
THE UNIVERSITY OF IOWA
College of Liberal Arts and Sciences
Department of Statistics and Actuarial Science

ACTS:4130 Quantitative Methods for Actuaries

Spring 2016
4:30 p.m. – 5:20 p.m., MWF, at 112 MH

1 Contact information

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(**Note: Please specify “ACTS:4130” in the subject line**)
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(**Note: Please specify “ACTS:4130” in the subject line**)

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2 Course description and objectives

This foundation course for B.S. and M.S. in Actuarial Science students consists of two separate parts:

Part 1. Financial derivatives (approx. 8 weeks)

The first objective of this course is to prepare you adequately for the second part of the SOA Exam FM (Financial Mathematics), namely, the financial economics portion, which accounts for 20-35% of the entire exam according to the exam syllabus. The knowledge about financial derivatives covered in this part of the course will also be of use when you take ACTS:4380 Mathematics of Finance II, which prepares you for SOA Exam MFE (Models for Financial Economics).

For the theory of interest part of Exam FM, you should take ACTS:3080 Mathematics of Finance I.

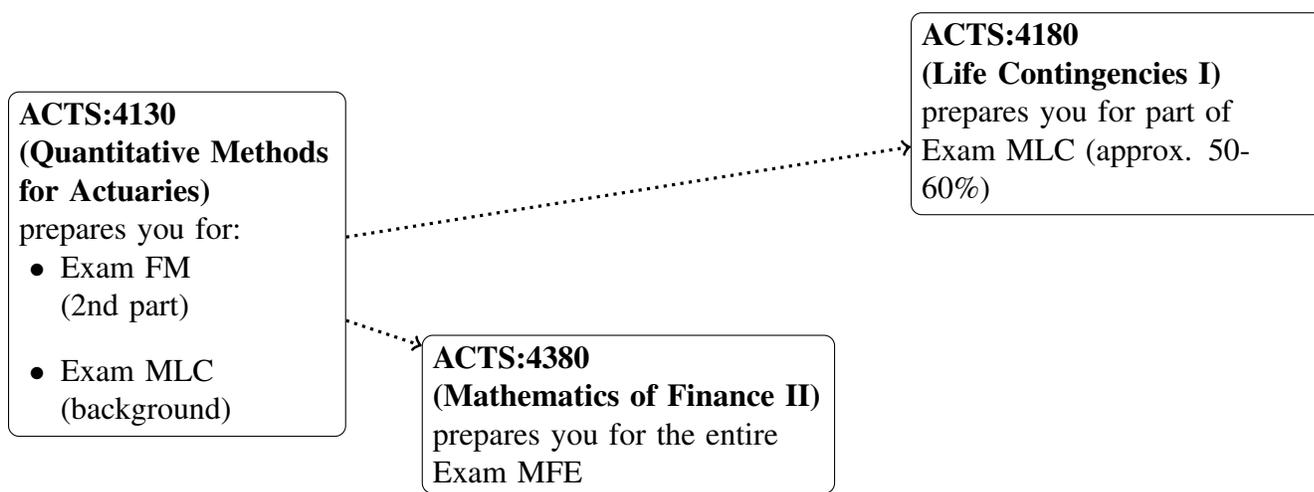
Part 2. Baby life contingencies (approx. 7 weeks)

In the second part, we shall switch gears and develop a probabilistic framework that is crucial to valuing *contingent* cash flows required in SOA Exam MLC (Models for Life Contingencies). The probabilistic tools we learn in this course will be applied and further enhanced in the two follow-up courses, ACTS:4180 Life Contingencies I and ACTS:4280 Life Contingencies II, to value typical insurance products.

After taking this course, you are expected to:

- Develop a conceptual (i.e. non-mathematical) understanding of different kinds of derivatives, in particular, forwards and options.
- Design an arbitrage strategy to exploit mispricing in the market.
- Take and, most importantly, pass Exam FM with considerable ease.
- Proceed to advanced courses on life contingencies and mathematical finance with strong confidence.

