

The University of Iowa
College of Liberal Arts and Sciences
Department of Statistics and Actuarial Science
Course Outline for ACTS:4280 Life Contingencies II Fall Semester 2023
MWF 4:30 to 5:20 pm E132 AJB

Instructor: Dr. E.S.W. Shiu Office: 362 SH Phone: 319 335 2580 E-mail: elias-shiu@uiowa.edu
Office Hours: 2:30 to 3:30 pm TWF; or by appointment.

Department: Statistics & Actuarial Science, 241 SH Phone: 319 335 2082

D.E.O.: Dr. Kung-Sik Chan Phone: 319 335 0712 E-mail: kung-sik-chan@uiowa.edu

Prerequisites: C+ or better in ACTS:4180. Calculus (including differential equations), linear algebra, and probability are used extensively in this course.

The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the add and drop deadlines, the “second-grade only” option (SGO), academic misconduct policies, and other undergraduate policies and procedures. Other UI colleges may have different policies.

The required textbook is *Actuarial Mathematics for Life Contingent Risks*, 3rd ed (2020), by D.C.M. Dickson, M.R. Hardy, and H.R. Waters, Cambridge University Press. The goal of the course is to cover its Chapters 8, 9, 10, 11, 13, 14, 17, and Sections 7.2.4, 7.3, 15.2, 18.6. We shall also study the “Variable Annuity Guarantees” study note ALTAM-21-23.

Below are some useful references.

- *Actuarial Mathematics*, 2nd edition (1997), by N. L. Bowers, Jr., H. U. Gerber, J. C. Hickman (U Iowa MS 1952, PhD 1961), D. A. Jones (U Iowa MS 1956, PhD 1959), and C. J. Nesbitt, SOA.
- *Solutions Manual for Actuarial Mathematics for Life Contingent Risks*, 3rd edition, by D. C. M. Dickson, M. R. Hardy, and H. R. Waters, Cambridge University Press.
- *Models for Quantifying Risk*, 6th edition (2014), by S.J. Camilli, I. Duncan, and R. L. London, ACTEX Publications, and its *Solutions Manual*.
- *Fundamental of Actuarial Mathematics*, 3rd edition (2015), by S. D. Promislow, Wiley.
- *Stochastic Models in Life Insurance* (2012) by Michael Koller (a book published by Springer for the European Actuarial Academy). Using a campus connection, you can download the entire book for free <http://link.springer.com/book/10.1007/978-3-642-28439-7>

There will be two evening (6:30 to 8:30 pm) midterm exams, held on October 3 (Tuesday) and November 10 (Friday), in 140 SH. All exams are closed book and closed note; no crib sheets are allowed. You are to use a SOA-approved calculator.

Tentatively, your numerical grade will be calculated by the formula,

$$\text{HW } 10\% + \text{Midterm Exams } 25\% + 25\% + \text{Final Exam } 40\%,$$

and translated to a University of Iowa grade as follows:

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

Graduate students F[0, 46); D-[46, 50.5); D[50.5, 55); D+[55, 59.5); C-[59.5, 64); C[64, 68.5); C+[68.5, 73); B-[73, 77.5); B[77.5, 82); B+[82, 86.5); A-[86.5, 91); A[91, 95.5); A+[95.5, 100]

The formula for SOA’s UEC score is: HW 20% + Final Exam 80%. To get ALTAM credit from the SOA, you need to achieve 85% or better. Your midterm exam marks contribute to your U of Iowa grade, but not to the SOA UEC score.

The **final** examination, to be held during the week of December 11, is **cumulative** (covering material from throughout the course).

On the next page is a tentative teaching schedule.

Dates	Topics	AMLCR Sections	Notes
8/21, 23, 25, 28, 30	Discrete- & Continuous-time Markov chains	Sec. 8.1 to 8.5 & 8.10	Matrix approach employed throughout. Chapman-Kolmogorov equation: ${}_t\mathbf{P}_x \times_s \mathbf{P}_{x+t} = {}_{t+s}\mathbf{P}_x$ Kolmogorov forward equation: $\frac{d}{dt} {}_t\mathbf{P}_x = {}_t\mathbf{P}_x \mathbf{M}_{x+t}$ Constant forces of transition implies ${}_t\mathbf{P} = \exp(t\mathbf{M})$
9/1, 6, 8, 11, 13, 15, 18	State-dependent insurance & annuities; Applications	Sec. 7.4 & 8.6 to 8.9	Reconcile the notation for Thiele's differential equations in Sec. 7.4.1 of AMLCR with that students have learned in ACTS:4180 using Bowers et al. Euler's method = Taylor's approximation: ${}_{t+h}\mathbf{P}_x \approx {}_t\mathbf{P}_x(\mathbf{I} + h\mathbf{M}_{x+t})$.
9/20, 22	Multiple Decrements	Ch. 9	Reconcile AMLCR notation with that in Bowers et al. which students have learned in ACTS:4180. Riemann-Stieltjes integral representation: ${}_nq_x^{(j)} = \int_0^n \left[\prod_{k=1, k \neq j}^m {}_t p_x^{(k)} \right] d_t q_x^{(j)}$
9/25, 27, 29	Joint Life	Ch. 10	Reconcile with what students have learned in ACTS:4180. Sec. 10.6 in AMLCR is beyond the coverage in Ch. 9 of Bowers et al.
10/3	Midterm 1		
10/4, 6, 9, 11, 13, 16, 18	Pension Mathematics	Sec. 11.1 to 11.11	
10/20, 23, 25, 27, 30, 11/1	Profit Analysis	Sec. 7.2.4 & 13.1 to 13.6	
11/3, 6, 8	Universal Life Insurance	Sec. 14.1 to 14.3.3 & 14.3.7	Account values of ULI by reserve recursion formulas in ACTS:4180. Type A ULI AV determined by Fackler's reserve accumulation formula: ${}_nV = \frac{{}_mV}{n-m E_{x+m}} + \sum_{h=m}^{n-1} \frac{\pi_h - v b_{h+1} \times q_{x+h}}{n-h E_{x+h}}$ Type B ULI AV determined by $(1+i)^{n-m} {}_mV + \sum_{h=m}^{n-1} [(1+i)^{n-h} \pi_h - (1+i)^{n-h-1} (b_{h+1} - {}_{h+1}V) q_{x+h}]$
11/10	Midterm 2		
11/13, 15, 17, 27, 29	Embedded Options in insurance & annuities	Study Note ALTAM -21-23; Sec. 15.1, 15.2, 17.1 to 17.7	Fundamental Theorem of Asset Pricing. "Option pricing by Esscher transforms," <i>Transactions of the SOA</i> (1994). "Actuarial Applications of Options and other Financial Derivatives" SOA study note IFM-22-18.
12/1, 4	Estimation of transition intensities	Sec. 18.6	
12/6, 8	Review		
12/11 to 15	Final Exam Week		

