University of Connecticut Department of Mathematics

MATH 5698 – Topics in Actuarial Science
Stochastic Control in Actuarial and Financial Mathematics

This Version: January 19, 2026

Lecture Time:	Monday 6:00 pm – 8:30 pm
Lecture Room:	MONT 113
Course Webpage:	HuskyCT `https://huskyct.uconn.edu/`
Webex Room:	`https://uconn-cmr.webex.com/meet/biz17006`

Instructor:	Bin Zou
Office:	MONT 428
Office Hours:	We 2:30 – 3:30 pm or by appointment (Webex)
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1 General Course Information

Course Description

This course aims to introduce stochastic control theory at the *applied* level and provides an overview of key applications in insurance and finance.

In the theory part, we will learn:

- framework for optimal control problems in both discrete time and continuous time;
- stochastic processes and calculus at the elementary level;
- fundamental approaches of solving stochastic control problems: dynamic programming, duality/martingale method, and maximum principle;

In the application part, we will study

- optimal investment-consumption problems;
- optimal (re)insurance problems;
- optimal dividend problems;
- and more.

Given the nature of the course, we will *not* pursue rigorous mathematical analysis of stochastic control; instead, we value heuristics and often rely on *specific* models or examples to seek essential insight.

Course Prerequisites

Undergraduate level probability and basic stochastic processes are preferred. Previous knowledge and experience using `R` or `Matlab` is helpful, but not required. Since we will cover all the preliminary background, the most important prerequisite is your own curiosity.

Notes and References

I will provide lecture notes, likely in a combination of electronic and handwritten format, and update them on HuskyCT as the course progresses. Several excellent references in this area are listed below, along with my *subjective* comments.

1. Fleming, Wendell and Soner, Mete (2006). Controlled Markov Processes and Viscosity Solutions. Springer.
   Bin's comment: This is arguably the book if you want to learn stochastic control; of course, there are certainly many excellent books in this area, such as Yong and Zhou, Krylov, Bertsekas, Karatzas and Shreve, among others. Nevertheless, Fleming and Soner is the one that got me into the field of stochastic control.

2. Øksendal, Bernt Karsten and Sulem, Agnes (2007). Applied Stochastic Control of Jump Diffusions. Springer.
   Bin's comment: This is an outstanding textbook that focuses on the application of stochastic control to financial mathematics problems, mainly optimal investment problems, in jump-diffusion market models.

3. Schmidli, Hanspeter (2008). Stochastic Control in Insurance. Springer.
   Bin's comment: This book is the first, and by far the BEST, monograph on the application of stochastic control in actuarial science.

4. Azcue, Pablo and Muler, Nora (2014). Stochastic Optimization in Insurance: A Dynamic Programming Approach. Springer.
   Bin's comment: Our library provides **FREE** electronic version of this book.

When we study individual problems in application, we will also rely heavily on classical papers, and the reading list will be updated on HuskyCT ahead of time.

2 Grade Evaluation

This course has **three** grading components, with weight given as below:

Component	**Homework**	**Midterm**	**Project**
Weight	20%	30%	50%

The schedule for letter grades will be decided once I have scores on all components. In general, 60% is guaranteed a pass (D-), and over 90% is sufficient for an "A."

Homework

- There will be several homework assignments, approximately at bi-weekly frequency. The **worst** performance will be automatically dropped out in calculation. Normally, you will be given one week to complete each homework.
- Late homework will be docked 4 percentage deduction every hour late (rounded up). Submissions 24 hours after the deadline will receive 0.
- The due for each homework will be set to 6 pm on a Monday (lecture day), so the best way is to submit your homework to me in person at the lecture.
- General discussions on homework among fellow students are allowed, but each one of you need to submit your own **independent** work. You are highly welcome to ask me for hints or clarifications if you have any question on homework.

Midterm Exam

- This course will have **one** Midterm exam, scheduled **in class** during a regular lecture, for about 75-90 minutes. The exam covers the theory part of the course.
- The midterm exam is open-book/notes, and you are allowed to use a calculator. No other electronic device is allowed. Any form of collaboration is forbidden.
- Detailed information (e.g., date and number of questions) will be posted about one week ahead on HuskyCT.

Project

This course does *not* have a Final exam; instead, there is a comprehensive project.

- The project consists of a *written* report and an *oral* presentation, and each of you complete your project *independently* (i.e., there is no team participation).
- After the midterm, a list of recent or classical papers on the application of stochastic control will be provided; you will select one paper from the list (or a related topic) for your project. Each paper from the list can only be selected by one student, and we follow the "First-come-first-serve" rule.
  You have the freedom to choose a paper (topic) outside my provided list, but you must consult me ahead for approval.
- The written report should follow the standard of an academic paper, and the goal is to provide a concise summary (of both "good" and "bad") on the selected paper. A (tex) template with detailed required will be provided later.

- The oral presentation is about 25 minutes, and the presenter ("you") should deliver the background, model, and results of (and your comments/discussions, if any, on) the selected paper to the audience. There is also a short "Q&A" after the presentation.

In general, there is **no** make-up for missing homework or exam. If there is an emergency, please communicate with me ASAP, and each request will be handled on a case-by-case basis.

3 Other

Academic Integrity

I expect all of you to be familiar with and abide by UConn's academic integrity policy at all times; see HERE for details. If you discuss homework questions with your classmates, you must write your own solutions individually and independently, and are suggested to make a declaration statement on collaborations. Academic misconduct includes, but is not limited to, providing or receiving assistance in a manner not authorized by the instructor in the creation of work to be submitted for academic evaluation (e.g., papers, projects, examinations and assessments - whether online or in class); presenting, as one's own, the ideas, words or calculations of another for academic evaluation; doing unauthorized academic work for which another person will receive credit or be evaluated; using unauthorized aids in preparing work for evaluation; and presenting the same or substantially the same papers or projects in two or more courses without the explicit permission of the instructors involved. A student who knowingly assists another student in committing an act of academic misconduct shall be equally accountable for the violation, and shall be subject to the sanctions and other remedies described in Appendix A of the Student Code. Sanctions shall include, but are not limited to, a letter sent to the Office of Community Standards of the University; a grade of 0 on the assignment, quiz or exam; a grade of F for the course.

Course Feedback

Your feedback on the course is always welcome and appreciated. If you have any comments or suggestions that may help improve the lecture quality and learning outcome, please do not hesitate to contact me.