ACSC/STAT 3703, Actuarial Models I(Further Probability with Applications to Actuarial Science)
Winter 2023
Toby Kenney

Instructor:	Toby Kenney
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Course Website:	`www.mathstat.dal.ca/~tkenney/3703/2023/`
Office Hours:	
Lectures:	MW: 10:05-11:25 LSC 332
Topics:	Insurance and Reinsurance Coverages, Basic Distributional Quantities, Characteristics of Actuarial Models, Continuous Models, Discrete Distributions, Frequency and Severity with Coverage Modifications, Aggregate Loss Models, Pricing and Reserving for Short-Term Insurance Coverages, Limited Fluctuation Credibility Theory.
Textbook:	"Loss Models: From Data to Decisions" (Fourth Edition or Fifth Edition
	by S. A. Klugman, H. J. Panjer and G. E. Wilmot
	published by Wiley, 2012
Additional References:	Short-Term Actuarial Mathematics Study Note
	by the Society of Actuaries (2017). Available at
	`https://www.soa.org/Files/Edu/2018/2018-ltam-loss-models-data.pdf`
	"Introduction to Ratemaking and Loss Reserving for Property
	and Casualty Insurance" (Fourth Edition), by R. L. Brown
	and W. S. Lennox published by Actex, 2015
	or (Third Edition), 2007, by R. L. Brown and L. R. Gottlieb

Course Work and method of assessment

There will be a midterm exam and a final exam. The midterm will be held in class on Wednesday 15th February, and should cover the material in Chapters 1–5.1 of the additional reference *Introduction to Ratemaking and Loss Reserving for Property and Casualty Insurance*, and Chapters 2–4 of the main textbook. The content of the exam may be changed, depending on the progress in lectures. The final exam will be scheduled by the Registrar's Office during the examination period: Thursday 13th to Tuesday 25th April.

There will also be approximately weekly homework assignments (a total of 8 are planned, but this could be adjusted), which must be submited on Thursdays by the end of the lecture, either in-person or via Brightspace. After this, I will put the model solutions on the course website. **No credit can be given for late homework.** The overall homework mark will be made up of an average of the homework marks, with the exception of the worst mark for each student. (So if there are indeed 8 homework assignments, this will be the average of the best 7 scores.)

The homework sheet will be divided into 2 sections: The *basic questions* section tests the basic concepts covered in the course: everyone should be able to do all these questions. The *standard questions* section has questions where the concepts covered in the course can be applied to more realistic situations, or questions which involve a stronger theoretical insight; these questions are mostly straightforward, though

there may be the occasional tricky question included. There may also be some *bonus questions*, which are either more challenging, or else raise interesting or important issues that are not central to this course.

Sometimes a question will be started on one sheet, but continued on the following sheet, after the relevant material has been covered. In this case, the full question will be given on the earlier sheet, but the parts that should only be attempted with the later sheet are clearly marked, and are repeated on the later sheet. For some questions, I may occasionally give out a hint, rather than a complete model solution. Revised answers to these questions may then be submitted with the following week's homework.

Grades will be determined by performance in the exams and the weekly homeworks. The midterm exam counts for 30%, the final counts for 55%, while the homework counts for the remaining 15%. You must pass the final exam to obtain a passing grade in the course.

Weekly Readings

Since class time is limited, I will be using it for explaining concepts and going over examples, rather than reading through the textbook. You should therefore read through the relevant sections of the textbook *before* the lecture, in order to gain the full benefit from the lecture. The sections of the textbook that will be covered each lecture will be listed on the website. This list may be updated from time to time, depending on the progress made in earlier lectures. Here is the current plan, with corresponding question numbers from the class questions.

