

# AS 3424/9424 Short Term Actuarial Math I Course Outline

## 1. Course Information

### Course Information

**Course name:** AS 3424B/9424B - Short Term Actuarial Math I  
**Academic Term:** Winter 2023  
**Lecture hours and location:** MWF 9:30am - 10:30am, AHB-1B04

### List of Prerequisites

**Prerequisites:** A minimum mark of 60% in Statistical Sciences 3657 A/B

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

## 2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Dr. Shu Li (Instructor & Course Coordinator)	shu.li@uwo.ca	WSC 229	5196612111 ext. 85419	
Duo Xu (Teaching assistant)	dxu258@uwo.ca		-	

Students must use their Western (@uwo.ca) email addresses when contacting their instructors, and indicate the course number (AS 3424) in the subject line. We strive to answer all emails within 2 business days.

## 3. Course Syllabus, Schedule, Delivery Mode

**Course Description:** Single life annuity and life insurance loss random variables and their distributions, with applications to the analysis of benefit premiums and reserves; survival model and their estimation; mortality Improvement and longevity models.

**Learning Outcomes:** The course material supports part of the Learning Objectives/Outcomes from SOA Exam FAM–Fundamentals of Actuarial Mathematics Syllabus.

Type	Mode	Dates	Time	Frequency
Lecture	In-person	MWF	9:30am - 10:30am	weekly

Note that the office hours are held in-person.

### Key Sessional Dates

- Classes begin: January 9, 2023;
- Spring Reading Week: February 18 – February 26, 2023;
- Classes end: April 10, 2023;
- Exam period: April 13 – 30, 2023.

### Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

## 4. Course Materials

**Textbook:** *Loss Models: From Data to Decisions*, by Klugmann, S.A., Panjer, H.H., and Willmot, G.E., John Wiley and Sons, Inc., 2019, **5<sup>th</sup> Edition**.

A student solutions manual to accompany Loss Models text has been published and this can be purchased online from Amazon.

This course is intended to familiarize the student with a variety of techniques for the analysis of aggregate losses. Following the introductory Chapters 1 and 2 of the textbook, coverage will focus primarily on Chapters 3 through 9.

More precisely, the following topics are covered:

#### A. Severity models

1. Calculate the basic distributional quantities: a) moments; b) percentiles; c) generating functions.
2. Describe how changes in parameters affect the distribution.
3. Recognize classes of distributions and their relationships.
4. Apply the following techniques for creating new families of distributions: a) multiplication by a constant; b) raising to a power; c) exponentiation; d) mixing.
5. Identify the applications in which each distribution is used and reasons why.
6. Apply the distribution, given the parameters.
7. Calculate various measures of tail weight and interpret the results to compare the tail weights.

## B. Frequency models

For the Poisson, mixed Poisson, binomial, negative binomial, geometric distribution and mixtures thereof:

1. Describe how changes in parameters affect the distribution.
2. Calculate moments and generating functions.
3. Identify the applications for which each distribution is used and reasons why.
4. Apply the distribution, given the parameters.
5. Apply the zero-truncated and zero-modified distribution, given the parameters.

## C. Aggregate models

1. Compute relevant parameters and statistics for collective and individual risk models.
2. Evaluate compound models for aggregate claims.
3. Compute aggregate claims' distributions.

## D. For severity, frequency and aggregate models:

1. Evaluate the impacts of coverage modifications: a) deductibles; b) limits; c) coinsurance.
2. Calculate loss elimination ratios (LER).
3. Evaluate effects of inflation on loss.

## E. Risk measures

1. Calculate VaR and TVaR and explain their use and limitations.
2. The desirable properties of a risk measure

## F. Continuous-time ruin models (additional notes)

1. The (homogeneous) Poisson process
2. The classical risk model
3. The adjustment coefficient and Lundberg's inequality

If time permits, we will cover the topic of simulation.

The course material supports part of the Learning Objectives/Outcomes from **SOA Exam FAM-S (Fundamentals of Actuarial Mathematics – Short Term) and Exam ASTAM (Advanced Short-Term Actuarial Mathematics Exam) Syllabus.**

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

All course material will be posted to OWL: <http://owl.uwo.ca>.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

## **Technical Requirements**

In the case of having to move the course to online platform, Zoom will be used to conduct synchronous online lectures.

