ACTS 4303 - Long Term Actuarial Mathematics II

Fall 2024

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Class Time	Mon & Wed, 10:00 AM - 11:15 AM
Classroom	SLC 1.204
Office Hours	Mon, Wed 1:00 PM - 2:00 PM
Office	FO 2.402E

Brief Description

The purpose of this class is to further develop the student's knowledge of the theoretical basis of life contingent actuarial models and the application of those models to insurance and other financial risks. Reserves for insurances and annuities, multi-state models, long-term insurance coverages, pension plans and retirement benefits will be studied. This class covers parts of SOA Exams FAM and ALTAM.

Prerequisite: ACTS 4301 with a grade C- or higher.

Calculators (required): In order to simulate actuarial exam conditions, the following SOA approved exam calculators are recommended

1. TI-30X MultiView (XS Solar or XB Battery) - frequently used
2. BA II Plus/ BA II Plus Professional - rarely used

For additional information, please see SOA Approved Calculators.

Recommended Textbook and Online Resources (Not Required)

- Coaching Actuaries - Exam FAM Online Seminar, Exam ALTAM Online Seminar
- The Infinite Actuary - Exam FAM Online Seminar, Exam ALTAM Online Seminar

Additional Textbooks (Not Required, but useful - check the library for these resources)

- Dickson, D., Hardy, M., & Waters, H. *Actuarial Mathematics for Life Contingent Risks* (International Series on Actuarial Science), Cambridge University Press.

Tentative Course Outline:

- Premium Calculation
- Reserves
- Multiple State Models
- Multiple Life Models
- Pension Mathematics
- Profit Measures (if time permits)

Course Description and Objectives

At the end of the course, students will be able to:

1. Perform calculations on the present value random variables associated with benefits and expenses. Specifically:
   (a) Calculate and interpret probabilities, means, variances, and percentiles.

(b) Calculate and interpret the effect of changes in underlying assumptions such as mortality and interest.

(c) To calculations involving these random variables, apply appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

2. Use and explain premium-calculation methodologies. Specifically:

(a) Calculate and interpret probabilities, means, variances, and percentiles of random variables associated with a premium, including loss-at-issue random variables.

(b) Calculate premiums based on the equivalence principle, and the portfolio percentile premium principle.

(c) Calculate and interpret the effect of changes in benefits or underlying assumptions such as decrements, morbidity, expenses, and interest.

(d) Apply appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

3. Understand reserves for life insurances and annuities. Specifically:

(a) Calculate and interpret the following reserve types:

(i) Net premium

(ii) Modified

(iii) Gross premium

(iv) Expense

(b) Calculate and interpret probabilities, means, variances, and percentiles of random variables associated with these reserves, including future-loss random variables.

(c) Calculate and interpret common profit measures such as expected profit, actual profit, gain, gain by source and period, internal rate of return, profit margin, and break-even year.

(d) Apply appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

4. Understand key concepts concerning multi-state models including single life, or multiple life, multiple decrements. Specifically:

(a) Explain and interpret survival models and transitioning between states.

(b) For models dealing with multiple lives and/or multiple states, explain the random variables associated with the model and calculate and interpret marginal and conditional probabilities.

(c) Describe the behavior of Markov chain models, identify possible transitions between states, and calculate and interpret the probability of being in a particular state and transitioning between states.

(d) Apply to calculations involving these models appropriate approximation methods for fractional ages based on uniform distribution of deaths or constant force.

5. Understand how the models from previous learning objectives apply to pension plans and retirement benefits. Specifically:

(a) Describe and compare defined contribution and defined benefit pension plans including final salary and career average earning plans.

(b) Identify and interpret the common states and decrements for pension plans, and the parametric and tabular models, including Markov chain models, associated with these decrements.

(c) Given particular participant data, plan provisions, and valuation assumptions, apply the models mentioned in learning outcome 5(b) to defined benefit pension plans and calculate and interpret replacement ratios, accrued benefits, gain or loss, and their expected values with adjustments such as the early retirement reduction factor.

(d) Given particular participant data, plan provisions, and valuation assumptions, calculate and interpret the actuarial accrued liability and the normal cost for a defined benefit plan under the projected unit credit (PUC) cost method and the traditional unit credit (TUC) cost method

(e) Calculate and interpret the effect of changes in underlying valuation assumptions such as mortality, discrete salary increase changes, other decrements and interest on the quantities mentioned in learning outcomes 5(c), 5(d).

