

University of Toronto Department of Statistical Sciences
ACT240 – Mathematics of Investment and Credit
Summer 2023

Instructor: Emma Kroell (emma.kroell@mail.utoronto.ca)

TAs: Yaqi Shi (yaqi.shi@mail.utoronto.ca)

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Lectures: Mondays and Wednesdays, 7 to 9 pm

Tutorials: Mondays and Wednesdays, 6 to 7pm

The first lecture will be on May 8th and the first tutorial will be on May 10th. **The tutorial slots on May 24 and June 12 will be used (combined with some class time) for term tests, thus your attendance is mandatory.** Other tutorials will be problem solving sessions with the TAs, where your attendance is not mandatory but highly encouraged.

Office hours

Instructor: Thursdays, 7 to 8 pm, May 11 to June 15

Extra office hours will be offered before tests and the exam – times TBA.

TAs: Tuesdays, 7 to 8 pm, May 16 to June 20

Office hours will be held on Zoom at <https://utoronto.zoom.us/j/84167590071>

Course communication

Students are expected to check Quercus regularly (at least daily) to stay up to date with the course. Having Quercus announcements delivered immediately to you via email is recommended.

Emails to the instructor will be answered within two business days. Please include “ACT240” in the e-mail subject.

Course description

Welcome to ACT240, your first actuarial science core course. In this course, we will study the theory of interest, including discount and present values, determination of prices of annuities, mortgages, bonds and equities, loan amortization, yield rates on investments, etc.

Course details

This is an accelerated course, as it is being taught over a six-week term. Because of that, it is very important that you set aside time to review course content and practice problems multiple times a week. Classes will be used to cover key points and present example problems. Tutorials will be used for practice problems. Make sure to do the associated readings and additional practice problems on your own time.

As this class prepares you for the Financial Mathematics (FM) exam of the Society of Actuaries (SOA) and the Casualty Actuarial Society (CAS), most of the questions and examples will resemble the structure of such exams.

Note: This course is for students working to enter an actuarial science major or specialist program. For other students interested in similar course material, please enroll in ACT230 Mathematics of Finance for

Non-Actuaries. In addition, in order to enroll in any 300- or 400-level ACT course, a minimum grade of 63% must be obtained in each of ACT240, ACT245 and ACT247.

Textbooks

The main textbook is the Broverman coursebook for ACT240+ACT245. It is available for purchase for \$45 from the Department of Statistical Sciences. Details on when and how you can purchase your textbook will be posted on Quercus. If you already have a copy from within the past two years, you can use that.

Extra reference book: Mathematics of Investment and Credit by S. Broverman

This book is not required, however, if you would like an additional textbook, this book is suggested. The 5th edition of this book is on reserve at the library, meaning that if you go to the Robarts library you can borrow it for free from the 1st floor Robarts loan desk for up to 5 hours at a time. Copies of this textbook, both digital and print, are available for purchase online as well. Any edition 4+ should be acceptable.

Calculator

You will need to use a calculator for this course. You may use any of the SOA-approved calculators: battery or solar-powered Texas Instruments BA-35 model calculator, the BA II Plus, the BA II Plus Professional, the TI-30Xa or TI-30X II (IIS solar or IIB battery), or TI-30X MultiView (XS Solar or XB Battery). Note that the BA II Plus/Plus Professional can do some finance calculations that the other calculators cannot, but you are not required to use this calculator.

Course evaluation

Assessment	Weight	
Weekly Quercus Quizzes	15%	Available weekly on Quercus Thursday through Sunday. The best 5 out of 6 quiz scores will be used for your final score.
Term Test 1	25%	May 24. Covers Sections 1 through 4. One page formula sheet permitted.
Term Test 2	25%	June 12. Covers Sections 5 through 9 (knowledge of earlier material is assumed). One page formula sheet permitted.
Final Exam	35%	During the final exam period; exact date TBA. Covers all course content. One page formula sheet permitted.