Figure 1 shows a flowchart of more advanced actuarial courses taken by a typical UI student after successfully completing this course (each arrow means a transition conditional on a grade of C+ or above in the preceding course).



Spring 2016

Fall 2016

Spring 2017

Figure 1: The actuarial courses you can take after satisfactorily completing ACTS:4130.

3 Exam FM

In 2016, Exam FM will be offered via computer-based testing (CBT) in February (16–27), April (7–18), June (9–20)ⁱ, August (4–15), October (13–24) and December (6–17). The registration deadlines are January 5, February 29, May 2, June 27, September 6 and October 31 respectively. More details of Exam FM (e.g. syllabus, sample exam questions, etc.) can be found at <https://www.soa.org/education/exam-req/edu-exam-fm-detail.aspx>.

4 Texts

There are no required textbooks in this course. We shall follow closely the course lecture notes, regarded as a mini-textbook, which will be made available on ICON chapter by chapter. The notes not only address all important topics required in the financial economics portion of Exam FM and the introductory part of Exam MLC, but also include a wide variety of examples for exam preparation. *You are strongly recommended to have a copy of the notes during class meetings.*

Here are two recommended texts available in the university bookstore:

1. *McDonald, R.L., 2013. Derivatives Markets (Third Edition). Pearson.*

This is the official textbook for the Financial Economics portion of Exam FM as well as Exam MFE. We shall cover the following required sections in the SOA Exam FM syllabus:

ⁱI recommend taking Exam FM in June shortly after completing this course.

- Chapter 1: Introduction to Derivatives
- Chapter 2: An Introduction to Forwards and Options
- Chapter 3: Insurance, Collars, and Other Strategies
- Chapter 5: Financial Forwards and Futures (Sections 5.1-5.4 and Appendix 5.B)
- Chapter 8: Swaps (Sections 8.1-8.3)

Chapter 4 on Introduction to Risk Management (Sections 4.1-4.4), which is an easy continuation of Chapter 3, will be left for self-study.

Pearson has published *Student Solutions Manual to Derivatives Markets*, which provides solutions to all even-numbered end-of-chapter questions in the text.

2. Dickson, D.C.M., Hardy, M.R., Waters, H.R., 2013. *Actuarial Mathematics for Life Contingent Risks (Second Edition)*. Cambridge University Press.

This is the official textbook for Exam MLC. We shall cover the following introductory chapters:

- Chapter 2: Survival models
- Chapter 3: Life tables and selection
- Chapter 4: Insurance benefits

There is a solution manual (*Solutions Manual for Actuarial Mathematics for Life Contingent Risks*) that accompanies this book.

5 Tentative teaching schedule

This approximate schedule will be updated as needed during the semester.

Teaching Week	Lecture	Date	Topic
Part I: Financial Derivatives			
1	—	January 18, 2016 (Mon)	(University Holiday)
	L01	January 20, 2016 (Wed)	Chapter 1*
	L02	January 22, 2016 (Fri)	Chapter 1
2	L03	January 25, 2016 (Mon)	Chapter 1
	L04	January 27, 2016 (Wed)	Chapter 1
	L05	January 29, 2016 (Fri)	Chapter 2
3	L06	February 1, 2016 (Mon)	Chapter 2
	L07	February 3, 2016 (Wed)	Chapter 2
	L08	February 5, 2016 (Fri)	Chapter 2
4	L09	February 8, 2016 (Mon)	Chapter 2
	L10	February 10, 2016 (Wed)	Chapter 2
	L11	February 12, 2016 (Fri)	Chapter 2

