Department of Mathematics & Statistics
Concordia University

MAST 336
Insurance Mathematics
Fall 2025

Instructor: Dr. N. Ben Ghorbel
Email: noomen.benghorbel@concordia.ca

Class Schedule: Mondays and Wednesdays, 16:15-17:30.

Office Hours: Fridays, 15:00-16:30.

Goal: This course intends to introduce the student to some techniques used by life insurers and Property & Casualty insurers to quantify and measure their liabilities. The course is subdivided into two main parts. The first aims at studying life-contingent liabilities such as life insurance and annuities. Life distribution related probabilities are studied and used to measure the actuarial present value of cash flows generated by life-contingent insurance contracts. The second part provides an overview of methods employed by Property & Casualty insurers to represent their liabilities. Frequency and severity models are discussed. Aggregate claims models are illustrated.

Prerequisite: MAST 221 or equivalent and MAST 335 or equivalent.

Reference: *Actuarial Mathematics for Life Contingent Risks,* 3rd Edition, by D.C.M. Dickson, M.R. Hardy, and H.R. Waters, Cambridge University Press, 2019.

Loss Models, 5th Edition, by Klugman, S.A., Panjer, H.H., and G.E. Willmot, Wiley, New York (you can also use the 4th Edition, if you already own a copy).

Assignments: There will be 5 or 6 assignments. Assignments are very important as they indicate the level of difficulty of the problems that students are expected to solve and understand independently. Students are expected to submit their assignments **as a single PDF file on Moodle site**. Solutions must be written up carefully, showing all work for full credit. **Late assignments will not be accepted.**

Midterm Test: There will be one midterm test during lecture time in week 7 covering weeks 1-6. **Midterm test will be held on Wednesday October 22, 2025, in class.**

There is no make-up for a missed midterm test.

Final Exam: The final examination (closed book exam) will be three hours long and will cover material from the entire course.

PLEASE NOTE: Students are responsible for finding out the date and time of the final exam once the schedule is posted by the Examination Office. Any conflicts or problems with the scheduling of the final exam must be reported directly to the Examination Office, **not** to your instructor. It is the Department's policy and the Examination Office's policy **that students are to be available until the end of the final exam period. Conflicts due to travel plans will not be accommodated.**

Grading Scheme: **The final grade** will be based on the higher of (A) or (B) below:

Option (A): the weighted average of assignments (10%), the Midterm (30%), and the Final Exam (60%), **or**
Option (B): the weighted average of assignments (10%) and of the Final Exam (90%).

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

Note: **THERE WILL BE NO SUPPLEMENTAL FOR THIS COURSE AND NO 100% OPTION FOR THE FINAL EXAM.**

Midterm Break: Reading Week, October 11-17.
Monday, October 13-Thanksgiving Day, university closed.

Calculators: The only calculators allowed in exams for this course are either the Math and Stat-approved calculators with the sticker or the battery- or solar-powered Texas Instrument calculators, models BA-II Plus*, BA-II Plus, TI-30X, TI-30Xa (the official CAS calculator) or TI-30X II*.

* The memory of TI–30X II (IIS solar or IIB battery), TI-30X MultiView (XS Solar or XB Battery), BA II Plus, and BA II Plus Professional will need to be cleared by the examination supervisor upon the candidates' entrance to the examination room. For the BA II Plus and BA II Plus Professional, clearing will reset the calculator to the factory default settings.

Week(s)	Chapters
1 & 2 Sep. 03 Sep. 08 Sep. 10 Sep. 15	**Chapter 2: Survival Models** The Future Lifetime Random Variable. The Force of Mortality. Mean and Variance of The Future Lifetime Random Variable. The Curtate Future Lifetime Random Variable.

3 & 4 Sep. 17 Sep. 22 Sep. 24 Sep. 29	**Chapter 3: Life Tables and Selection** Life Tables. Fractional Age Assumptions. Comparing Mortality. Notation and Formulae for Select Survival Models.
5 & 6 Oct. 01 Oct. 06 Oct. 08	**Chapter 4: Insurance benefits** Valuation of insurance benefits.
October 13: Thanksgiving Day, University closed. **October 11 - October 17: Mid-term Break**	
7 Oct. 20 Oct. 22	 **Review** **Midterm Test**
8 Oct. 27 Oct. 29	**Chapter 4: Insurance benefits** Variable insurance benefits.
9 & 10 Nov. 03 Nov. 05 Nov. 10 Nov. 12	**Chapter 5: Annuities** Review of Annuities-Certain Annual Life Annuities. Annuities Payable Continuously. Annuities Payable 1/mthly. Deferred Annuities. Guaranteed Annuities. Non-Level Annuities. Evaluating Annuity Functions. Increasing Annuities.
11 & 12 Nov. 17 Nov. 19 Nov. 24 Nov. 26 Dec. 01	**Chapter 8: Frequency and Severity with Coverage Modifications (Loss Models)** Introduction. Deductibles. The Loss Elimination Ratio and the Effect of Inflation for Ordinary Deductibles. Policy Limits. Coinsurance and Combining Policy Modifications.

	Chapter 9: Aggregate Loss Models (Loss Models) Individual Risk Model. Collective Risk Model. Stop-Loss Insurance. **Review**

Student Services
You may wish to access the many services available to you as a Concordia student. An overview of these resources can be found here: https://www.concordia.ca/students/services.html

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: https://www.concordia.ca/conduct/academic-integrity.html" *[Undergraduate Calendar, Sec 17.10.2]*

Behaviour
All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

Intellectual Property
Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

Extraordinary circumstances
In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.