Academic Honesty and Misconduct

All students in CLAS courses are expected to abide by the [CLAS Code of Academic Honesty](#). Undergraduate academic misconduct must be reported by instructors to CLAS according to [these procedures](#). Graduate academic misconduct must be reported to the Graduate College according to Section F of the [Graduate College Manual](#).

Student Complaints

Students with a complaint about a grade or a related matter should first discuss the situation with the instructor and/or the course supervisor (if applicable), and finally with the Director or Chair of the school, department, or program offering the course.

Undergraduate students should contact [CLAS Undergraduate Programs](#) for support when the matter is not resolved at the previous level.

Graduate students should contact the CLAS [Associate Dean for Graduate Education and Outreach and Engagement](#) when additional support is needed.

Drop Deadline for this Course

You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the [drop deadline for this course](#) here. When you drop a course, a “W” will appear on your transcript. The mark of “W” is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the [Registrar's website](#).

Undergraduate students can find policies on dropping and withdrawing [here](#). Graduate students should adhere to the [academic deadlines](#) and policies set by the Graduate College.

Date and Time of the Final Exam

The final examination date and time will be announced by the Registrar generally by the fifth week of classes and it will be announced on the course ICON site once it is known. **Do not plan your end of the 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.** According to Registrar's final exam policy, students **have a maximum of two weeks after the announced final exam schedule** to request a change if an exam conflict exists or if a student has more than two exams in one day (see the [policy](#) here).

Attendance and Absences

University regulations require that students be allowed to make up examinations that have been missed due to illness, religious holy days, military service obligations (including service-related medical appointments), or other unavoidable circumstances or University-sponsored activities. Students with UI-authorized activities must discuss their absences with the instructor as soon as possible. Religious obligations must be communicated within the first three weeks of classes.

Exam Policies

Communication: UI Email

Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community.

Mental Health Resources and Student Support

Students are encouraged to be mindful of their mental health and seek help as a preventive measure or if feeling overwhelmed and/or struggling to meet course expectations. Students are encouraged to talk to their instructor for assistance with specific class-related concerns. For additional support and counseling, students are encouraged to contact University Counseling Service (UCS). Information about UCS, including resources and how to schedule an appointment, can be found at [counseling.uiowa.edu](#). Find out more about UI mental health services at [mentalhealth.uiowa.edu](#).

[Student Care and Assistance](#) provides assistance to University of Iowa students who are experiencing a variety of crisis and emergency situations, including but not limited to medical issues, family emergencies, unexpected challenges, and sourcing basic needs such as food and shelter. More information on the resources related to basic needs can be found at [basicneeds.uiowa.edu/resources/](#). Students are encouraged to contact Student Care & Assistance in the Office of the Dean of Students (Room 135 IMU, [dos-assistance@uiowa.edu](#), or 319-335-1162) for support and assistance with resources.

University Policies

Accommodations for Students with Disabilities

The University is committed to providing an educational experience that is accessible to all. If a student has a diagnosed disability or other disabling condition that may impact the student's ability to complete the course requirements as stated in the syllabus, the student may seek accommodations through [Student Disability Services](#) (SDS). SDS is responsible for making Letters of Accommodation (LOA) available. **The student must provide an LOA to the instructor as early in the semester as possible, but requests not made at least two weeks prior to the scheduled activity for which an accommodation is sought may not be accommodated.** The LOA will specify what reasonable course accommodations the student is eligible for and those the instructor should provide. Additional information can be found on the [SDS website](#).

Free Speech and Expression

Absences for Religious Holy Days

Classroom Expectations

Non-discrimination

Sexual Harassment/Misconduct and Supportive Measures

Sharing of Class Recordings