

ACT452H1S Loss Models II Winter 2023

Instructor: X. Sheldon Lin

Office: Department of Statistical Sciences, Room 9111, 9th Floor

Ontario Power Building, 700 University Avenue

Emails: sheldon.lin@utoronto.ca (personal); act452h1@gmail.com (for submitting your course-work)

Lectures: Wednesdays 10:10am-noon in person. Room MS4171;

Fridays 10:10am-11am by Zoom <https://utoronto.zoom.us/j/81864328757>.

Please note that there are no passwords nor waiting room for the zoom lectures so you can join in any time. The lectures will be recorded and uploaded to My Media afterwards.

Office hours: Wednesdays from 1-3pm.

Course Prerequisites: STA261 and ACT451. This requirement is strictly enforced.

If you do not meet the above requirement, please contact me or the Undergard Chair for actuarial science (ugchair.actsci@utoronto.ca) by Friday Jan 20 or you will be removed from the class.

Required Textbooks

1. **ACTEX Study Manual for SOA Exam FAM-S, Fall 2022 Edition** by Sam Broverman.

The study manual was used for ACT451 last semester. If you do not have a copy it may be purchased at ACTEX Publications

(<https://www.actexamdriver.com/OrderSelection.aspx?terms=>).

2. **Survival Analysis and Nonparametric Estimation**

LTAM Notes (Sections 41-43) by Sam Broverman that will be provided for free.

Calculators

Only one of the following calculators is allowed in the midterm test and the final exam: BA-35, 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.

Course Description

This course will cover the statistical aspects of insurance loss models. As I described in ACT451, The SOA has redesigned the ASA Exams again. The topics used to be in LTAM (Life insurance) and STAM (Non-life Insurance) have been rearranged with some new topics in four exams: FAM-S, FAM-L, Advanced LTAM (ALTAM) and ASTAM. FAM-S and FAM-L exams have been offered since last Fall and they will be combined into one (FAM) in the future. ALTAM and ASTAM will start this May. As a result, topics in statistical

estimation have spread all over the place. Non-parametric estimation is covered in FAM-L and Advanced LTAM (ALTAM) and parametric estimation in FAM-S and ASTAM. Nevertheless, I want to teach this subject properly and here is my plan:

I will begin with survival analysis and nonparametric estimation using the study notes by Prof Broverman for LTAM followed by statistical estimation and tests for parametric distributions. The latter is covered in Sections 20-25 of the FAM-S Study Manual. If time permits, I may teach some topics (such as fitting algorithms for mixture models) that are not covered in the SOA exams but useful in insurance modelling.

Topics and Tentative Schedule

Weeks 1 and 2: Review of Math Stats, Complete Data and Grouped Data and their Empirical Estimates (STA261; FAM-S Section 20; LTAM Section 41).

Week 3: Censored and Truncated Data, the Kaplan-Meier and Nelson-Aalen Estimators (LTAM Section 42).

Weeks 4 and 5: Delta Method, Analysis of Empirical/Kaplan-Meier and Nelson-Aalen Estimators (LTAM Section 43).

Week 6: MLE based on Complete Data (FAM-S Section 21).

Weeks 7 and 8: MLE based on Complete Data, cont'd, MLE based on Incomplete Data (FAM-S Section 22).

Reading Week: Feb 20-24.

Week 9: Applications to parametric distributions and the EM algorithm for mixtures (FAM-S Section 23 and my personal notes).

Weeks 10 and 11: Properties of MLE, Multidimensional Delta Method, Properties of MLE on Transformed Distributions (FAM-S Sections 24 and 25).

Week 12: Hypothesis Testing (Notes will be provided), Graphical Methods for Model Selection and Tests.

Quizzes, Exams and Others

Quizzes

There will be five 10-minutes in-class quizzes during the semester. The dates will be announced 2-3 days prior. If a quiz is online, you will need to email your answer in 13 minutes to act452h1@gmail.com for the TA to grade. There will be no makeup quizzes.

Homework

There will be no homework but I will post practice problems from the study manuals weekly at my teaching website.

Assessments

I will give three one-hour in person term tests. The dates are: Test 1, Feb 10, 10-11am; Test 2, March 17, 10-11am, Test 3, April 10, 10-11am (the makeup day for Good Friday).

Marking Scheme

The best four quizzes will be counted, 2.5% each, toward the final grade. Test One will account for 30%, Test Two 35% and Test Three 25% of the final grade.

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. You will be given an **one-on-one oral test**.

The Code of Behaviour on Academic Matters

Visit www.artsci.utoronto.ca/osai/students

Canadian Institute of Actuaries (CIA)'s University Accreditation Program (UAP)

This course is one of the mandatory courses under Canadian Institute of Actuaries (CIA)'s University Accreditation Program (UAP). UAP has moved away from the course-by-course accreditation method and towards program accreditation method (the "Pathway 1 of CIA qualification"). Under the new pathway, in order to obtain ACIA (Associate of CIA) professional credential, students need to:

1. Complete a degree from an actuarial program (ACT Specialist or Major) at University of Toronto and pass a list of mandatory courses. No minimum course grade or GPA is required as long as students pass all the mandatory courses. The full list of UofT's 16 mandatory courses are: ACT240, ACT245, ACT247, ACT348, ACT349, ACT370, ACT451, ACT452, ACT466, STA257, STA261, STA302, STA314, ECO101, ECO102, MGT201/RSM219.

For transition: CIA will accept an actuarial degree from UofT completed between June 30, 2015 and October 31, 2023 without all the specified mandatory courses.

2. Complete the ACIA Module (administered by CIA, projected Spring 2023).

For transition: a student can be exempt from the ACIA Module if they complete SOA exam PA and the 8 FAP Modules and assessments by December 31, 2023.

3. Complete an open-book ACIA Capstone Exam (administered by CIA, projected Fall 2023).

For transition: a student can be exempt from the capstone exam by completing any combination of UAP credits or exams for P, FM, IFM, LTAM, STAM and SRM by October 31, 2023. The deadline to apply for UAP credits is September 30, 2023.

Details on the new pathway for students can be found here: <https://education.cia-ica.ca/acia/acia-for-accredited-university-students/>