Quizzes

We will have 6 weekly quizzes on Quercus. They will be available Thursday morning through Sunday afternoon. Once started, you have 45 minutes to complete the quiz. The quizzes will be open book. The best 5 quiz scores will be used for your final score.

Formula sheet

You may bring a 1-page (standard 8.5 by 11 inch), 1-sided formula sheet (sometimes called a “cheat sheet”) to the term tests and final, where you may list out relevant formulas you wish to have access to during the tests.

Alternate grading scheme

The following alternate grading scheme will be used *only if it results in a higher final grade for the individual student*:

Quizzes 15%, Best Term Test 30%, Final Exam 55%

Missed Assessments

Quizzes

Because the lowest quiz is dropped and you can complete them any time over the course of 4 days, no adjustments will be made for missed quizzes.

Term Tests

If you miss a term test for a valid reason, you must **notify the instructor via email within 72 hours of the missed examination**. In addition, you must declare your absence to the University using the Absence Declaration area in ACORN.

If you miss a single test, you will have the choice of:

1. Re-weighting the mark to the other assessments in the following manner:
Quizzes 15%, Remaining Term Test 30%, Final Exam 55%.
2. Writing a make-up test which will be held on **June 19 from 4:00 to 5:15 pm** and will cover material from *both* term tests.

You must indicate your preference (make-up vs. grade shifting) to the instructor when you notify the instructor of your missed test.

Please be aware that in the exceptional circumstance that you should miss both term tests for valid reasons, you must write the makeup test.

Grading questions and regrade requests

For questions or clarifications about a grade on a term test, please first contact Xinyun (xinyunchristina.li@mail.utoronto.ca), **cc'ing the instructor**, within 3 days of receiving the grade. Clearly explain your question or concern and attach a photo of the relevant question and feedback.

After this, if you would like to request a regrade, please forward your request to the instructor (emma.kroell@mail.utoronto.ca) with the title "ACT240: Regrade request" within 3 days of receiving the response from the TA. You must include a detailed written explanation of why you wish to be regraded. The instructor will re-evaluate the requested content. Please be aware that a regrade could result in a lower mark than you originally received.

Tentative Course Schedule

Week	Date	Content	Readings
1	Monday May 8	Introduction to the course; Simple and compound interest	Section 1
	Wednesday May 10	Nominal rates of interest and discount	Section 2
2	Monday May 15	Force of interest; Inflation; Risk of default	Section 3
	Wednesday May 17	Annuity-immediate and annuity-due; Recap for term test 1	Section 4
3	Monday May 22	Public holiday: No class today	

	Wednesday May 24	Term Test 1 (up to Section 4); Annuity valuation at any time point	Section 5
4	Monday May 29	Annuities with differing interest and payment periods	Section 6
	Wednesday May 31	Annuities whose payments follow arithmetic or geometric progressions	Sections 7 & 8
5	Monday June 5	Amortization of a loan	Section 9
	Wednesday June 7	Bond valuation; Recap for term test 2	Section 10
6	Monday June 12	Term Test 2 (up to Section 9); Bond valuation continued	
	Wednesday June 14	Bond amortization; Callable bonds	Section 11
7+	Monday June 19	Measures of the rate of return on a fund	Section 12
	Wednesday June 21 to Monday June 26	Final Exam (to be scheduled by the university)	

Academic Integrity

Academic integrity is fundamental to learning and scholarship at the University of Toronto. Please read the University of Toronto's Code of Behaviour on Academic Matters available at <https://www.academicintegrity.utoronto.ca>.

In particular, quizzes are open-book, meaning you can use lecture and tutorial materials as well as the coursebook and reference book. You should not use other sources and all work must be done yourself. Tests will be closed-book except for a one-page formula sheet. No aids other than the approved calculators will be permitted, and you may not possess any other electronic devices during the test or exam. Receiving help from or *providing help to* another student is a serious academic offense.

Copyright notice

All course materials, including questions from assessments, are the property of the author, instructor, or university (as relevant) and may not be distributed online or by any other means.

Canadian Institute of Actuaries University Accreditation Program

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. Under the new pathway, 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/%20acia-for-accredited-university-students/>.