ACT452H1S Loss Models II Winter 2024

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Lectures: Wednesdays 10:10am-noon; Fridays 10:10am-11am; Student Commons(SU) B120 (in the basement).
Office hours: Wednesdays, 2-4pm.

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

If you do not meet the above requirement, please contact me. Otherwise the Undergard Chair for actuarial science (ugchair.actsci@utoronto.ca) will remove you from the class by Friday Jan 19.

Textbook
1. **Survival Analysis and Nonparametric Estimation**
ALTAM Notes (Sections 41-43) by Sam Broverman that will be provided for free.

2. **Study Manual for SOA Exam ASTAM**, 2nd Edition by Samuel Braverman and Wenjun Jiang.

3 (Optional). **ACTEX Study Manual for SOA Exam FAM-S**, Fall 2022 Edition, by Sam Broverman.

The study manuals are available for purchase at ACTEX Learning (`https://www.actexmadriver.com/OrderSelection.aspx?terms=`). The website provides three purchase options. The first two are a digital copy that will expire in 6 and 12 months, so I strongly recommend that you purchase a hard copy (Option 3). If you took ACT451 in Fall 2023 from me, you should already have a copy of the ASTAM Study Manual.

Calculators
Only one of the following calculators is allowed in the midterm test and the final exam: BA-35, BAII 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 the ACT451 class, the SOA redesigned the ASA Exams a couple of years ago. The topics used to be in LTAM and STAM have been rearranged along with a few new topics in three exams: FAM (Fundamental Actuarial Math that covers the basics of Life Contingencies and Nonlife

Mathematics), Advanced LTAM (ALTAM) and ASTAM. To become an ASA you need to pass FAM and one of ALTAM and ASTAM. 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 and Sections 21-25 of the ASTAM Study Manual. If you have a copy of FAM-S, that is great. But if you do not want to buy a copy, it is fine. My notes should be detailed enough to cover the topics in those sections. 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; ASTAM Sections 21 and 22; 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). Please note that the Delta method is also covered in ASTAM Section 23.3.
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 19-23.
Week 9: Applications to parametric distributions and the EM algorithm for mixtures (FAM-S Section 23 and my notes).
Weeks 10 and 11: Properties of MLE, Multidimensional Delta Method, Properties of MLE on Transformed Distributions (Section 23).
Week 12: Hypothesis Testing (Section 22), Graphical Methods for Model Selection and Tests (Section 25).

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. There will be no makeup quizzes.
Homework
There will be no homework but I will post practice problems from the study manuals weekly at Quercus.
Assessments
I will give three one-hour in person term tests. The dates are: Test 1, Feb 9, 10-11am; Test 2, March 15, 10-11am; Test 3, April 8, 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/`