

# STAT 3558 - Elements of Probability Theory (Honours)

Fall 2021    **Instructor:** Gennady Shaikhet    **E-mail:** [gennady@math.carleton.ca](mailto:gennady@math.carleton.ca)

## Course overview

- An intermediate course in Probability: Probability spaces; Random variables; Discrete and continuous distributions; Limit theorems; Monte-Carlo Simulation; Multivariate distributions; Transformations; Conditional distributions and expectations; Special distributions, etc.
- The course is a good preparation for the probability exam (P exam of Society of Actuaries). For more details, see <https://www.soa.org/globalassets/assets/files/edu/2019/2019-07-exam-p-syllabi.pdf>

## Course schedule

The course will be taught **online**. Slides and asynchronous video lectures will be posted in Brightspace.

The materials will be complemented by **online (live, via Zoom)** tutorials and consultation sessions:

- Instructor's consultation sessions: **Tuesdays, Thursdays, 9:00 – 10:00.**
- Tutorials (by the teaching assistant, **starting Sept 21**): **Tuesdays 18:35 – 19:25.**

## Course evaluations

The course grade is composed of homework (20%), quizzes (40%) and the final exam (40%).

- **Homework:** there will be **6** home assignments, to be submitted individually. Late assignments will not be accepted. **See the homework schedule below**
- **Quizzes:** there will be **10** short quizzes during the semester. The best **8 of 10** will count towards the course mark. No make-up, early or delayed tests. **See the quiz schedule below**
- **Final exam:** a 3-hour written exam (scheduled by the University) will be given during the official examination period

## Homework Schedule

|                     | <u>Release date</u> | <u>Due date</u>   |
|---------------------|---------------------|-------------------|
| <b>Assignment 1</b> | Sept 10             | Sept 24, 23:59 pm |
| <b>Assignment 2</b> | Sept 25             | Oct 8, 23:59 pm   |
| <b>Assignment 3</b> | Oct 9               | Oct 22, 23:59 pm  |
| <b>Assignment 4</b> | Oct 23              | Nov 12, 23:59 pm  |
| <b>Assignment 5</b> | Nov 13              | Nov 26, 23:59 pm  |
| <b>Assignment 6</b> | Nov 27              | Dec 10, 23:59 pm  |

## Test Schedule

|                | <u>Date</u> | <u>Starting time</u> |
|----------------|-------------|----------------------|
| <b>Quiz 1</b>  | Sept 28,    | 8:30 am              |
| <b>Quiz 2</b>  | Oct 5       | 8:30 am              |
| <b>Quiz 3</b>  | Oct 12      | 8:30 am              |
| <b>Quiz 4</b>  | Oct 19      | 8:30 am              |
| <b>Quiz 5</b>  | Nov 2       | 8:30 am              |
| <b>Quiz 6</b>  | Nov 9       | 8:30 am              |
| <b>Quiz 7</b>  | Nov 16      | 8:30 am              |
| <b>Quiz 8</b>  | Nov 23      | 8:30 am              |
| <b>Quiz 9</b>  | Nov 30      | 8:30 am              |
| <b>Quiz 10</b> | Dec 7       | 8:30 am              |

All quizzes are scheduled for **Tuesdays, 8:30 am - 9:00 am**, during the **formal lecture time slots**, and will last ~ 30 minutes (one or two short questions). **Mark your calendars.** There will be no make-up quizzes. All quizzes will be online. The main purpose of quizzes is to make sure that the students are keeping up with the course. **The best 8 out of 10** quizzes will count towards the course mark.

**Textbook** – **no formal textbook is required.** In addition to my lecture notes, the following books will be our references throughout the course:

|   |   |   |
|---|---|---|
| Probability with Applications in Engineering, Science, and Technology (2014)<br>(by Matthew A. Carlton & Jay L. Devore) | <b>Available online (!)</b> through Carleton Library.   | <b>Good book</b><br>and it is free<br>☺ |
| Probability and Statistics. A Course for Physicists and Engineers (2018)<br>(by Arak M. Mathai and Hans J. Haubold)     | <b>Available online (!)</b> through Carleton Library.   | <b>Good book</b><br>and it is free<br>☺ |
| First Course in Probability (2019)<br>(by Sheldon Ross).  | The current 10 <sup>th</sup> edition may not be freely available, but previous editions are very likely to be open access somewhere these days. | <b>Very good classic book</b>           |

# Policies

## Academic Integrity

All tests, assignments and exams are to be done independently. Any instance of suspected cheating or plagiarism will not be tolerated. Suspected cheating will be reported to the Dean, according to the policies stated in General Regulations. For more information, please consult:

<https://carleton.ca/registrar/academic-integrity/>

## Deferrals, Petitions and Appeals

Students are expected to be available for the duration of a course including the examination period. Dates and deadlines are made available to students in the Carleton University Undergraduate Calendar well in advance of registration. For more information, please consult:

<https://carleton.ca/registrar/special-requests/deferral/>

## Academic Accommodations

Contact the instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see

<https://carleton.ca/edc/teachingresources/administrative-pedagogy/academic-accommodations/>

## Students with Disabilities

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send the course instructor your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable).

After requesting accommodation from PMC, communicate with the instructor to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam. For more information, see: <https://carleton.ca/pmc/>

## Class outline for Fall 2021

| Week | Important dates  | Topics   |
|------|--|--|
| 1    |  | Counting, Sample Spaces, Definition of Probability                                   |
| 2    |  | Independence, Conditional Probability  |
| 3    | HW 1 due – Sept 24<br>Quiz 1 – Sept 28                       | Random variables; Discrete variables, Indicators; Distribution of discrete variables |
| 4    | Quiz 2 – Oct 5   | Expectation, Variance, Continuous variables  |
| 5    | HW 2 due – Oct 8<br>Quiz 3 – Oct 12                          | Normal Variable, Central Limit Theorem, Moment Generating Functions                  |
| 6    | Quiz 4 – Oct 19  | Discrete joint distributions   |
| 7    | HW 3 due – Oct 22<br>Fall Break, Oct 25-29<br>Quiz 5 – Nov 2 | Continuous joint distributions   |
| 8    | Quiz 6 – Nov 9   | Transformations; Extensions to more than two variables                               |
| 9    | HW 4 due – Nov 12<br>Quiz 7 – Nov 16                         | Covariance, correlation; Conditional densities                                       |
| 10   | Quiz 8 – Nov 23  | Monte Carlo Simulation   |
| 11   | HW 5 due – Nov 26<br>Quiz 9 – Nov 30                         | Normal; Multivariate normal, applications  |
| 12   | Quiz 10 – Dec 7  | Gamma, Beta, $t$ -, $F$ -, <i>Student's</i> distributions                            |
| 12½  | HW 6 due – Dec 10  |  |