

AS 3429A / 9429A COURSE OUTLINE

The University of Western Ontario

Fall 2020

1. General Course Information

Course Name: Life Contingencies II

Class Schedule: Mondays, Wednesdays and Fridays from 10:30 to 11:20am (first class on September 9th, 2020)

Prerequisite Requirements

A minimum mark of 60% in each of Actuarial Science 2427A/B and Statistical Sciences 2858A/B. Restricted to students enrolled in any Actuarial Science module.

Pre/Corequisite(s): Statistical Sciences 3657A/B

Warning: 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

Instructor	Xiaoming Liu
Office	WSC 215
Email	xliu@stats.uwo.ca
Phone	Ext. 88233
Office hours	Tuesdays 9:30-10:20 am and 3:30-4:20 pm starting from Sept. 15, 2020 on Zoom (link available in OWL)

3. Course Description/Syllabus

Calendar 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 estimates; mortality Improvement and longevity models.

This course is accredited under the Canadian Institute of Actuaries (CIA) University Accreditation Program (UAP) for the 2020-21 academic year. Achievement of the established exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams.

Specifically, a combination of this course, Actuarial Science 3431B (each with a minimum of 80%) and Actuarial Science 2427B (minimum grade of 75%) is required to achieve an exemption for preliminary exam LTAM. The following pages provide the relevant Society of Actuaries Exam LTAM Learning Objectives to be covered in this course.

Long-Term Actuarial Mathematics
FALL 2020

1. Topic: Long-term insurance coverages (2-8%)

Learning Objectives

The Candidate will understand the key features of long-term insurance coverages.

Learning Outcomes

The Candidate will be able to:

- a) Describe the long-term coverages in insurance (life, health, and general), annuities, and retirement benefits (e.g. pensions, retiree health care, etc.)
- b) Describe the similarities and differences between the long-term coverages identified in Learning Outcome 1a.
- c) Describe the appropriate models to be used to calculate expected present values, premiums or contributions, and reserves for each long-term coverage.

2. Topic: Survival models and their estimation (15-25%)

Learning Objectives

The Candidate will understand key concepts concerning parametric and non-parametric (tabular) and multi-state models including single life, or multiple life, and multiple decrements.

Learning Outcomes

The Candidate will be able to:

- a) Explain and interpret survival models and transitioning between states.
- b) Calculate and interpret standard functions including survival and mortality probabilities, force of mortality, and complete and curtate expectation of life.
- c) Calculate nonparametric estimates of survival models using the Kaplan-Meier and Nelson-Aalen formulas for seriatim data and adaptations for grouped data.
- d) Calculate, using both seriatim and grouped data, maximum likelihood estimates of transition probabilities assuming constant transition intensity during fixed age intervals.
- e) Calculate the variances of and construct confidence intervals for the estimators in parts c) and d).
- f) Calculate transition intensities exactly, or estimate transition intensities using large sample approximations.
- g) Describe and apply simple longevity models.
- h) For models dealing with multiple lives and/or multiple states, explain the random variables associated with the model and calculate and interpret marginal and conditional probabilities.
- i) Construct and interpret select and ultimate survival models.
- j) Describe the behavior of Markov chain models, identify possible transitions between states, and calculate and interpret the probability of being in a particular state and transitioning between states.
- k) Apply to calculations involving these models appropriate approximation methods for fractional ages based on uniform distribution of deaths or constant force.

3. Topic: Present Value Random Variables (10-20%)

Learning Objectives

The Candidate will be able to perform calculations on the present value random variables associated with benefits and expenses for any of the models in Learning Objective 2.

Learning Outcomes

The Candidate will be able to:

- a) Calculate and interpret probabilities, means, variances, and percentiles.
- b) Calculate and interpret the effect of changes in underlying assumptions such as mortality and interest.
- c) Apply appropriate approximation methods such as uniform distribution of deaths, constant force, ~~Woolhouse~~, and Euler.

4. Topic: Premium Calculation (15-30%)

Learning Objectives

The Candidate will be able to use and explain premium-calculation methodologies.