5	L12	February 15, 2016 (Mon)	Chapter 3
	L13	February 17, 2016 (Wed)	Chapter 3
	L14	February 19, 2016 (Fri)	Chapter 3
6	L15	February 22, 2016 (Mon)	Chapter 3
	L16	February 24, 2016 (Wed)	Chapter 3
	L17	February 26, 2016 (Fri)	Chapter 4
7	L18	February 29, 2016 (Mon)	Chapter 4
	L19	March 2, 2016 (Wed)	Chapter 4
	L20	March 4, 2016 (Fri)	Chapter 4
8	L21	March 7, 2016 (Mon)	Chapter 4
	L22	March 9, 2016 (Wed)	Chapter 4
	L23	March 11, 2016 (Fri)	Chapter 4
—	—	March 14, 2016 (Mon)	(Spring Break - No class!)
	—	March 16, 2016 (Wed)	
	—	March 18, 2016 (Fri)	
Part II: Baby Life Contingencies			
9	L24	March 21, 2016 (Mon)	Chapter 6
	L25	March 23, 2016 (Wed)	Chapter 6
	—	March 25, 2016 (Fri)	(No class. Midterm Exam in evening)
10	L26	March 28, 2016 (Mon)	Chapter 6
	L27	March 30, 2016 (Wed)	Chapter 6
	L28	April 1, 2016 (Fri)	Chapter 6
11	L29	April 4, 2016 (Mon)	Chapter 6
	L30	April 6, 2016 (Wed)	Chapter 7
	L31	April 8, 2016 (Fri)	Chapter 7
12	L32	April 11, 2016 (Mon)	Chapter 7
	L33	April 13, 2016 (Wed)	Chapter 7
	L34	April 15, 2016 (Fri)	Chapter 7
13	L35	April 18, 2016 (Mon)	Chapter 8
	L36	April 20, 2016 (Wed)	Chapter 8
	L37	April 22, 2016 (Fri)	Chapter 8
14	L38	April 25, 2016 (Mon)	Chapter 8
	L39	April 27, 2016 (Wed)	Chapter 8
	L40	April 29, 2016 (Fri)	Chapter 8
15	L41	May 2, 2016 (Mon)	Chapter 8
	L42	May 4, 2016 (Wed)	Chapter 8
	L43	May 6, 2016 (Fri)	Chapter 8 / Review

* Refer to the numbering in the lecture notes

6 Grading system

Assessment in this course comprises the following items:

1. **Attendance: $\pm \varepsilon$ %**

You may choose to attend or not to attend classes, but everyone needs to be aware that absence from classes without a valid reason can negatively affect the final grade. It is also impossible to get a copy of any course material you miss and inquire about any announcements made in class.

2. **Assignments: 15%**

There will be 5 to 6 non-equally weighted individual assignments in this course. Most of the assignment questions will come from the end-of-chapter problems in the lecture notes. You will have about 10 days to work on each assignment. Late homework will be severely penalized (see the instructions on the assignment sheet). Illustrative solutions will be provided.

A note on collaboration: Discussion with other students on homework problems is encouraged. However, what you hand in must ultimately be your own work.

3. **Short quizzes: 10%**

There will be about 5 announced 15-minute quizzes throughout the semester. These quizzes are intended to motivate you to study regularly (not just cram before the Midterm and Final Exams!) and will consist of reasonably straightforward questions. The quiz with the lowest score will be dropped when it comes to computing the final grade. No make-up quizzes will be given.

4. **Midterm Exam: 30%**

There will be one 90-minute written Midterm Exam to be held in the evening of **March 25, 2016** (Friday) covering Part I (Financial Derivatives) of this course. It consists of a mixture of true-or-false, fill-in-the-blanks and computational questions similar in style to SOA Exam FM problems. You will therefore find that released Exam FM sample questions are useful in preparing for the Midterm Exam.

5. **Final Examination: 45%**

A two-hour written examination covering Part II (Life Contingencies) of this course will take place in the week of May 9–13, 2016. It consists of a mixture of short computational and structured written-answer questions similar in style to SOA Exam MLC problems. The exact date and time will be announced by the Registrar in mid-September. Please do not plan your end-of-semester travel plans until the final exam schedule is made public. It is your responsibility to know the date, time, and place of the final exam.

All quizzes and exams in this course are closed-book and no formula sheet is allowed (and on all SOA exams as well!). Only SOA/CAS-approved calculators listed on Point 9 of <https://www.soa.org/Files/Edu/edu-rules-reg-instructions.pdf> are allowed.

Note on absence from exams If, for medical reasons, you are unable to take any exam in this course, you should inform the course instructor *within 48 hours* of the exam, and submit original documentation as soon as possible. Otherwise, a zero score will be awarded. Absence for other reasons will not be allowed, unless approval from the instructor is sought well in advance.

