatting in electronic communication, as well as timely responsiveness, are all expectations in every professional interaction, including with instructors. Everything said and written should demonstrate respect and goodwill.

Punctuality and Disruption

- Class starts and ends promptly at the assigned periods. Students are expected to be in their seats and ready to begin class on time.
- Packing belongings before the end of class is disruptive to both other students and the instructor. Barring emergencies and within reason, students are expected to remain in their seats for the duration of the class.

Technology

- The use of other technology is sanctioned only as permitted by the course instructor. As research on learning shows, peripheral use of technology in classes negatively impacts the learning environment in three ways:
 1. Individual learning and performance directly suffer, resulting in the systemic lowering of grades earned.
 2. One student's use of technology automatically diverts and captures other people's attention, thus impeding their learning and performance. Moreover, even minor infractions have a spillover effect and result in others doing the same.
 3. Subverting this policy (e.g., using a phone during class, even if hidden below the table; tapping on a smartwatch; using a laptop for non-course related matters) is evident to the course instructor and offensive to the principles of decorum in a learning environment.
- Networking, computing, and associated resources in the trading rooms, advanced technology rooms, and general classrooms are to be used in the manner intended.

- Sharing links for unrelated materials, attempting to join an online class that you are not enrolled in, or posting disruptive content during online class sessions are strictly prohibited and may lead to disciplinary action.
- For more instructions on information technology resources at Rutgers University, please refer to the [Acceptable Use Policy for Information Technology Resources](#).

Misappropriating Intellectual Property

- Almost all original work that is available to you is subject to claims of copyright by its creators or copyright holders. These copyright holders may include publishers, authors, professors, the University, RBS, and in some cases, your fellow students. The protected materials may include but are not limited to syllabi, recorded lectures, PowerPoint presentations, and other recorded, printed, or electronically stored media. These materials are only limited to completing the requirements of the class.
- Unauthorized use includes such things as copying, sharing, forwarding, selling, renting, online posting, publication, or any other form of distribution of these materials without the written permission of the copyright holder. Such misconduct may potentially subject you to disciplinary action by the University, significant civil penalties, and even severe criminal sanctions.
- For more instructions on copyright protections at Rutgers University, please refer to the [Rutgers Libraries](#).

Rutgers Business School is committed to the highest standards of integrity. We value mutual respect and responsibility, as these are fundamental to our educational excellence both inside and outside the classroom.