

COURSE OUTLINE

Probability: MATH 451

Instructor

Lecturer Gourab Ray

Research Area Probability theory.

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General Course Information

Number of Units 1.5

Pre-requisites One of MATH 204, MATH 236, MATH 300, MATH 330A, MATH 334; and MATH 352 or STAT 350.

Background in measure theory (e.g. math 435) is not strictly required, and the requisite notions will be introduced in class. Some results from measure theory will be stated without proofs.

Although the topics outlined in Math 352 and Stat 350 are the same, the approach to these courses are quite different. I am going to assume you know several things which were covered in Math 352 during this course, therefore for those of you with Stat 350 background, some topics might seem fast paced.

Office Hours and Assistance

Wednesday 2:00 pm to 3:00 pm, DTB A440

or By appointment (send email to book one)

Other Help The Mathematics & Statistics Assistance Centre is a large space where students can go to work, on their own or in groups, and to discuss math & stats problems. The Centre is staffed with talented Teaching Assistants who are happy to discuss primarily first and second year course material with you. Please see <http://www.math.uvic.ca/~msassist/index.html> for more information.

Math Club Students in Undergraduate Mathematics and Statistics (SUMS) was founded in 2014 as the reincarnation of a previous undergraduate course union that had been inactive for a few years. Please see <http://www.uvic.ca/science/math-statistics/current-students/undergraduate/sums/index.php> for more information.



Learning Objectives

This course provides a rigorous introduction to probability theory. We will develop the framework of the formal language of probability theory from a measure theoretic standpoint and learn about basic laws of large number and central limit theorems. The course is intended to be useful for those who use probability as a tool in other fields, or planning to do research in probability. Probability theory has applications in analysis, electrical and computer engineering, statistics, economics, finance, applied mathematics, math biology, combinatorics and partial differential equations and has ties to many other fields

Course Material and Online Resources

Textbook *Probability: Theory and Examples* by Rick Durrett. Edition 4.1 downloadable from https://services.math.duke.edu/~rtd/PTE/PTE4_1.pdf.

Course webpage [https://coursespaces.uvic.ca:201901 MATH 451 A01](https://coursespaces.uvic.ca:201901/MATH%20451/A01)

Reference textbooks For probability:

- L. Breiman. Probability.
- R. Ash. Real Analysis and Probability
- D. Williams. Probability with Martingales.
- P. Billingsley. Probability and Measure.
- O. Kallenberg. Foundations of Modern Probability.

For measure theory:

- R. Ash. Real Analysis and Probability (or Real Analysis)
- W. Rudin Real and Complex Analysis

Class Meetings

- Lectures: Tuesday, Wednesday, Friday: 12:30-13:20, DSB C128.

The first lecture will be Tuesday, January 8, 2019.

Evaluation and Grading

Your final percentage grade will be computed according to the following scheme.

Homework Assignments (6)	Projects	Final
50%	20%	30%

Projects: I will provide a few topics to read, understand and present in class and write a report on it near the end of the course. This will be done in groups, and will be graded according to your level of understanding of each topic conveyed through the report and the presentation.



Outline of topics

We will cover the first 3 Chapters of the textbook (*Probability: Theory and Examples* by Rick Durrett. Edition 4.1) and some of Chapter 5.

1. Foundations. [Ch. 1] Probability spaces, random variables, expectation, some results from measure theory.
2. Laws of Large Numbers. [Ch. 2] Independence, modes of convergence, Borel-Cantelli Lemma, Kolmogorov Extension Theorem (statement only), weak and strong laws of large numbers, Kolmogorov 0-1 Law, introduction to random walk.
3. Central Limit Theorem. [Ch. 3] Weak convergence, characteristic functions, Binomial convergence to the Poisson law, central limit theorem, multidimensional central limit theorem.
4. Conditional Expectation and Introduction to Martingales [Ch 5]. Conditional expectation, martingales and submartingales, martingale convergence theorem.



Calculator Only acceptable calculator is the Sharp EL-510R, EL-510RN or EL-510RNB. It may be purchased at the UVic Bookstore or elsewhere for about \$12. A calculator is permitted in this course.

Accessibility Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the Centre for Accessible Learning (CAL) as soon as possible. The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations <http://uvic.ca/cal>. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Grading Percentage scores will be converted to letter grades according to the university-wide standard table
(Undergraduate: <http://web.uvic.ca/calendar2017-05/undergrad/info/regulations/grading.html#>). (Graduate: <http://web.uvic.ca/calendar2017-05/grad/academic-regulations/grading.html#>).

Final Examination Off-schedule final examinations (i.e., deferred examinations) are given only in accordance with the university policy as outlined in the Calendar. If you are unable to write a final examination due to illness, accident or family affliction, please refer to the following webpages for detailed instructions how to proceed:
Undergraduate: <http://web.uvic.ca/calendar/undergrad/info/regulations/concessions.html> Graduate: <http://web.uvic.ca/calendar/grad/registration/concessions.html> Students are **strongly advised not to make plans for travel or employment during the final examination period** as special arrangements will not be made for examinations that conflict with such plans.

Supplemental Examinations. The Department of Mathematics and Statistics does not award 'E' grades or offer Supplemental Examinations in any of its courses.

Policies and Ethics

Attendance The university Calendar states 'Students are expected to attend all classes in which they are enrolled.'

Undergraduate: <http://web.uvic.ca/calendar/undergrad/info/regulations/attendance.html> Graduate: <http://web.uvic.ca/calendar/grad/academic-regulations/attendance.html#>

Our courses are conducted on that basis. If you miss an announcement (information concerning midterms, corrections to assignment, etc.) because you did not attend class, you must accept the consequences of not having learned of the change.

Guidelines on Religious Observances Where classes or examinations are scheduled on the holy days of a religion, students may notify their instructors, at least two weeks in advance, of their intention to observe the holy day(s) by absenting themselves from classes or examinations. Instructors will provide reasonable opportunities for such students to make up work or missed examinations.



Missing work There will be 6 homework assignments. No homework/midterm extension or make-up will be offered. If you are unable to complete homework or attend a midterm due to serious illness or religious observances, then that homework will be excused if you provide adequate documentation as quickly as possible to your instructor. At most one midterm can be excused overall, provided the adequate documentation.

Academic Integrity Academic integrity is intellectual honesty and responsibility for academic work that you submit individual or group work. It involves commitment to the values of honesty, trust, and responsibility. It is expected that students will respect these ethical values in all activities related to learning, teaching, research, and service. Therefore, plagiarism and other acts against academic integrity are serious academic offenses.

The responsibility of the institution

Instructors and academic units have the responsibility to ensure that standards of academic honesty are met. By doing so, the institution recognizes students for their hard work and assures them that other students do not have an unfair advantage through cheating on essays, exams, and projects.

The responsibility of the student

Plagiarism sometimes occurs due to a misunderstanding regarding the rules of academic integrity, but it is the responsibility of the student to know them. If you are unsure about the standards for citations or for referencing your sources, ask your instructor. Depending on the severity of the case, penalties include a warning, a failing grade, a record on the students transcript, or a suspension.

It is your responsibility to understand the University's policy on academic integrity:

Undergraduate: <http://web.uvic.ca/calendar/undergrad/info/regulations/academic-integrity.html>
Graduate: <http://web.uvic.ca/calendar/grad/academic-regulations/academic-integrity.html>

