MATH 5633: Loss Models I

Course Outline

Autumn 2024

Instructor: Dr. Kenneth Ng
E-mail: ng.499@osu.edu
Office: Room 440, Mathematics Tower (MW 440)
Class Hours and Location: Tuesday and Thursday, 2:20 - 3:40 pm; University Hall 082
Office Hours: Tuesday and Thursday, 11:00am - noon, or by appointment

---

Course Description

This course provides an introduction to the construction and evaluation of actuarial models for short-term insurance products. It equips students with the mathematical foundations for the Exam FAM-S/ASTAM offered by the Society of Actuaries (SOA), and the corresponding exam by the Casualty Actuarial Society (CAS). This course can be followed by MATH 5634 Loss Models II.

Course Materials

- The class notes available on Canvas would be the main source of course materials.
- Reference books:
    1. *Loss Models: From Data to Decisions*, 5th edition, by Klugman, Panjer and Willmot.
    2. *Introduction to Ratemaking and Loss Reserving for Property and Casualty Insurance*, 4th Edition, by Brown and Lennox, ACTEX.
    3. *Loss Data Analytics*. An open text authored by the Actuarial Community. Available on https://openacttexts.github.io/Loss-Data-Analytics/

Prerequisites

C- or above in STAT 4202; and a C- or above in 4530, 5530H, or STAT 4201. Open only to actuarial science majors, and to MMS students specializing in Financial Math.

Grading and Assessments

- Grade composition:
  1. Homework: 30% of the final grade. About 7-9 homework assignments, one for each chapter. Each homework carries equal weight.
  2. Two midterm exams: 40% of the final grade, each carries 20%.
  3. Final exam: 30% of the final grade.
- Grades of this course will be assigned mainly based on the OSU Standard Grade Scheme. Mild adjustment could be made based on difficulties of the exam papers. For students' reference, the OSU Standard Grade Scheme is given below:

Grade	Score
A	93%
A-	90%
B+	87%
B	83%
B-	80%
C+	77%
C	73%
C-	70%
D+	67%
D	60%
E	Below 60%

Course Policies

Homework Submission Policies

Please submit your assignment as a single PDF file to Canvas. The due dates of homework will be specified on Canvas, which will usually be two weeks after the homework was posted.

Late assignments will be accepted for no penalty if a valid excuse is communicated to the instructor before the deadline. Assignments will be accepted with a 10%/30%/50% deduction within 1/2/3 days after the deadline. After this any assignments handed will be given 0.

Academic Integrity and Honesty

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct. If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions 3 for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

Accommodations for Disabilities

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services (SLDS). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or https://slds.osu.edu.

Diversity

The Ohio State University affirms the importance and value of diversity of people and ideas. We believe in creating equitable research opportunities for all students and to providing programs and curricula that allow our students to understand critical societal challenges from diverse perspectives and aspire to use research to promote sustainable solutions for all. We are committed to maintaining an inclusive community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among all members; and encourages each individual to strive to reach their own potential. The Ohio State University does not discriminate on the basis of age, ancestry, color, disability, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, race, religion, sex, gender, sexual orientation, pregnancy, protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment.

To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit: https://odi.osu.edu and https://cbsc.osu.edu

Course Syllabus and Schedule

This course consists of 2 parts with 6 chapters.

Part 1: Severity, Loss and Aggregate Risk Models

Chapter	Content	References
1 Basic Probability	• Probability and random variables • Distributional quantities of random variables • Generating functions • Joint distributions • Conditional expectations	[1] 3.1-3.3
2 Severity Model	• Parametric distributions • Coverage modifications • Tails of distributions* • Transformations of random variables* • Mixing*	[1] 5.1-5.3, 8.1-8.5
3 Frequency Model	• Parametric distributions • The $(a, b, 0)$ class • The $(a, b, 1)$ class • Compound frequency model* • Impact of deductibles on claim frequency*	[1] 6, 7.1, 8.6
4 Aggregate Risk Model	• Individual risk model • Collective risk model • Panjer's recursion* • Impact of coverage modifications on aggregate loss*	[1] 9

Part 2: Estimation and Credibility

Chapter	Content	References
5 Risk Measures	• Risk measures: value-at-risk, expected shortfall and tail value-at-risk • Coherent risk measures	[1] 3.5
6 Credibility Theory	• Limited fluctuation credibility • Full credibility • Partial credibility	[1] 16

Remarks:

1. *Materials for Exam ASTAM
2. [1] and [2] respectively refers to Reference book 1 and 2 on p.1.

Schedule

The following table lists the tentative schedule of the course. Students may expect deviations from the table according to actual teaching progress.

Week	Dates	Topics	HW/Exam
1	8/20 - 8/23	Probability	–
2	8/26 - 8/30	Probability/Severity Model	HW1
3	9/2 - 9/6	Severity Model	–
4	9/9 - 9/13	Severity Model	HW2
5	9/16 - 9/20	Severity Model	–
6	9/23 - 9/27	Frequency Model	HW3
7	9/30 - 10/4	Frequency Model	–
8	10/7 - 10/11	Aggregate Risk Model/Autumn Break	–
9	10/14 - 10/18	Midterm 1	Midterm 1
10	10/21 - 10/25	Aggregate Risk Model	–
11	10/28 - 11/1	Aggregate Risk Model/Risk Measures	HW4
12	11/4 - 11/8	Risk Measures	-
13	11/11 - 11/15	Risk Measure/Credibility Theory	–
14	11/18 - 11/22	Midterm 2/Credibility Theory	Midterm 2
15	11/25 - 11/29	Credibility Theory/Thanksgiving	HW5
16	12/2 - 12/6	Final Review	Final Exam

Exam Dates

1. Midterm 1: 10/17/2024, Thursday during class time
2. Midterm 2: 11/19/2024, Tuesday during class time
3. Final Exam: 12/06/2024, Friday, 4:00pm-5:45pm at University Hall 082