(f) Apply appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

Important Dates:

- Classes begin ..... Monday, August 19, 2024
- Labor Day ..... Monday, September 02, 2024: No Class
- Census Day: Last Day to Drop a Class without a "W" ..... Wednesday, September 04, 2024
- **Midterm Exam #1** ..... Monday, September 30, 2024, 10:00 AM - 11:15 AM **in Classroom**
- Mid-Term grades viewable online ..... Saturday, October 12, 2024
- **Midterm Exam #2** ..... Monday, November 4, 2024, 10:00 AM - 11:15 AM **in Classroom**
- Fall break, No classes ..... Monday, November 25 – Wednesday, November 27, 2024
- Thanksgiving break, No classes ..... Thursday, November 28 – Sunday, December 01, 2024
- Last day of classes for full term session ..... Thursday, December 05, 2024
- **Final Exam** ..... Monday, December 9, 2024, 11:00 AM - 1:45 PM **in SCI 2.210**

Grading Scheme

- – Participation: 5%
  – Weekly or biweekly assignments: 15%
  – Two midterm exams: 25% each
  – Final exam (Comprehensive): 30%
- All letter grades will be assigned in accordance with the table of numeric to alphabetic conversions given below.

A+	98 – 100	A	94 – 97	A–	90 – 93
B+	85 – 89	B	80 – 84	B–	75 – 79
C+	70 – 74	C	65 – 69	C–	60 – 64
D+	55 – 59	D	50 – 54	D–	45 – 49
F	0 – 44				

Homework submission

- Scan your assignment as a **single pdf** and upload it on eLearning. DO NOT submit multiple files.
- You will have **two submission attempts** to upload homework assignment. Only the final submission will be graded.
- If you have a smartphone, use **Adobe Scan** or **Office Lens** app to scan your assignment. They are free, and can create multi-page PDFs. Make sure you install one of these apps in your phone and test it before the deadline to upload the first homework.
- **It is your responsibility to ensure the submission is legible with solutions in the correct order.** You can click on "My Grades" on the left panel of the course homepage to see all your HW submissions.
- Assignments should be uploaded by the deadlines specified on eLearning. Instructions to upload an assignment on eLearning can be found at

  https://www.youtube.com/watch?v=KFbndtgDsQs&t=51s

  Make sure you understand the procedure before the deadline to upload the first homework.
- Only the grades for the assignments correctly submitted by the due date and time to the **e-Learning** system and downloaded by the grader from the e-Learning system will be graded and recorded. Late assignments or assignments sent to the instructor or grader via e-mail will not be accepted for **any** reason. If you have a scheduled absence for an official UTD function or obligation, you must upload your paper in before the due date.

Late/Missed Coursework

- There will be **no make-up exams** unless accompanied by a note from a doctor, religious or otherwise documented official reason pertained to the University business. Undocumented cases will not be honored.

Course and Exam Policies

- If you have a legitimate schedule conflict with one of the exams, then contact me at least a week **prior** to the exam date.
- By default, all exams (midterms and final) are closed book. **Only the calculators mentioned in this syllabus can be used on the exam.**
- **Academic dishonesty is taken very seriously and will not be tolerated in this class in any form.**
- The following behavior during an exam is **strictly prohibited**:

  (a) Use of any class notes or texts;
  (b) Use of any website;
  (c) Any cell phone use;
  (d) Any communication with anyone regarding any portion of the exam;
  (e) Transmission of the exam content of any kind (e.g. electronic, verbal, digital).

  Further information on the academic conduct policy can be found at

  http://www.utdallas.edu/deanofstudents/dishonesty/

Class Citizenship

1. Participation is **REQUIRED**.
2. **ARRIVING LATE:** Arriving late is disruptive to class activities and may affect your attendance and participation grade. If you have a legitimate reason for being late, please inform your instructor in advance.
3. **USE OF CELL PHONES or OTHER ELECTRONIC DEVISES:** Unless there is a true emergency, any use of cell phones or other electronic devises unrelated to the course during the class period is **strictly prohibited**. Violators will be asked to stop using the devise immediately. Repeated violations will be reflected in the student's grade.
4. **POSTING COURSE MATERIAL:** It is strictly prohibited to upload, post and/or distribute in any form or fashion ANY course material provided to students in class and via e-Learning. Violation of this policy will constitute academic dishonesty, violation of privacy and copyright infringement and will result in immediate report to the UTD Office of the Academic Affairs.

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

Academic Support Resources

The information contained in the following link lists the University's academic support resources for all students. Please see http://go.utdallas.edu/academic-support-resources.

Official UTD Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please go to

https://go.utdallas.edu/syllabus-policies/

for these policies.

Please note: The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.