Learning Outcomes

The Candidate will be able to:

- a) Calculate and interpret probabilities, means, variances, and percentiles of random variables associated with a premium, including loss-at-issue random variables.
- b) Calculate premiums based on the equivalence principle, the portfolio percentile premium principle, and profit testing.
- c) Using the models in Learning Objective 2, calculate and interpret the effect of changes in benefits or underlying assumptions such as decrements, morbidity, expenses, and interest.
- d) Apply appropriate approximation methods such as uniform distribution of deaths, constant force, ~~Woolhouse~~, and Euler.

5. Topic: Reserves (20-30%)

Learning Objectives

The Candidate will understand reserves for insurances and annuities for models in Learning Objectives 2 and 4.

Learning Outcomes

The Candidate will be able to:

- a) ✓ Calculate and interpret the following reserve types:
 - Net premium
 - Modified
 - Gross premium
 - Expense
- b) ✓ Calculate and interpret probabilities, means, variances, and percentiles of random variables associated with these reserves, including future-loss random variables.
- c) Calculate and interpret common profit measures such as expected profit, actual profit, gain, gain by source and period, internal rate of return, profit margin, and break-even year.
- d) ✓ Apply appropriate approximation methods such as uniform distribution of deaths, constant force, ~~Woolhouse~~, and Euler.

4. Course Materials

One Textbook + Two Study Notes:

1. *Actuarial Mathematics for Life Contingent Risks (AMLCR)* by Dickson, C.M.D., Hardy, M.R., and Waters, H.R., 2013, **2nd Edition**.
 - Chapters 6 and 7 (excluding 6.10, 7.3.5, 7.6, 7.7, 7.10)
2. [SOA LTAM-21-18 Supplementary Note on Long Term Actuarial Mathematics \(Hardy\)](#) by Hardy, M.R.
 - Chapters 4 and 5 (excluding 5.3), including Section 3.11 of *AMLCR*
3. [SOA LTAM-22-19 Estimation based on Empirical Data \(KPW\)](#) from *Loss Models, From Data to Decisions*, by Klugman, S.A., Panjer H.H., and Willmot, G.E., 2018, **5th Edition**.
 - Background reading from Chapters 10 and 11
 - Chapter 14 is required (excluding 14.4, 14.6).

A solutions manual for the *AMLCR* text has been published and can be purchased online from Amazon.

5. Course Delivery Platform

I will use OWL to post lecture notes, announcements and student's grades.

I will use Zoom to conduct **synchronous online lectures**, and the Zoom link for each class has been set up in OWL.

I will use **OneNote's Class Notebook** to give lecture's demonstrations. More information on how to install OneNote and the plug-in of Class Notebook will be provided in the instructional slides, which will be posted in OWL as well.

In order to effectively participate online classes and office hours through Zoom, students need to have a stable internet connection and computer with working microphone and/or webcam. A digital pen that allows you to write on your computer screen will be very convenient thus desirable to have.

6. Methods of Evaluation

There will be **three quizzes and three projects** to help students to maintain their study progress over the term, a strategy adopted for online teaching environment. Each quiz contains a combination of some automated-marked questions and a short written-answer question.

There is **one in-class midterm test scheduled on Oct. 30, 2020**.

Students should contact the instructor within one week of starting date of the Fall term if they find a conflict with the scheduled quizzes and midterm test.

There will be a **three-hour final exam** during the final examination period (to be scheduled by the Office of the Registrar).

The overall course grade will be based on the following:

Quizzes	21 % (7 % for each)
Projects	9% (3% for each)

Participations	5% (including class participation and course forum discussions)
Test	20 %
Final Exam	45 %

7. Accommodation and Accessibility

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 Academic Accommodation for Students with Disabilities policy can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf

Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

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 Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:

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

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

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 Academic Calendar for details (under [Special Examinations](#)).

8. Academic Policies

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

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, 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 his/her official university address is attended to in a timely manner.

All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

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.

Tests and examinations in this course will be conducted using the remote proctoring service, such as Proctortrack. 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**. More information about this remote proctoring service is available in the Online Proctoring Guidelines at the following link:

<https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>

Quizzes in this course will be conducted using Zoom. You will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will **not** be recorded.*

More information about the use of Zoom for exam invigilation is available in the Online Proctoring Guidelines at the following link:

<https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom. Information about the system requirements are available at the following link:

<https://support.zoom.us/hc/en-us>

* Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.

9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop 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 Student Accessibility Services (SAS) 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/mental_health) 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>.