

MATH 464 - THEORY OF PROBABILITY

Fall 2019

Instructor: Vahan Huroyan

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Lecture: Tu Th 11:00AM – 12:15PM

Lecture Location: Communication, Rm 113.

Course Webpage: <https://vahan.huroyan.com/math464.html>

Textbook:

“Introduction to Probability” by David F. Anderson, Benedek Valkó, Timo Seppäläinen

Course Goals and Objectives:

This course will serve as an introduction to the study of theory of probability. Topics covered include probability spaces, axioms of probability, random variables, various discrete and continuous probability distributions, expectations, moment generating functions, laws of large numbers, central limit theorem.

Prerequisites:

MATH 323, Formal Mathematical Reasoning and Writing or instructor permission.

Homework:

There will be weekly or biweekly homework (depending on the hardness of the material). The one with the lowest score will be dropped.

Exams:

There will be 2 midterms and one final exam

Midterm 1: *October 10, 2019*

Midterm 2: *November 21, 2019*

Final Exam: *10:30am-12:30am December 17, 2019*

Grading Policy:

Homework: total 25%; 2 midterms: total 40% (20% each); final exam (35%).

Learning Outcomes:

Upon completion of the course, the student will

1. be able to think probabilistically, and be familiar with the glossary of probability and statistics;

2. be able to interpret, explain, and apply probabilistic concepts such as probability, conditional probability, independence, expectations;
3. be able to set up and interpret probability models for variety of chance experiments;
4. understand the relationship between random variables and their distributions / densities;
5. understand the meaning, scope, and consequences of the Law of Large Numbers and the Central Limit Theorem, including the meaning of convergence in distribution and convergence with probability 1;
6. be able to interpret and do calculations with the most common probability distributions, e.g., the normal, the exponential, and the uniform distributions.

Tentative schedule of topics and activities:

- Week 1 Axioms of probability, sampling, review of counting, infinitely many outcomes, review of the geometric series (Sections 1.1-1.3)
- Week 2 Rules of probability, random variables, conditional probability (Sections 1.4, 1.5, 2.1)
- Week 3 Bayes' formula, independence, independent trials (Sections 2.2, 2.3, 2.4)
- Week 4 Independent trials, birthday problem, conditional independence, probability distribution of a random variable (Sections 2.4, 2.5, 3.1)
- Week 5 Cumulative distribution function, expectation and variance (Sections 3.2, 3.3, 3.4)
- Week 6 Gaussian distribution, normal approximation and law of large numbers for the binomial distribution (Sections, 3.5, 4.1, 4.2).
- Week 7 Application of normal approximation, Poisson approximation, exponential distribution (Sections 4.3, 4.4, 4.5).
- Week 8 Moment generating function, distribution of a function of a random variable (Sections 5.1, 5.2)
- Week 9 Joint distribution (Sections 6.1, 6.2)
- Week 10 Joint distribution and independence, sums of independent random variables, exchangeability (Sections, 6.3, 7.1, 7.2)
- Week 11 Expectations of sums and products, variance of sums (Sections 8.1, 8.2)
- Week 12 Sums and moment generating functions, covariance and correlation (Sections 8.3, 8.4)
- Week 13 Markov's and Chebyshev's inequalities, law of large numbers, central limit theorem (Section 9.1-9.3)
- Week 14 Conditional distributions (Sections 10.1-10.3)
- Week 15 Conditional distributions, review (Sections 10.1-10.3)
- Week 16 Review

Class Policy:

Regular attendance is essential and expected. No make up exams, quizzes or late submitted homework will be accepted. However, in complex and unusual circumstances, which are beyond your control, a make-up exam may be given on a case-by-case basis. This will require providing a detailed account of the situation and supporting documents. Approval in these cases is at the sole discretion of the instructor and/or the dean of students.

Homework assignments not turned by the due date receive an automatic zero. Extensions may be granted on a case by case basis, either with prior permission of the instructor (a valid reason must be given) or with instructors agreement in cases of emergency. In the latter case, the student must contact the instructor within 24 hours if possible.

Classroom Behavior Policy:

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Threatening Behavior Policy:

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations:

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, <https://drc.arizona.edu/>) to establish reasonable accommodations.

Code of Academic Integrity:

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>. The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.

UA Nondiscrimination and Anti-harassment Policy:

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>.

Academic Honesty:

Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation.

Absence and Class Participation Policies:

The UAs policy concerning Class Attendance, Participation, and Administrative Drops is available at <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>.

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences preapproved by the UA Dean of Students (or deans designee) will be honored. See <http://policy.arizona.edu/employmenthuman-resources/attendance>.

Changes to the Course Syllabus:

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor. In particular, the dates of midterm exams, the number of exams, and the order in which topics are covered may differ from the dates and arrangement in the tentative weekly schedule.