Grading scheme Plus or minus grading system will be used in this course, and undergraduate and graduate students will be treated as two separate groups when it comes to assigning final grades. An *approximate* guide is as follows:

Undergraduate students		
A- [83.5, 89)	A [89, 94.5)	A+ [94.5, 100]
B- [67, 72.5)	B [72.5, 78)	B+ [78, 83.5)
C- [50.5, 56)	C [56, 61.5)	C+ [61.5, 67)
D- [34, 39.5)	D [39.5, 45)	D+ [45, 50.5)
F [0, 34)		

Graduate students		
A- [85, 90)	A [90, 95)	A+ [95, 100]
B- [70, 75)	B [75, 80)	B+ [80, 85)
C- [55, 60)	C [60, 65)	C+ [65, 70)
D- [40, 45)	D [45, 50)	D+ [50, 55)
F [0, 40)		

These are not completely absolute scales and the instructor reserves the “option” to lower the cutoffs. Note that with this grading scheme you are not “graded on a curve”, and so you are not competing with fellow students. Therefore, you are not penalized in any way for working together to better understand concepts and to perform better in this course.

IMPORTANT NOTE

1. A grade of C+ or higher in this course is a prerequisite for ACTS:4180 and ACTS:4380, which will be offered in Spring 2016. The department has the right to de-register students who fail to meet the prerequisite requirement.
2. This is *not* an easy course for most students, *even for those who have passed Exam FM*. Each week you should spend about 3 hours outside of class meetings reviewing the course notes and working on the end-of-chapter problems. It is fine to work harder, but working less is risky. Let me know if you encounter any problems with your learning.

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A short introduction to the instructor Professor Ambrose Lo earned his B.S. in Actuarial Science (first class honors) and Ph.D. in Actuarial Science from The University of Hong Kong in 2010 and 2014 respectively. He joined the Department of Statistics and Actuarial Science at The University of Iowa in August 2014 as an assistant professor in actuarial science. He is a Fellow of the Society of Actuaries (FSA) and a Chartered Enterprise Risk Analyst (CERA). His research interests lie in dependence structures, quantitative risk management as well as optimal (re)insurance. His research papers have been published in top-tier actuarial journals, such as *Insurance: Mathematics and Economics* and the *Scandinavian Actuarial Journal*.

Besides dedicating himself to actuarial research, Ambrose attaches equal importance to teaching, through which he nurtures the next generation of actuaries and serves the actuarial profession. He has taught courses on financial derivatives, mathematical finance, life contingencies, credibility theory and advanced probability theory. His emphasis in teaching is always placed on concrete problem-solving skills complemented by a thorough understanding of the subject matter. He is also the sole author of ACTEX CAS Exam S Study Manual (Spring 2016 Edition).

College of Liberal Arts & Sciences: Policies and Procedures

Administrative Home

The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Academic Policies Handbook at <http://clas.uiowa.edu/students/handbook>.

Electronic Communication

University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondence (Operations Manual, III.15.2. Scroll down to k.11).

Accommodations for Disabilities

A student seeking academic accommodations should first register with Student Disability Services and then meet with the course instructor privately in the instructor's office to make particular arrangements. See www.uiowa.edu/~sds/ for more information.

Academic Honesty

All CLAS students or students taking classes offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty: "I pledge to do my own academic work and to excel to the best of my abilities, upholding the IOWA Challenge. I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled (CLAS Academic Policies Handbook).

CLAS Final Examination Policies

The final examination schedule for each class is announced by the Registrar generally by the fifth week of classes. Final exams are offered only during the official final examination period. **No exams of any kind are allowed during the last week of classes.** All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of a final exam.

Making a Suggestion or a Complaint

Students with a suggestion or complaint should first visit with the instructor (and the course supervisor), and then with the departmental DEO. Complaints must be made within six months of the incident (CLAS Academic Policies Handbook).

Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Department of Public Safety website.

**** END OF COURSE SYLLABUS ****