**ACTS 4304 SYLLABUS FALL 2024**

# Short Term Actuarial Mathematics I

**BRIEF DESCRIPTION**: The purpose of this class is to develop the student's knowledge of the severity, frequency and aggregate risk models and the application of those models to insurance and other financial risks. Property/Casualty Insurance coverages, health insurance, loss reserving, ratemaking, coverage modifications and risk measures will be discussed. This class covers parts of SOA Exam STAM and CAS Exams MAS I, MAS II and 5. Prerequisite: STAT 4352 with the grade C- or higher.

The class meets on T/TH 11:30 am - 12:45 pm in room SLC 2.304 (Student Learning Center).

**NOTE for ACTUARIAL MAJOR STUDENTS:** This course constitutes the first part of a sequence. You must receive the grade of a **C- or higher** in this course to be able to take ACTS 4305 and ACTS 4311.

**INSTRUCTOR:** Natalia A. Humphreys

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Office Hours: T/TH 1:00 pm – 2:00 pm, or by appointment (In-person, BlackBoard Collaborate, MS Teams, or WebEx).

**INSTRUCTIONAL MODE:** Traditional Classroom/Laboratory Course (face-to-face) – The instructor and students are present in the classroom/laboratory each class meeting according to the class schedule.

**COURSE PLATFORM:** This course will be delivered in a classroom on UT Dallas Campus. Some material will be posted on e-Learning.

**LEARNING OUTCOMES:**

At the end of the course students will be able to perform the tasks listed below.

A. Severity Models
   1. Calculate the basic distributional quantities:
      a) Moments
      b) Percentiles
      c) Generating functions
   2. Describe how changes in parameters affect the distribution.

3. Recognize classes of distributions and their relationships.
4. Apply the following techniques for creating new families of distributions:
    a. Multiplication by a constant
    b. Raising to a power
    c. Exponentiation,
    d. Mixing
5. Identify the applications in which each distribution is used and reasons why.
6. Apply the distribution to an application, given the parameters.
7. Calculate various measures of tail weight and interpret the results to compare the tail weights.
8. Identify and describe two extreme value distributions.

B. Frequency Models for the Poisson, Mixed Poisson, Binomial, Negative Binomial, Geometric distribution and mixtures thereof:
    1. Describe how changes in parameters affect the distribution,
    2. Calculate moments,
    3. Identify the applications for which each distribution is used and reasons why,
    4. Apply the distribution to an application given the parameters.
    5. Apply the zero-truncated or zero-modified distribution to an application given the parameters.

C. Aggregate Models
    1. Compute relevant parameters and statistics for collective risk models.
    2. Evaluate compound models for aggregate claims.
    3. Compute aggregate claims distributions.

D. For severity, frequency and aggregate models
    1. Evaluate the impacts of coverage modifications:
        a) Deductibles
        b) Limits
        c) Coinsurance
    2. Calculate Loss Elimination Ratios.
    3. Evaluate effects of inflation on losses.

E. Risk Measures: Calculate VaR, and TVaR and explain their use and limitations.

F. Insurance and Reinsurance Coverages

    1. Describe different types of short-term insurance coverage including auto, homeowners, liability, health, disability, and dental.
    2. Describe the types of policy limits and coverage modifications for short-term insurance.
    3. Describe the operation of basic forms of proportional and excess of loss reinsurance.

4. Derive the distribution of claim amounts paid by the insurer and reinsurer under various forms of reinsurance.

G. Pricing and Reserving for Short-Term Insurance Coverages

1. Explain the role of rating factors and exposure.
2. Describe the different forms of experience rating.
3. Describe and apply techniques for estimating unpaid losses from a run-off triangle, using the following methods:
    a) Chain ladder
    b) Average cost per claim
    c) Bornhuetter Ferguson
4. Describe the underlying statistical models for the methods in 3.
5. Calculate premiums using the pure premium and loss ratio methods.

**TEXTBOOKS** (required):

1. ASM Study Manual for Exam STAM, recent addition, Abraham Weishaus.
2. Probability and Statistics for Actuaries (First Edition), 2020, Natalia Humphreys and Yuly Koshevnik.

**ADDITIONAL TEXTS** (not required, but useful):

1. Loss Models: From Data to Decisions, (Fourth Edition), 2012, Klugman, S.A., Panjer, H.H. and Willmot, G.E.
2. Introduction to Ratemaking and Loss Reserving for Property and Casualty Insurance, (Fouth Edition), 2015, Robert L. Brown, W. Scott Lennox
3. Individual Health Insurance (Second Edition), 2015, by Bluhm and Leida

**MATERIAL COVERED**:

| Topic Number | Topic Name | | Topic Number | Topic Name |
|---|---|---|---|---|
| **1** | Probability Review | | **12** | Loss Elimination Ratio |
| **2** | Parametric Distributions | | **13** | Increased Limits Factors and Increased Deductible Relativities |
| **3** | Mixtures and Splices | | **14** | Reinsurance |
| **4** | Property/CasualtyInsurance Coverages | | **15** | Risk Measures and Tail Weight |
| **5** | Health Insurance | | **16** | Other Topics in Severity Coverage Modifications |
| **6** | Loss Reserving: Basic Methods | | **17** | Bonuses |
| **7** | Loss Reserving: Other Methods | | **18** | Discrete Distributions |
| **8** | Ratemaking: Preliminary Calculations | | **19** | Poisson/Gamma |
| **9** | Ratemaking: Rate Changes and Individual Risk Rating Plans | | **20** | Frequency – Exposure and Coverage Modifications |

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|---|---|---|---|---|
| **10** | Policy Limits | | **21** | Aggregate Loss Models: Compound Variance |
| **11** | Deductibles | | | |

**TABLES:**

https://www.soa.org/globalassets/assets/Files/Edu/2019/2019-02-exam-stam-tables.pdf

**Exam STAM information:**

https://www.soa.org/Education/Exam-Req/edu-exam-stam-detail.aspx

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

**GRADING:** Your grade will be based on your participation, homework, two midterms and a final exam. It will be assigned based on the following grade scale and weights:

**DATES:** Homework – weekly or biweekly;

Midterm I – Tuesday, September 24, 2024, 11:30 am - 12:45 pm, SLC 2.304, closed-book exam;

Midterm II – Tuesday, November 5, 2024, 11:30 am - 12:45 pm, SLC 2.304, closed-book exam;

Final –Tuesday, December 10, 2024, 11:00 am – 1:45 pm, SLC 2.304, closed-book exam.

**WEIGHTS:** Participation in class and the Friday Actuarial Events: 5%, Homework: 15%, Midterms: 25% each, Final: 30%.

**CLASS CITIZENSHIP:** Assignments should be submitted on **e-Learning** by due date specified in class **before the start** of the class period. 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.

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.

**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.

**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.

**CALCULATORS:** In order to simulate an actuarial exam conditions, an SOA approved exam calculator is recommended: the 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).

For additional information please see:

http://www.soa.org/education/exam-req/exam-day-info/edu-calculators.aspx

**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.

**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.

**UT DALLAS 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 http://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.*