

# STAT 3660 A: Actuarial Mathematics I

Itre Mtalai

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E-mail: [Itre.Mtalai@carleton.ca](mailto:Itre.Mtalai@carleton.ca)

Web: <https://brightspace.carleton.ca/>

Office Hours: will be posted Brightspace. Class Hours: Mon. & Wed. 1:05 pm - 2:25 pm

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## Course Description

The objective of this course is to learn some concepts and tools related to modelling, estimating and pricing risks in non-life insurance. It will introduce students to a variety of frequency, severity, and aggregate models that are useful for short-term actuarial applications. It will cover the following topics: severity/frequency models, loss models, risk measures, value at risk, stochastic processes, Poisson process, characteristics of actuarial models, creating new univariate distributions, heavy-tailed distributions, mixed distributions, coverage modifications.

This course attempts to cover portions of the syllabus for the fifth exam given by the Society of Actuaries (Exam STAM: Short-Term Actuarial Mathematics). The syllabus for STAM may be found at <https://www.soa.org/globalassets/assets/files/edu/2020/2020-06-exam-stam-syllabi.pdf>.

## Required Materials

- Course material will be posted on Brightspace.
- Textbook: Loss Models: From Data to Decisions, (Fifth Edition), 2019, by Klugman, S.A., Panjer, H.H. and Willmot, G.E., Wiley, ISBN: 978-1-119-52378-9. Its solutions manual is also available.

## Prerequisites/Corequisites

Prerequisites: STAT 2655 with grades of C+ or higher; or permission of the School.

## Grading Policy

I reserve the right to adjust a student's final mark by up to 3% based on participation. The grade will count the assessments using the following proportions:

- Assignments: 45%.
- Midterm exam: 20%.
- Final exam: 35%.

## Exams and Assignments

### Assignments

Three assignments of 15% each.

### Midterm exam

The midterm exam is an open book exam that covers the material seen in chapters 1 to 3 (weeks 1-8).

Students who miss the midterm because of a legitimate and documented reason, may apply to write a deferred exam, see [http://carleton.ca/registrar/wp-content/uploads/med\\_cert.pdf](http://carleton.ca/registrar/wp-content/uploads/med_cert.pdf).

### Final exam

The final exam is a 3-hours open book exam that covers the material seen in chapters 1 to 7.

Students are required to obtain a minimum score of 50% on both exams.

### Statistical software

This course will require the use of a statistical software of choice such as R or Python.

## Tentative Course Outline

This course includes seven chapters.

1. Chapter 1: Probability theory - review.
2. Chapter 2: Individual risk modelling.
3. Chapter 3: Collective risk modelling.
4. Chapter 4: Stochastic Sampling.
5. Chapter 5: Premium Calculations and Aggregate Models.
6. Chapter 6: Coverage modification.
7. Chapter 7: Discrete time risk models.

## Tentative Course Schedule

Week	Chapter	Topics
0	CH 0	First Activities, STAM exam overview
1-2	CH 1	Functions and moments, Probability distributions, Variance, Conditional probability and expectation, conditional variance, risk measures.
2-4	CH 2	Frequency models, severity models
5-7	CH 3	Collective risk models, Risk measures, Risk pooling, Costs per contract.
N/A	N/A	FALL BREAK
8	CH 4	Stochastic Sampling - Inverse method, Mixture distributions, estimation of VaR and TVaR
9-10	CH 5	Sum of independent rvs, Panjer Algorithm, discretization, FFT
10-11	CH 6	Deductibles, limits, coinsurance
12	CH 7	Introduction to Ruin theory, Lundberg exponential bound

## Course Policies

### Academic integrity

The University Senate defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This can include:

- reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings;
- failing to acknowledge sources through the use of proper citations when using another's works and/or failing to use quotation marks;
- handing in "substantially the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs.

Plagiarism is a serious offence that cannot be resolved directly by the course's instructor. The Associate Dean of Science and/or the Associate Dean of Business conducts a rigorous

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investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of "F" for the course. For more details, see the Academic Regulations of Carleton University at <http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity>.

## Accommodations

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

**Accommodation for students with disabilities:** Students with disabilities are responsible for identifying their needs for accommodation to the Paul Menton Centre (see below) and providing appropriate disability documentation. A PMC coordinator will review the documentation and establish an accommodation protocol for the student. PMC will email the course instructor and the student a formal Letter of Accommodation (LoA), which outlines classroom and/or test/exam accommodations. The student is responsible for contacting the course instructor soon after the LoA is issued to discuss accommodation arrangements.

**Accommodation for submission of work deadlines:** Accommodation of deadlines is at the discretion of the instructor. Normally a few days should be sufficient. All work should be submitted by the end of the exam period at the very latest.

**Accommodation for formally scheduled exams:** is administered by Scheduling and Examination Services.

**Accommodation for religious observation:** Carleton University accommodates students who, by reason of religious obligations, must miss a compulsory academic event, such as test, examination, assignment deadline, etc. Students are required to bring you a formal written request for alternate date and/or means of satisfying academic requirements at least two weeks prior to the event. Please refer to Equity Services for a list of recognized holidays and for more detail on religious accommodation. [carleton.ca/equity/accommodation/religious-observances/](http://carleton.ca/equity/accommodation/religious-observances/).

**Accommodation for pregnancy:** A pregnant student should seek advice from Equity Services and arrange a letter of accommodation. She should contact the course instructor to discuss her needs at least 2 weeks prior to the academic event requiring accommodation.

For more details, see Carleton University Academic Accommodation Policy: [carleton.ca/equity/accommodation/academic/](http://carleton.ca/equity/accommodation/academic/).

## Final grades

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

## **Course copyright**

My lectures and course materials (including all presentations, handouts, and similar materials) are protected by copyright. You may take notes and make copies of course materials for your own educational use. You may not allow others to reproduce or distribute lecture notes and course materials publicly for commercial purposes without my express written consent.