ECON590
Computational Economcis
Module 2, 2025

Course Information

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Classes: Nov.14,18,21,25,28,Dec.2,5,9,12,16,19,23,26,30,Jan.2,6,9,13
Lectures: Tue & Fri 8:30-10;20
Venue: PHBS Building, Room

1. Course Description

1.1 Context

Course overview: This is an evolving course that is designed to introduce you to optimization and probability with applications in economics. It is still under development. I shall adjust the content according to the feedback from students.

Prerequisites: Calculus, linear algebra

1.2 Textbooks and Reading Materials

The first half of the course is on optimization. Most topics are from Kim Border's notes:
https://healy.econ.ohio-state.edu/kcb/AddedByPJ/Maximization.pdf
We shall briefly cover basic topological concepts and calculus. Then we dive into convex analysis and Lagrange multiplier theory. See Chapter 4 and 5 on the notes above.

The second half is on probability. We shall cover Shum Matt's lecture 1-4:
https://www.its.caltech.edu/~mshum/stats/stats.html
and Kim Border's lecture 5-17:
https://healy.econ.ohio-state.edu/kcb/Ma103/

2. Learning Outcomes

2.1 Intended Learning Outcomes

Learning Goals	Objectives	Assessment (YES with details or NO)
1. Our graduates will be	1.1. Our students will produce quality	No

effective communicators.	business and research-oriented documents.	
	1.2. Students are able to professionally present their ideas and also logically explain and defend their argument.	Yes. There will be a lot of proofs in this course, and you will be expected to prove things.
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.	No
	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.	No
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. The goal of this course is to present the useful results from optimization and probability in a way that you understand their proofs and can use them in economics.
	5.2. Our students will be prepared to face problems in various business settings and find solutions.	No
	5.3. Our students will demonstrate competency in critical thinking.	Yes. There will be a lot of proofs in this course, and you will be expected to prove things.

2.2 Course specific objectives

The goal of this course is to present the useful results from optimization and probability in a way that you understand their proofs and can use them in economics. There will be a lot of proofs in this course, and you will be expected to prove things. If you do not like proving theorems, you might not want to take this course.

2.3 Assessment/Grading Details

The grade will be based on participation (30%), homework (30%), final exam (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：
Using AI tools to complete assignments or assessments without the approval of the course instructor will be regarded as an act of academic dishonesty. Depending on the severity of the situation, penalties will be implemented in accordance with the provisions of the Peking University Graduate Student Handbook.

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

3. Topics, Teaching and Assessment Schedule

The first half of the course is on optimization. Most topics are from Kim Border's notes:
https://healy.econ.ohio-state.edu/kcb/AddedByPJ/Maximization.pdf

We shall briefly cover basic topological concepts and calculus. Then we dive into convex analysis and Lagrange multiplier theory. See Chapter 4 and 5 on the notes above. We shall spend around 22 hours on these topics.

The second half is on probability. We shall cover Shum Matt's lecture 1-4:
https://www.its.caltech.edu/~mshum/stats/stats.html
and Kim Border's lecture 5-17:
https://healy.econ.ohio-state.edu/kcb/Ma103/

I also cite the following introduction from Kim:
" Convex analysis is the study of the properties of convex sets and convex and concave functions. The fundamental results in the field are the separating hyperplane theorems. These results have interpretations as existence theorems for prices, so they are fundamental in many areas of economic theory.

Another class of theorems goes by the name of the Theorem of the Alternative. These theorems give conditions for the existence of solutions to linear inequalities in terms of the existence of solutions to an alternative set of inequalities. This may not seem especially useful, but these results are at the heart of fundamental results in decision theory and asset pricing theory."

4. Miscellaneous

Any remarks that incite national division or propagate religion are strictly prohibited. Such violations will be treated with the utmost severity and constitute grounds for an immediate failing grade and potential expulsion from the university.