ACT240 – Mathematics of Investment and Credit

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.

To effectively understand the topics above, the lectures will center around four real-life "puzzles": payday loan, stock pricing, many scenarios of a residential mortgage, and reading WSJ bond quotes.

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: Prof. V. Zhang
Lectures: Mondays, 11am-1pm
Lecture location: NL 6 (6 Queen's Park Crescent West)
Tutorials: Fridays, 10-11am
Tutorial Location: TBD (will be posted on Quercus)
Office: 6th floor, SS Room 6027A
Office Hour: Mondays, 1:30pm-3:30pm
Course website: http://q.utoronto.ca
Email: vicki@utstat.toronto.edu

Textbook:
The main textbook is Broverman course book for ACT240+ACT245.

Note: It is my pedagogical objective to link the course material to the real world as much as possible. Therefore, you should pay close attention to the lecture 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:
2% Class participation (using Poll Everywhere)
8% In-class pop quizzes (using Poll Everywhere; 1 point for each question answered correctly)
25% Term Test 1
25% Term Test 2
40% Final Exam

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

1. Creative thinking/artmaking (up to 2%): Research shows that learning is most effective when students resort to both their cognitive and emotional faculties. To that end, you are welcome (but **NOT** required) to use artistic means to convey a topic you have learned in this course. Examples include drawing/painting, song/music, concept map, video, 3D model, poem, even a performance/dance. A brief artistic statement should accompany the artwork, describing how the work connects with the course content. I will also post a more detailed guideline on Quercus as well as links to creative samples from similar courses.
2. In-class bonus questions (up to 2%)

To celebrate great work, there will also be a possibility of creating an e-zine (published online) for the best creative work from this course.

Estimated Weekly Schedule of Topics:

Lecture 1 - September 9:

- Welcome and introduction
- 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?**
    - Introducing simple and compound interest, present value, effective rate of interest (Section 1)

September 13 - NO tutorial in the first week.

Lecture 2 - September 16:

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

Tutorial – September 20:

- If you have problem registering on Poll Everywhere, your TA will help you trouble shoot in this tutorial

Lecture 3 - September 23:

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

Lecture 4 – September 30:

- **Puzzle #2: How are stocks priced?**
    - Introducing present value of cash flow patterns known as "perpetuity" and "annuity". (Section 4)
- Annuity Immediate and Annuity Due

Lecture 5 - October 7:

- "Equating" two cashflows (Section 4)

- More “annuity” valuation (interest rate change, etc.) (Section 5)

October 14: Thanksgiving, no class

Tutorial October 18 – Term test 1 (55 minutes, 10:05-11am)

Lecture 6 - October 21:
- More “annuity” valuation - Annuity with different interest and payment period (Section 6)

Tutorial October 25 – Term test 1 review

Lecture 7 - October 28:
- More “annuity” valuation - Annuities following a geometric and arithmetic progression (Section 7&8)

November 4: Fall break, no class. Last day to drop class.

No Tutorial on November 8 (Fall break). There is no office hour (Professor’s or TA’s) this week.

Lecture 8 - November 11:
- **Puzzle #3: What do all the numbers on a mortgage statement mean?**
    - Introducing amortization of a loan (Section 9)

Tutorial November 15 – Term Test 2 (55 minutes, 10:05-11:05am).

Lecture 9 - November 18:
- Real-life case study: the many considerations of a mortgage (amortization schedule, different amortization period, lump-sum prepayment, etc.)
- **Puzzle #4: How to read Wall Street Journal bond quotes page?**
    - Introducing bond valuation (Section 10)

Tutorial November 22 – Term Test 2 Review with TA

Lecture 10 - November 25:
- Bond amortization (Section 11)

Lecture 11 - December 2:
- Callable bonds (Section 11)
- How do you read actual quotes on WSJ? – clean and dirty price (Section 10)

Lecture 12 - December 5 (“Makeup Monday”)
- Measurements of the Rate of Return on a Fund (Section 12)

December 6 - NO tutorial in the last week

Final Exam – Date TBA, will be announced on portal

Missed Assignments or Exams

- There are no makeup in-class pop quizzes or 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 immediately 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. You can only do this once (i.e. not for both term tests).
- There will be **ONE** make-up final exam arranged by Faculty of Arts and Science directly.

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 Felllowship (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.