

ACT240 – Mathematics of Investment and Credit

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

Vital Statistics:

Instructor: Vicki Zhang, FSA, ACIA, CERA, MStat (with completion of PhD qualification exams)

Lectures: Mondays, 10am-12pm

Lecture location: SS 2117

Tutorials: Fridays, 10-11am

Tutorial Location: TBD (will be posted on Blackboard)

Office: 6th floor, SS Room 6027A

Office Hour: Tuesdays, 4:15-6:15pm

Blackboard: <http://portal.utoronto.ca>

Email: vicki@utstat.toronto.edu

Textbook:

The main textbook we will use for this course is Sam Broverman's Study Guide for SOA EXAM FM/ CAS EXAM2. Study guides from 2013-2016 are accepted. The Actuarial Club has made cheap version of the 2016 edition available. Detailed textbook purchase information from the Actuarial Club is posted in the course portal.

Note that it is my pedagogical objective to link the course material to the real world as much as possible. Therefore, you should pay attention to the course notes as some of the real-world references are not presented in the textbook.

Calculator:

You need one of the following 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)

Evaluation:

5% In-class quiz

7% One Excel homework

8% One team project (see details below)

20% Term Test 1

20% Term Test 2

40% Final Exam

Team Project:

For a lack of better term, we will call this project "repurposing finance". Towards the later part of the course, you will study loans and bonds. After studying those materials, you will be asked to work in a team of three students to either research and present an existing loan/bond that was designed with a socially and/or environmentally beneficial

objective, or if you so wish, try your hands at designing a loan/bond to tackle a social/environmental issue that is dear to your heart. You should expect to present the following:

- (1) the issue(s) the loan/bond was designed to solve (e.g. the project the bond is supporting);
- (2) the financial aspects of the loan/bond presented in Excel (e.g. duration of the project, initial loan amount, amortization schedule/periodic payments to investors, overall costs of issuing the loan/bond, projection of profits from the projects the bond/loan is supporting, etc);
- (3) benefits (both financial and social/environmental) of the loan/bond, its limitations and proposals for future improvements if applicable.

Your audience/reader of the research/design report are the general public, and therefore you should strive in your writing to be reader-friendly (e.g. use graphics and charts and other creative means, plain English in describing a financial concept, etc). **You will also need to make a note in the report documenting the main contributions made to the project by each individual team member.** A sample division of labor could be a leader in data gathering, a leader in data analysis in Excel, and a leader in communication and reporting. Team members should however participate in all aspects of the project, while assuming individual leadership in specific task(s). Detailed grading rubrics will be posted later in the term.

Bonus points opportunities (to be applied to final course mark):

1. In-class questions using Poll Everywhere (up to 5% bonus points): For each question that is answered correctly, you are awarded 0.5 point. If the question is open-ended, you receive 0.5 point for participation. All participation is voluntary but strongly recommended. Bonus points will be awarded and accumulated from week 3 (although I will only post the total bonus points at semester's end).
2. Team project (8% base point, up to 3% bonus points plus 1% team bonus): Bonus points will be judged mainly based on two criteria: (1) the depth and thoroughness of your research, and (2) creativity in either the presentation of research findings or in product design. Every team of three that has a note documenting individual contributions automatically receive 1% team bonus.

To celebrate great work, there will also be a possibility of creating an e-zine (published online) for the best papers/presentations from the team project.

Estimated Weekly Schedule of Topics:

Lecture - September 12:

- The five "puzzles" we will solve in this course
- Poll Everywhere test-run
- Puzzle #1 What was Jon Oliver ranting about when it came to payday loan?
 - o A.k.a: Simple and compound interest, present value, effective rate of interest (Section 1)

No tutorial in the first week.

Lecture - September 19:

- Rate of discount (Section 1)
- Nominal rate of interest and normal rate of discount (Section 2)

Tutorial – September 23

- Poll Everywhere tutorial

Lecture - September 26:

- Inflation (Section 2)
- Taking it to the limit: Force of interest (Section 3)

Lecture – October 3:

- Puzzle #2: How are stocks priced?
 - o A.k.a: present value of cash flow patterns known as “perpetuity” and “annuity”. (Section 4)
- Annuity Immediate and Annuity Due

October 10: Thanksgiving, no class

Tutorial October 14 – Term test 1 (55 minutes, 10:05-11am), in tutorial room, covering materials up to Section 3 force of interest

Lecture - October 17:

- Equating two cashflows (Section 4)
- More “annuity” valuation (interest rate change, etc) (Section 5)

Tutorial October 21 – Term test 1 review

Lecture - October 24:

- More “annuity” valuation - Annuity with different interest and payment period (Section 6)

Lecture - October 31:

- More “annuity” valuation - Annuities following a geometric and arithmetic progression (Section 7&8)

Team project sign-up this week. You have until **November 8th** to give your team members' names to your TA. You should select team members within your own tutorial group. After November 8th your TA will randomly assign you into a project group of three (within your own tutorial group). You can then arrange to meet your team outside of class to discuss the project. I also designate November 11th tutorial for team members meet-and-greet.

