

STAT 3661 A: Life Contingent Risk Modelling 1

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Course Description

The objective of this course is to learn how to price and reserve for an insurance whose benefits may not be paid for a long time. In other words, this course considers cash flows contingent on the life of a person which extends the valuation concepts learnt in STAT 2660 to value non-deterministic cash flows. Note that this course considers cash flows contingent on only one life and hence covers survival models, life tables, life insurance benefits, lifetime annuities, and reserves. We will extend these concepts to multiple lives in the follow up course STAT 3662 B (Winter 2020).

This course attempts to cover portions of the syllabus for the fourth exam given by the Society of Actuaries (Exam LTAM: Long-Term Actuarial Mathematics). The syllabus for LTAM may be found at <https://www.soa.org/curriculum-changes/preliminary-syllabi/>.

Required Materials

- Course material will be posted on cuLearn.
- Textbook: Actuarial Mathematics for Life Contingent Risks, Second Edition, by David Dickson, Mary Hardy and Howard Waters (2013), Cambridge University Press. Its solutions manual is also available.

Prerequisites/Corequisites

Prerequisites: STAT 2660 and STAT 3506 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:

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- Assignments: 65%.
 - Midterm exam: 15%.
 - Final exam: 20%.

Exams and Assignments

Assignments

Six assignments of 10% each and a small oral exam regarding one (or more) assignment(s) worth 5%.

Midterm exam

The midterm exam is an open book exam that covers the material seen in chapters 1 to 4 (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.

Final exam

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

Tentative Course Outline

This course includes seven chapters.

1. Chapter 1: Introduction to Long-Term Insurance.
2. Chapter 2: Probability review.
3. Chapter 3: Survival models.
4. Chapter 4: Insurances.
5. Chapter 5: Annuities.
6. Chapter 6: Premiums.
7. Chapter 7: Reserves.

Week	Chapter	Topics
0	CH 1	First Activities, LTAM exam overview, Introduction to Long-Term Insurance
1	CH 2	Functions and moments, Probability distributions, Variance, Normal distribution, Conditional probability and expectation, conditional variance.
2-4	CH 3	Probability functions, Force of mortality, Mortality laws, Moments, Percentiles and recursions, Fractional ages, Mortality improvement models.
5-6	CH 4	Annual and $1/m$ -thly Moments, Continuous moments, probability and percentiles, Varying insurance.
N/A	N/A	FALL BREAK
7-8	CH 5	Discrete, continuous, Expectation, variance, probabilities, Varying annuities, $1/m$ -thly payments.
9-11	CH 6	Discrete insurances, Fully continuous insurances, Gross premiums, Variance of future loss.
11-12	CH 7	Net premium reserve, Gross premium reserve and Expense reserve, Whole life and Endowment insurance, Recursive formulas, Modified reserves.

Tentative Course Schedule

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 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/.

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/.

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

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