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Course Description: This course is a comprehensive introduction to the abstract theory of probability, as a language for interpreting and analyzing problems in statistics, natural and social sciences, and philosophy. Emphasis will be placed on refinement of problem-solving and mathematical modeling skills.

Prerequisites: MATH113 and MATH202, or Instructor Consent.

Textbook: *Introduction to Probability*, 2nd Edition by Blitzstein and Hwang. We will cover chapters 1 through 10. Reading assignments will be given on frequent basis, so daily access to the textbook is highly recommended. A free online copy of the textbook is available through the Reed library website.

Course Website: Documents, a daily schedule, assignments, and discussions will be posted on our Moodle page at `https://moodle.reed.edu`.

Technology: We will make frequent use of the R programming language to perform routine calculations and create probability models. Instructions for using R and RStudio are available on the course Moodle page. Calculators may be used on problem sets, but unless otherwise noted, no calculators or other electronic devices may be used on quizzes or exams.

Communication: If you would like to contact me, I can most easily be reached by email weekdays between 10am and 6pm. While I try to answer email as soon as possible, in some cases, I may not be able to respond until the following school day. You are also welcome to stop by my office outside of office hours—I usually have at least a few free minutes to help.

Course Outcomes: By the end of the course, a student should be able to:

1. Describe uncertainty and randomness using the axiomatic language of sets and functions.
2. Incorporate new observations into a probability model using conditional probability and independence.
3. Quantify, predict, and analyze the outcomes of random experiments using both discrete and continuous random variables.
4. Calculate the expected value, variance and quantiles of common discrete and continuous random variables.
5. Summarize and specify a random variable using its moments and moment generating function.
6. Compare and describe multiple random variables using joint, marginal, and conditional distributions, along with covariance and correlation.
7. Obtain and analyze new random variables by applying transformations to a class of elementary distributions.
8. Estimate outcomes of experiments based on existing evidence, and describe the result using conditional expectation and conditional variance.
9. Determine the limit of a sequence of random variables, and characterize the limit's mean and fluctuations using inequalities.
10. Create and sample from probability models using the R programming language.

Grading Criteria:
Your grade in the class will be determined by your proficiency in each of the *Course Outcomes*, as demonstrated in the following assessments:

1) Daily Readings 2) Homework 3) Participation 4) Midterm Exams 5) Final Exam

Daily Reading: Mathematical knowledge takes time to develop, and understanding deepens upon revisiting a concept a 2^{nd}, 3^{rd}, or n^{th} time. Studying basic terminology and elementary examples in the textbook before class means that lectures can be spent clarifying and expanding ideas, rather than introducing them. Daily reading assignments will be posted on the Moodle course page. These assignments will list the specific section(s) to read for each day, along with several basic questions to check comprehension. Answers are due by 8am each day of class (to give me time to review them before class), and can be submitted by following the same link on Moodle where the assignment was found and then either a) uploading a typed assignment or a clear and legible picture of a handwritten assignment, or b) typing directly into the text-box. Up to three daily reading assignments may be missed without penalty.

Homework: Each week, a written assignment will be posted on Moodle, to be completed and submitted on paper in my office or electronically on Moodle by 5pm on the following Friday. These assignments will usually include one or two longer or more challenging problem, along with several more routine problems and exercises. Solutions to each problem may be either hand-written or typed, must be in complete sentences, and must include a brief explanation of reasoning. Up to twice throughout the term, you may request a five day extension on your homework. Except in extraordinary circumstances, requests must be made prior to an assignment's due date.

In-class Participation: Once per week (usually on Fridays), a significant portion of class will be devoted to the investigation and discussion of an open-ended problem or paradoxical phenomenon in probability. Topics and timings for these discussions will be posted in advance. Following each discussion, you will be asked to write a follow-up response or to solve a related problem before the start of the next class.

Midterm Exams: Two 50-minute midterm exams will be given during the term: tentatively, the first is scheduled for Friday, October 4 (Week 5), and the second for Friday, November 8 (Week 10). If you foresee a conflict with the scheduled time for one of the exams, please notify me during the first week of class so that appropriate arrangements can be made. Except in extraordinary circumstances, exams cannot be made up after the exam date. However, if an emergency prevents you from taking an exam, *notify me as soon as possible.*

Final Exam: A cumulative three-hour final exam will be given during Finals Week, as scheduled by the Registrar.

Accessibility: Reed College is dedicated to creating inclusive learning environments. Please notify me as soon as possible if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation. You are also encouraged to contact Disability Support Services at disability-services@reed.edu, and to peruse the services offered on their website at `https://www.reed.edu/disability_services/`.

Academic Integrity: Students are allowed and encouraged to collaborate on most in-class and homework assignments. However, any work that you turn in for grading must be your own. You are welcome to use internet resources to supplement content we cover in this course, with the exception of solutions to homework problems. Copying solutions from the internet is an Honor Principle violation. Exams will be closed book, closed notes, and closed colleague, unless otherwise specified. All written work that references material outside of the textbook or lecture should be accompanied by an appropriate citation.

Tentative Schedule: (Section numbers from Bltizstein and Hwang's *Intro to Probability*)

Week	**Sections Covered**	**Week**	**Sections Covered**
1	1.1 - 1.6	9	7.1 - 7.5
2	2.1 - 2.8	10	8.1 - 8.3 (Midterm 2)
3	3.1 - 3.9	11	8.4 - 8.6, 9.1 - 9.5
4	4.1 - 4.6	12	10.1 - 10.4
5	4.7 - 4.9 (Midterm 1)	13	Special Topics
6	5.1 - 5.4	14	Special Topics
7	5.5 - 5.7, 6.1 - 6.6	15	Special Topics
8	Fall Break (No Class)	16	Final Exam