Western Science

Department of
Statistical and Actuarial Sciences

Course outline

AS 3424b/AS 9424b Short-term Actuarial Mathematics I 2021/2022

Instructor Information

Instructor:	Kristina Sendova
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Office Hours:	Mon. 10:30 a.m. – 11:30 a.m.
	Zoom Meeting ID: 948 0371 9490
	Passcode: 507859

Students must use their Western (@uwo.ca) email addresses when contacting their instructors.

Course Information

Course Description:	Insurance loss frequency and severity models; aggregate loss models; risk measures; ruin theory; coverage modifications.
University Accreditation Program:	This course along with Actuarial Science 4824A (both courses with a minimum mark of 80%) can give you an exemption for the STAM exam.
Prerequisites:	SS3657A/B A minimum mark of 60% in Statistical Sciences 3657A/B. Restricted to students enrolled in any Actuarial Science module, or those registered in the Honours Specialization module in Statistics or the Honours Specialization in Financial Modelling module.
Antirequisites:	The former Actuarial Science 4424A/B.
Pre-, Co-requisites:	Unless you have either the prerequisites for this course or a written special permission from your Dean to enrol in it, you may be removed from this course and it will be deleted from your record. You can be deregistered at any time even after writing the final exam. This decision may not be appealed. You will receive no

Pre-, Co-requisites:	adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites
Lecture Hours:	Mon., Wed., Fri. 9:30 a.m. – 10:30 a.m., WSC 240;

University Accreditation Program

This course is accredited under the Canadian Institute of Actuaries (CIA) University Accreditation Program (UAP) for the 2021-22 academic year. Achievement of the established exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams.

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.

Book information

Textbook: Loss Models: From Data to Decisions, 5th edition by Klugmann, S.A., Panjer, H.H., and Willmot, G.E., John Wiley and Sons, Inc.

Course objectives

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 quantiles:
   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.
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.
6. Recognize classes of distributions and their relationships.

C. Aggregate models

1. Define collective and individual risk models and calculate their expectation and variance.
2. Use the normal distribution to approximate the aggregate distribution.
3. Use the recursive formula to calculate the values of the collective risk models with discrete distributions of severities.
4. Calculate the expected aggregate payments in the presence of an aggregate deductible.
5. Evaluate the effect of the coverage modifications on the expected aggregate payments.
6. Perform the exact calculation of aggregate loss distribution in case of the normal distribution of severities, exponential and gamma (Erlang) distribution of severities and a compound model with negative binomial frequency and exponential distribution of severities

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.
3. Evaluate effects of inflation on loss.

E. Risk measures

1. Calculate VaR and TVaR and explain their use and limitations.
2. Explain the desirable properties of a risk measure and determine whether a given risk measure has these properties.

F. Continuous-time stochastic processes

1. The homogeneous Poisson Process
2. The non-homogeneous Poisson process
3. The compound Poisson process

Course Delivery Mode

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining 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. In particular, tests and the final examination will 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 providepersonal information (including some biometric data) and the session will berecorded. Completion of this course will require you to have a reliable internet connection, a laptop or a computer that meets the technical requirements for this service, and a working microphone and webcam. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: https://remoteproctoring.uwo.ca.

Assessment

Assignments:	One case will be assigned and graded after covering Chapter 8. One assignment due at the last day of classes will be graded. In addition, some practice questions will be assigned to help understand the material. These questions are important in the preparation for the midterm tests and the final exam.
Midterm tests:	Two midterm tests will be given on February 7 and March 14, respectively, during the regular class time.
Final exam:	A three-hour final exam is scheduled by the Registrar's Office during the regular exam session.

Evaluation

Undergraduate students will be evaluated on the basis of the case, the assignment, the two midterm tests and the final exam. The final mark will be based on weights of 5% for each of the case and the assignment, 20% for each of the midterm tests, and 50% for the final exam.

Graduate students will be evaluated on the basis of the case, two assignments, the two midterm tests and the final exam. The final mark will be based on weights of 5% for the case and 2.5% for each of the assignments, 20% for each of the midterm tests, and 50% for the final exam.

In order to obtain full credit or maximize partial credit on questions, students must outline clearly their approach, showing calculations when necessary.

Each week suggested practice questions will be posted on OWL website of the course. Assistance with solving them may be obtained during the instructor's office hours. If a student requires remarking of a test, the test must be submitted to the instructor within two weeks of the test date. Any changes made after this period will not be reflected in the recorded marks.

Across the Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. **Final grades** on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks **will not** be bumped to the next grade or GPA, e.g. a 79 **will not** be bumped up to an 80, an 84 **will not** be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

Course website

No lecture notes will be posted online. However, some relevant readings, assigned practice questions, slides and announcements will be posted on the course OWL web page.

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.

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.

Calculators

A calculator is essential for working exercises, tests and final exam. There is no restriction on models of (non-programmable) calculators allowed for use in the course. It is, though, preferable for actuarial students to practice on SOA /CAS approved calculators.

CIA accreditation

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Student absences

Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet

academic requirements may submit a request for academic consideration through the following routes:

(i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for an SRA:

- an absence must be no more than 48 hours;
- the assessments must be worth no more than 30% of the student?s final grade;
- no more than two SRAs may be submitted during the Winter term (Note that SRA is applicable to undergraduate students only.)

(ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.

(iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Observe that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. All documentation required for absences that are not covered by the SRA Policy must be submitted to the Academic Counselling office of a student's Home Faculty.

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf
and for the Student Medical Certificate (SMC), see:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

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.

Absences from assessments

For all students who have had a valid reason (as per (i) to (iii) and Religious Accommodation above) and miss an evaluation, there will not be a make-up evaluation apart from the final exam. Instead, the weight of the missed assessment will be adjusted accordingly based on the other test and the final exam as long as they have not been written yet. In all other cases, students will receive a mark of 0 for the assessment.

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 make-up 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).

Accommodation policies

Students with disabilities work with Accessible Education (formerly SSD), 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.pd

E-mail communication

You are welcome to communicate with your instructor by e-mail, but e-mail communication should only be used to provide her with information or to ask a question that requires a brief response. The best means of learning material that you find challenging is to book an appointment or drop by during office hours. If you do e-mail me, please use your UWO account, as these are the preferred email addresses (as e-mails sent from other addresses often get spammed).

Attendance

Classroom attendance is viewed as an important part of the learning process. Students are advised that excessive absenteeism may result in the student being disbarred from the final exam (see Western Academic Calendar).

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/.

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 (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check

out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Learning-skills counsellors at the Student Development Centre (http://www.sdc.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.

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

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