Tutorial November 4:

- Basic Excel skills (in preparation of Excel homework)

November 7: Fall break, no class. Last day to drop class.

Tutorial November 11: Team members meet-and-greet: free time to connect with your team members and have very preliminary project discussions. You won't have all the knowledge necessary to do the project until after the lecture on November 21, but you may start team building, discuss rough divisions of labor based on each team member's aptitude and interest.

Lecture - November 14:

- Puzzle #3: What do all the numbers on a mortgage statement mean?
 - o A.k.a: amortization of a loan (Section 9)

Tutorial November 18 – Term Test 2 (55 minutes, 10:05-11:05am), in tutorial room, covering materials up to Section 8 annuities following arithmetic progression

Lecture - November 21:

- Your Excel homework on mortgage amortization
- Puzzle #4: How to read Wall Street Journal bond quotes page?
 - o A.k.a. Bond valuation (Section 11)

Tutorial November 25 – Term Test 2 Review with TA

Lecture - November 28:

- Excel homework recap – solving the various puzzles about mortgage
- Bond amortization (Section 12)
- Team project Q&A

Lecture - December 5:

- Callable bonds (Section 12)
- How do you read actual quotes on WSJ? – clean and dirty price (Section 11)

Lecture - December 7 (“Makeup Monday”)

- Sinking fund method of loan repayment (Section 10)
- Other loose ends

Team Project is Due 6pm, December 7th.

NO tutorial in the last week

Final Exam – Date TBA, will be announced on portal

Missed Assignments or Exams

- There is **no** make-up for in-class quizzes or bonus questions.
- There is **no** make-up Excel homework, or team project.

- There are **no** make-up term tests. However, if you miss a term test, and you can provide me with one of the following: a UofT Verification of Illness or injury form (www.illnessverification.utoronto.ca), or an Accessibility Services letter, or a letter from your college registrar about personal matters interfering with your studies, **by the day after the term test at the latest**, your missed term test weight will be shifted to the final exam (i.e. if you missed a 20% term test, your final exam will be worth 60%). This “shifting” may be done after comparing and adjusting the class average of the missed test and final exam to ensure fairness to all students. You will be informed of that adjustment should it happen.
- There will be **ONE** make-up final exam arranged by Faculty of Arts and Science directly.

A Word on Tutorials:

In the past one of the common feedbacks from students is that they do not find tutorials with TAs particularly useful. In this semester, other than the tutorial hours designated for reviewing term tests, Poll Everywhere, Excel basics (see the above weekly schedule), we will use tutorial hours partially as a type of group office hour with your TA. There will be some questions from the textbook suggested for the tutorials. However, students in this course are expected to work on all the end-of-section practice questions. You are encouraged to post your “muddiest points” – concepts and questions you do not quite understand – to your own TA *by noon on Thursday before your tutorial on Friday*. The concepts and questions can be related to any section we have covered in lectures so far – they do not have to be from the most recent lecture/sections. During tutorials TAs will try to address the common questions posted by students.

A Word on Recommendation Letter Request

If you request a recommendation letter from me in the future based on this course, you need to meet the following criteria:

- (1) your final course grade is at least 80%; **AND**
- (2) your team project grade is at least 8% or you project has been selected into the “best paper/presentation” collection.

The reason for the second criterion is that to write a customized recommendation letter that will have any impact to your application, I will need to have some performance data that is beyond a numeric course grade. In a large-classroom course like this one, your team project provides me with some basis to comment on your independent research, communication, critical thinking, and creative skills. Those are the characteristics that are required to be commented upon in a recommendation letter.

Canadian Institute of Actuaries (CIA)’s University Accreditation Program (UAP)

ACT240 is an accredited course under the UAP program. The minimum grade needed to apply for an exemption is 70. For detailed information on UAP, please visit the following webpages:

- University Accreditation Program description (<http://www.cia-ica.ca/membership/uap>)

- List of accredited courses offered by University of Toronto: <http://www.cia-ica.ca/membership/uap/accredited/toronto>
- How to apply for CIA exemptions: <http://www.cia-ica.ca/membership/uap/information-for-students>

Note: The CIA will grant credits to students for SOA/CAS examinations based on the achievement of the minimum Grade towards Associateship (ACIA) and Fellowship (FCIA) in the CIA. At the time of this agreement, CIA credits are recognized by the following actuarial organizations towards their respective designations:

Casualty Actuarial Society (CAS): ACAS, FCAS
UK Institute and Faculty of Actuaries (IFoA): FIA, AIA
Institute of Actuaries of Australia (IAA): AIAA, FIAA
Actuarial Society of South Africa (ASSA): AMASSA, FASSA
American Academy of Actuaries (AAA): MAAA

The CIA does not guarantee that credits granted to students under the CIA UAP will be recognized by any other actuarial organizations towards their actuarial designations.