

ACT452H1S Winter 2025

University of Toronto, Department of Statistical Sciences

Statistical methods for actuarial loss models (Loss models II)

1 Course description

Insurance data often exhibits unique characteristics such as deductibles, policy limits, and truncation, requiring specialized statistical methods to model and analyze losses and survival outcomes. This course introduces statistical methods for modelling and analyzing loss and survival data in actuarial science. Key topics include product-limit estimation, empirical estimation methods, moment and percentile estimation, maximum likelihood estimation, and simulation techniques. Emphasis is placed on understanding the theoretical foundations of these methods and applying them to real loss data using R.

The objective of this course is to provide students with a solid understanding of the statistical methods used in actuarial science for loss and survival data. The course will help students to prepare for portions of the ALTAM and ASTAM SOA exams and to develop the skills necessary to analyze real-world loss data.

2 Course information

Instructor	Christopher Blier-Wong
Email	christopher.blierwong@utoronto.ca
Lectures	Wednesdays 10:00 – 12:00; MS 2172 Fridays 10:00 – 11:00; MS 2172
Office Hours	Wednesdays 14:00 – 16:00 Hydro building 9108

Teaching Assistant	Sophia Chan
Email	ianweng.chan@mail.utoronto.ca

Prerequisites: ACT240H1, ACT245H1, ACT247H1, STA261H1/ STA238H1, ACT451H1. If you do not meet the above requirement, please contact the instructor.

3 Suggested reading

We will be using slides during lectures. The instructor will suggest some exercises from the study manuals. More information about the content can be found in the study manuals or in the optional textbooks listed below.

1. Study Manual for SOA exam ALTAM Notes (Sections 41–43) by Samuel Broverman (provided for free)
2. Study Manual for SOA exam ASTAM, 2nd edition by Samuel Broverman and Wenjun Jiang (should have from ACT451)
3. Loss Data Analysis: online textbook (*optional*)
4. Loss Models: From Data to Decisions, 5th edition by Klugman, Panjer, and Willmot (*optional*)

4 Tentative lecture schedule

The following is a tentative schedule of the topics that will be covered in the course. The order of the topics may change depending on the pace of the class.

Week 1	Review of mathematical statistics
Week 2	Complete data, grouped data and their empirical estimates
Week 3	Censored and truncated data, Kaplan-Meier and Nelson-Aalen estimators
Week 4	Delta method
Week 5	Analysis of Kaplan-Meier and Nelson-Aalen estimators
Week 6	Maximum likelihood estimation for complete data
Week 7	Maximum likelihood estimation for complete data
Week 8	Maximum likelihood estimation for incomplete data
Week 9	Multivariate delta method, properties of MLE
Week 10	Hypothesis tests and model selection
Week 11	Graphical methods for model selection
Week 12	Flexible

5 Evaluation

There will be three term tests, each of which will be 1h long. The tests will be held during the lecture time. The dates of the tests are as follows:

- Test 1: 30% (Feb 7)
- Test 2: 35% (March 14)
- Test 3: 35% (April 4)

Some more information about evaluations

- There are no assignments/homework in this course, but I will suggest some exercises from the study manuals to help you prepare for the tests.
- Should you be forced to miss a term test, you are required to inform me within one week with appropriate documentation from the U of T Health Services.
- If you miss a term test for an accepted reason according to U of T guidelines, the student will have an oral one-on-one test with the instructor.
- Calculators: Only one of the following calculators is allowed term tests: BA35, BAI Plus, BA II Plus Professional Edition, TI-30Xa, TI-30XIIS, TI-30XIIB, TI-30XS MultiView, and TI-30XB MultiView. These are the calculators allowed in the SOA exams.

6 Course conduct

- Questions about the course material should be asked on Piazza or during office hours.
- General announcements will be made through Quercus.
- Personal matters should be discussed with me in private. If using email, please use your U of T email address.
- We follow the code of conduct, The Code of Behaviour on Academic Matters for more information.