FIN 514
Applied Stochastic Processes
Module 4, 2025-2026

Course Information

Instructor: Yu SUN (孙羽)
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Office Hour: Wednesday 10:00AM–12:00PM; Tuesday & Friday 2:00PM–3:00PM

Teaching Assistant:
Phone: TBD
Email: TBD

Classes:
Lectures: Tuesday & Friday 10:30 AM – 12:20 PM
Venue: PHBS Building, Room TBD

Course Website:
Will be set up soon.

1. Course Description

1.1 Context

Course overview: This course introduces the concepts of stochastic models and their various applications in finance and management. Topics covered include Markov chains, hidden Markov chains, Monte Carlo simulations, Markov decision processes, reinforcement learning, and more.

Prerequisites:

Undergraduate-level understanding of calculus, linear algebra, and probability.

1.2 Textbooks and Reading Materials

Lecture Notes

Reading Materials:

- *Markov Processes for Stochastic Modeling*, Oliver C. Ibe, 2nd edition, 2013.
- *Stochastic Processes*, Sheldon M. Ross, 2nd edition, 1996.
- *Reinforcement Learning: An Introduction*, Richard S. Sutton and Andrew G. Barto, 2nd edition, 2018.

2. Learning Outcomes

2.1 Intended Learning Outcomes

Learning Goals	Objectives	Assessment (YES

		with details or NO)
1. Our graduates will be effective communicators.	1.1. Our students will produce quality business and research-oriented documents.	YES
	1.2. Students are able to professionally present their ideas and also logically explain and defend their argument.	YES
2. Our graduates will be skilled in team work and leadership.	2.1. Students will be able to lead and participate in group for projects, discussion, and presentation.	YES
	2.2. Students will be able to apply leadership theories and related skills.	NO
3. Our graduates will be trained in ethics.	3.1. In a case setting, students will use appropriate techniques to analyze business problems and identify the ethical aspects, provide a solution and defend it.	NO
	3.2. Our students will practice ethics in the duration of the program.	NO
4. Our graduates will have a global perspective.	4.1. Students will have an international exposure.	YES
5. Our graduates will be skilled in problem-solving and critical thinking.	5.1. Our students will have a good understanding of fundamental theories in their fields.	YES
	5.2. Our students will be prepared to face problems in various business settings and find solutions.	YES
	5.3. Our students will demonstrate competency in critical thinking.	YES

2.2 Course specific objectives

By the end of this course, students will be able to:

1) Comprehend the fundamental theories of stochastic processes and Markov decision processes.
2) Understand the essential methods for solving Markov decision problems.
3) Apply the above theories and methods to decision-making challenges across various domains.

2.3 Assessment/Grading Details

Tentative weights are as below:
Attendance 10%, Assignments 50%, Final project 40%.

2.4 Academic Honesty and Plagiarism

It is important for a student's effort and credit to be recognized through class assessment. Credits earned for a student work due to efforts done by others are clearly unfair. Deliberate dishonesty is considered academic misconducts, which include plagiarism; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis.

All assessments are subject to academic misconduct check. Misconduct check may include reproducing the assessment, providing a copy to another member of faculty, and/or communicate a copy of this assignment to the PHBS Discipline Committee. A suspected plagiarized document/assignment submitted to a plagiarism checking service may be kept in its database for future reference purpose.

Where violation is suspected, penalties will be implemented. The penalties for academic misconduct may include: deduction of honour points, a mark of zero on the assessment, a fail grade for the whole course, and reference of the matter to the Peking University Registrar.

AI tools requirements:
Assignments and projects should be completed independently with original thought. AI tools may be used to aid in understanding related mathematical concepts but must not be used to generate answers directly. Penalties will be implemented in accordance with the provisions of the Peking University Graduate Student Handbook for any violation of this rule.

For more information of plagiarism, please refer to *PHBS Student Handbook*.

3. Topics, Teaching and Assessment Schedule

Course outline is subject to changes along the progress of the course.

Topic 1: Introduction and review of probability theory

Topic 2: Markov chains

Topic 3: Hidden Markov chains

Topic 4: Poisson process and queuing theory

- Application: queuing systems

Topic 5: Monte Carlo simulation for financial models

- Application: option pricing, interest rate models

Topic 6: Markov decision processes

- Application: gambling problem, inventory management

Topic 7: Reinforcement learning

- Application: financial investment problems

Topic 8: Final presentation

4. Miscellaneous

- Grade in letters (e.g., A+, A, A-, ..., D+, D, F). A- or above < 30% and B- or below > 10%. If the enrollment number is fewer than 15 students, grade curving is not required.