

ACT452H1S Loss Models II Winter 2022

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)

Teaching website: <https://utstat.utoronto.ca/sheldon/teaching.html>

Lectures by Zoom: Wednesdays 10:10am-noon <https://utoronto.zoom.us/j/88336135056>;

Fridays 10:10am-11am <https://utoronto.zoom.us/j/82104313823>.

Office hours: Fridays from 1-3pm by Zoom <https://utoronto.zoom.us/j/85168361014>, or by appointment.

Please note that there are no passwords nor waiting room for these zoom meetings so you can join in any time.

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 Professor Sam Broverman (ugchair.actsci@utoronto.ca) by Friday Jan 21. If you fail to do so, Prof Broverman will remove you from the class.

Required Textbooks

Survival Analysis and Nonparametric Estimation

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

Statistical Estimation and Tests

Broverman, S., ACTEX Study Manual for SOA Exam STAM - Short Term Actuarial Mathematics, Fall 2020 or later Edition.

If you took ACT451 from me the last semester you should have a copy of the ACTEX manual. Otherwise, purchase a copy from <https://www.actexamdriver.com/OrderSelection.aspx>

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. Due to the recent changes in SOA exams, they are now split into two exams: LTAM and STAM. The LTAM part is on **survival analysis and nonparametric estimation** and the STAM part is about **statistical estimation and tests for parametric distributions**. I will cover both

so that you can properly prepare for both exams (the exams will change again to be split into three parts. The first part starts in November 2022 and the second and third parts in May 2023. Please check the updates at the SOA website <https://www.soa.org>).

I will begin with survival analysis and nonparametric estimation using study notes by Prof Broverman for LTAM followed by statistical estimation and tests for parametric distributions. The latter is covered in Sections 22-31 of the study manual for SOA Exam STAM. 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; STAM Sections 22 and 28; 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). First term test.

Week 6: MLE based on Complete Data (STAM Section 23).

Weeks 7 and 8: MLE based on Complete Data, cont'd, MLE based on Incomplete Data (STAM Section 24).

Reading Week: Feb 22-25.

Week 9: Applications to parametric distributions and the EM algorithm for mixtures (STAM Sections 25-27 and my personal notes). Second term test.

Weeks 10 and 11: Properties of MLE, Multidimensional Delta Method, Properties of MLE on Transformed Distributions (STAM Section 29).

Week 12: Hypothesis Testing (STAM Section 30), Graphical Methods for Model Selection and Tests (STAM Section 31). Third term test.

Lectures, Assignments, Exams and Others

Lectures

Due to the latest Covid situation, the teaching will be conducted online using Zoom with the links given above. The format of teaching and exams are the same as those of ACT451 from the last semester. Please make sure you have access to Zoom. During a lecture, I will use the share screen function to show my notes. If you have a question, use the chat room to post it. I will record each lecture when possible, and post it and the pdf of the notes afterward at my teaching website, in case you have missed it.

Office hours

I will have zoom office hours from 1pm to 3pm of each Friday. You may join in any time. If permitting, I will have in person office hours on some Mondays (after January). You may email me your questions. I am also happy to provide advice on job interview/resume writing, career developments, company information, graduate schools, and things in that nature.

Quizzes

There will be five 10-minutes in-class quizzes during the semester. I will post a quiz using

share screen and you will need to email your answer in 12 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 do not want what happened to the final exam for ACT451 to repeat for this course. To have a full control of the assessments, I will give three one-hour term tests. The dates are: Test 1, Feb 11, 10-11am; Test 2, March 18, 10-11am, Test 3, April 8, 10-11am. At this moment, I plan to have them in person but if that is not allowed, I will move them online.

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)

ACT452 is an accredited course under the UAP program. The minimum grade needed to apply for an exemption is 75. For detailed information on UAP, please visit the following webpages:

- University Accreditation Program description (<http://www.cia-ica.ca/membership/uap>)
- List of accredited courses offered by University of Toronto:
<http://www.cia-ica.ca/membership/uap/accredited/toronto>
- How to apply for CIA exemptions:
<http://www.cia-ica.ca/membership/uap/information-for-students>

Note: The CIA will grant credits to students for SOA/CAS examinations based on the achievement of the minimum Grade towards Associateship (ACIA) and Fellowship (FCIA) in the CIA. At the time of this agreement, CIA credits are recognized by the following actuarial organizations towards their respective designations:

Casualty Actuarial Society (CAS): ACAS, FCAS

UK Institute and Faculty of Actuaries (IFoA): FIA, AIA

Institute of Actuaries of Australia (IAA): AIAA, FIAA

Actuarial Society of South Africa (ASSA): AMASSA, FASSA

American Academy of Actuaries (AAA): MAAA

The CIA does not guarantee that credits granted to students under the CIA UAP will be recognized by any other actuarial organizations towards their actuarial designations.