Week beginning	Monday	Wednesday
9th January	Introduction and Preliminaries, **IRLRPCI 1 Why insurance?**, 1.3 Insurance and Utility **Q.1**, 1.4 Insurable Risks	**IRLRPCI 2 Types of short-term insurance coverage**: 2.2 Automobile Insurance **Q.2**, 2.3 Homeowner's Insurance **Q.3**
16th January	**IRLRPCI 2 Types of short-term insurance coverage (cont.)** 2.4 Tennant's Package, 2.5 Worker's Compensation, 2.6 Fire Insurance, 2.7 Marine Insurance, 2.8 Liability Insurance, 2.9 Limits to Coverage **Q.4–5 IRLRPCI 5 Intermediate topics** 5.3 Reinsurance **Q.6**	**IRLRPCI 4 Ratemaking** 4.1 Introduction, 4.2 Objectives of ratemaking, 4.3 Data for ratemaking, 4.4 Premium data **Q.7**, 4.5 The exposure unit, 4.6 The expected effective period **Q.8–9**, 4.7 Ingredients of ratemaking, 4.8 Rate changes **Q.10–12**
23rd January	**IRLRPCI 3 Loss Reserving** 3.2 How outstanding claim payments arise, 3.3 Definition of terms, 3.4 Professional considerations, 3.5 Checking the data, 3.6 Loss reserving methods	3.6.1 Expected Loss ratio method **Q13**, 3.6.2 Chain Ladder method **Q14**, 3.6.3 Bornhuetter-Fergusson method **Q15**
30th January	**2 Random Variables: Q16–19**, **3 Basic Distributional Quantities:** 3.1 Moments **Q20–22**, 3.2 Percentiles **Q.23–25**, 3.3 Generating Functions and Sums of Random Variables **Q26–27**,	3.4 Tail Weight **Q28–33**, 3.5 Measures of Risk **Q34–40**,
6th February	**4 Characteristics of Actuarial Models:** 4.2 The Role of Parameters **Q41–42**, 4.3 Semiparametric and Non-Parametric Methods **Q43–48**,	Revision IRLRPCI & Chapters 2–4
13th February	Revision IRLRPCI & Chapters 2–4	MIDTERM EXAM
20th February	STUDY WEEK	
27th February	**5 Continuous Distributions:** 5.2 Creating New Distributions **Q49–53**, 5.2.4 Mixture Distributions **Q54–65**,	5.3 Selected Distributions and their Relationships , 5.3.2 Two Parametric Families **Q66**, 5.3.3 Limiting Distributions **Q67–68**, 5.4 The Linear Exponential Family **Q69–70**,
6th March	**6 Discrete Distributions:** 6.2 The Poisson Distribution (revision) **Q71–72**, 6.4 The Binomial Distribution (revision) **Q73–74**, 6.3 The Negative Binomial Distribution **Q75–78**,	6.5 The (a,b,0) Class Q.79-80, 6.6 Truncation and Modification at Zero **Q81–84**,
13th March	**8 Frequency and Severity with Coverage Modifications:** 8.2 Deductibles **Q85**, 8.3 Loss Elimination Ratio and Inflation **Q86–87**, 8.4 Policy Limits **Q88**,	8.5 Coinsurance, Deductibles and Limits **Q89–90**, **9 Aggregate Loss Models:** 9.1 Introduction,
20th March	9.2 Model Choices **Q91**, 9.3 The Compound Model for Aggregate Claims **Q92–96**,	9.3 The Compound Model for Aggregate Claims (cont.),
27th March	9.8 The Individual Risk Model **Q97-100**,	**17 Limited Fluctuation Credibility Theory :** 17.3 Full Credibility **Q101–103**, 17.4 Partial Credibility **Q104–105**, 17.5 Problems with this approach **Q106**,
3rd April	Revision	Revision

Sections of the text covered

We expect to cover most of the material in Chapters 2–6, 8, 9.1–9.3, 9.8, and 17 in the main textbook, and Chapters 1–4 and 5.1 in the additional reference.

Students with disabilities

Students with disabilities are encouraged to register as quickly as possible at the Student Accessibility Services if they want to receive academic accommodations. To do so, plese 'phone 494-2836, email access@dal.ca, drop in at the Killam, G28, or visit our website at www.studentaccessibility.dal.ca.

Plagiarism

Plagiarism is a serious academic offense which may lead to loss of credit, suspension or expulsion from the university. Please read the Policy on Intellectual Honesty contained in the Calendar or on the Dalhousie web site at: http://www.registrar.dal.ca/calendar/ug/UREG.htm#12.

Dalhousie Writing Centre

Writing expectations at university are higher than you will have experienced at high school (or if you are entering a master's or PhD program, the expectations are higher than at lower levels). The Writing Centre is a Student Service academic unit that supports your writing development. Make an appointment to discuss your writing. Learning more about the writing process and discipline-specific practices and conventions will allow you to adapt more easily to your field of study.