## 5. Methods of Evaluation

The overall course grade will be calculated as listed below:

<b>Tests (3)</b>	<b>60% (20% each)</b>
<b>Final Exam</b>	<b>40%</b>

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**Tests:** There will be three 50-minute tests held in-class, on **Fridays February 10, March 10 and March 31**.

**Final Exam:** A 3-hour final exam will be scheduled by the Registrar's Office in the final examination period.

**Note:** All the above evaluations are **closed book**.

**Note:** Students only have **one week** to request remarking their quizzes or tests after the papers are distributed back.

Specific conditions that are required to pass the course:

- a minimum 40% of the evaluations must be completed before the final exam.

**Calculators:** Any non-programmable calculator may be used in this course.

**Practice questions:** Suggested practice questions will be posted on OWL. Assistance with solving them may be obtained during the instructor's and TA's office hours.

## 6. University Accreditation Program – Canadian Institute of Actuaries (CIA)

### Honours Specialization Program in Actuarial Science

If you are in 2<sup>nd</sup> or 3<sup>rd</sup> year

If you graduate from with an HSP in Actuarial Science, this course will be one of the courses that you will take in your program that will allow you to be exempt from the preliminary exams of the Society of Actuaries (SOA). This is under the new **CIA program accreditation program**. If your plan is to become a fully qualified actuary working in Canada, then all you would need to do is graduate from your HSP in actuarial science. You would then be eligible for the CIA Capstone Exam. Taking and passing this exam, along with an online module and a practice education course, would make you eligible to become an ACIA (associate of the Canadian Institute of Actuaries).

If you are in 4<sup>th</sup> year

This course is accredited under the Canadian Institute of Actuaries (CIA) University Course Accreditation Program (UAP) for the 2022-23 academic year. Achievement of the established

exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams. **This is the last year of the CIA course accreditation program.**

### **Major in Actuarial Science**

If you are a student in a major in Actuarial Science, the CIA program accreditation program will not apply to you. If your plan is to become a fully qualified actuary, you will need to continue to write and pass the preliminary exams of the SOA. However, for 2022-23 this course is still accredited under the Canadian Institute of Actuaries (CIA) University Course Accreditation Program (UAP) for the 2022-23 academic year. Achievement of the established exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams. **This is the last year of the CIA course accreditation program.**

Please see the following link for full details:

<http://www.cia-ica.ca/membership/university-accreditation-program---home>

In addition to the university's internal policies on conduct, including academic misconduct, candidates pursuing credits for writing professional examinations shall also be subject to the **Code of Conduct and Ethics for Candidates in the CIA Education System** and the associated **Policy on Conduct and Ethics for Candidates in the CIA Education System**.

<https://www.cia-ica.ca/docs/default-source/2020/220065e.pdf>

## **7. Student Absences**

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

**Assessments worth less than 5% of the overall course grade:** Does not apply to this course.

**Assessments worth 5% or more of the overall course grade:**

For work totalling 5% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf).

The Student Medical Certificate is available at

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

**Missed Quiz or Test:** The policy of the department of Statistical and Actuarial Sciences is that there will be **no make-up exams** for a missed quiz/test. For those that do legitimately miss a midterm and provide the required supporting documentation, the standard practice will be that the weight of the midterm will be reassigned to the final exam. If your reason is not deemed valid, then you will receive a mark of 0.

## Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

**Note:** missed work can *only* be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is **not** sufficient on its own.

## 8. Accommodation and Accessibility

### Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

### Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf).

## 9. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

[https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf),

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Cell phones and all other electronic devices are prohibited during tests, quizzes and exams.

**Scholastic offences** are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

In the case of in-person class pivoting to 100% online learning, tests and examinations in this course may be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

<https://remoteproctoring.uwo.ca>.

## 10. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

[https://www.uwo.ca/health/student\\_support/survivor\\_support/get-help.html](https://www.uwo.ca/health/student_support/survivor_support/get-help.html).

To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

[http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html)

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.