Mathematical Economics

Instructor:
Jianan Yang (email: jianan.yang@pku.edu.cn)

Course Description:
Mathematical Economics is a specialized course designed to develop students' ability to analyze and solve economic problems using mathematical methods. Prerequisites for this course include Calculus, Linear Algebra, and Probability & Statistics. The course covers fundamental mathematical methods, static optimization theory, and an introduction to dynamic optimization methods. It aims to equip students with mathematical tools essential for economic analysis, bridge the gap between economic intuition and mathematical thinking, and lay a solid foundation for advanced economic theory studies.

Reading List:
1. Principles of Mathematical Analysis, Walter Rudin, McGraw-Hill Education, 1976, Third Edition.
2. Introductory Real Analysis, A. Kolmogorov, S. Fomin and Richard Silverman, Dover Publications, 1975.
3. Mathematics for Economists, Simon, Carl P., and Lawrence Blume, W. W. Norton & Company, 1994.
4. Recursive Methods in Economic Dynamics, Stokey and Lucas. Harvard University Press, 1989.

Grading Policies:
The final grade will be based on homework assignments (25 percent), one midterm (35 percent) and a final exam (40 percent). The midterm exam is scheduled for **April 18,** during regular class time. The final exam will take place on **June 15**, from 14:00 to 16:00.

You will complete one homework assignment each week, based on the material covered that week. There will be 12 homework assignments throughout the quarter, each due at the beginning of class the following week. Homework will be graded based on completeness rather than correctness. However, you must demonstrate genuine effort in completing each assignment to receive credit. Out of the 12 assignments, your 10 highest-scoring assignments will count toward your final grade.

Course Outline:
Mathematical Foundation:
- Linear algebra
- Basic concepts in topology
- Multi-Variable Calculus

Static Optimization:
- Multi-Variable Unconstrained Optimization

- Multi-Variable Constrained Optimization: Optimization with linear constraints, Optimization with nonlinear constraints, Karush-Kuhn-Tucker theorem
- Comparative Statistics, and envelope theorems
- Concave and quasi-concave functions, convex sets, separation of convex sets
- General form of Karush-Kuhn-Tucker theorem and the full proof

Dynamic Optimization:
- Introduction to modern macroeconomics
- Sequential problems and difference equations
- Recursive formulation of dynamic programs
- Brief introduction to dynamic optimization in continuous time

Tentative Schedule

Week	**Class**	**Date**	**Topic**
1	1	2/21	Math Review
2	2	2/28	Math Review (HW1)
3	3	3/7	Math Review / Static Optimization (HW2)
4	4	3/14	Static Optimization (HW3)
5	5	3/21	Static Optimization (HW4)
6	6	3/28	Static Optimization (HW5)
7		4/4 (Break)	
8	7	4/11	Static Optimization (HW6)
9	8	4/18 (Midterm)	
10	9	4/25	Static Optimization (HW7)
11		5/2 (Break)	
12	10	5/9	Static Optimization (HW8)
13	11	5/16	Static Optimization (HW9)
14	12	5/23	Dynamic Optimization (HW10)
15	13	5/30	Dynamic Optimization (HW11)
16	14	6/6	Dynamic Optimization (HW12)