《博弈论（英语）》教学大纲

**Game Theory**

**Syllabus**

课程编号： Course Code：150012B

课程类型：专业选修课

总 学 时： Hours：32

讲课学时： Lecture Hours: 32 实验（上机）学时：0

学　　分： Credits: 2

适用对象：金融学（数据与计量分析）

Applied Majors: Finance

先修课程：经济学原理，中级微观经济学

Prerequisites: Principles in Economics

一、课程的教学目标**(Purposes)**

博弈论作为经济金融类专业本科生的专业选修课程，包括非合作博弈理论和信息经济学初步两部分内容。该课程的讲授对于培养和训练学生的经济学思维，提高学生的专业素质和综合能力。本课程教学的主要目标是培养学生掌握在信息不对称和非合作条件下微观经济理论，并能够较好地应用博弈论的方法思考并解决实际问题，为学生们后续高级微观经济学及相关课程的学习打下坚实的基础。课程会帮助学生理解如何通过设计博弈规则实现社会主义价值观中的效率与平等、利他与合作，让学生在课程学习中养成良好的行为规则，成为合格的社会主义公民。

Game Theory is a course specific for undergraduate students in Finance and Economics, and includes basics in Game Theory and some preliminaries in Information Economics. This course will teach students to think as economists, and improve their expertise in economics and finance. The target of this course is to help students to analyze and solve some problems in real life using Game Theory, and let students understand the economics theories in the context of information asymmetric, and thus shed the light for their studies and professions in the future. This course will help students understand how to design game rules to achieve efficiency and equity, altruism and cooperation in the socialism value, and learn the behavioral rules to be a qualified socialist citizen.

**二、教学基本要求(Requirement)**

本课程的主要内容是阐述博弈论和信息经济学的基础知识。目的在于帮助学生理解并掌握在非合作条件下经济主体的决策过程，和博弈论的基本原理，以及不同的决策过程的经济福利影响。本课程在非合作博弈理论部分的主要内容包括完全信息静态博弈、完全信息动态博弈、不完全信息静态博弈以及不完全信息动态博弈。该部分重点阐述博弈的战略式表示和扩展式表示、纳什均衡、子博弈精炼纳什均衡、贝叶斯纳什均衡以及精炼贝叶斯纳什均衡。在信息经济学部分，本课程将重点阐述委托-代理机制、逆向选择和信号传递等内容。作为理论的应用，本课程将讨论如何在博弈论框架内理解社会主义核心价值观中的重要概念。

本课程的考核方式及其所占权重如下：

出勤及课堂测验： 10%

家庭作业： 20%

期中考试： 30%

期末考试： 40%

This course is mainly to teach the principles in non-cooperative game theory and information economics, and let the students to understand the decision making process under the non-cooperative conditions, as well as its welfare effects. In the non-cooperative game theory part, this course will cover static game with complete information, dynamic game with complete information, static game with incomplete information and dynamic game with incomplete information. The information economics part will cover the principal-agent problem, adverse selection, signaling and screening. As applications of game theory, this course will discuss how to understand some key concepts in the socialism value.

The evaluation of this course and its weights is as follows:

Attendance and quizzes: 10%

Homework: 20%

Midterm Exam: 30%

Final Exam: 40%

**三、**各教学环节学时分配(Hours Schedule)

**教学课时分配**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 序号  (Number) | 章节内容(Content) | 讲课（Hours） | 实验  （Practice） | 其他  （Others） | 合计  （Total） |
| **1** | **完全信息静态博弈**  Static game with complete information | **6** | **0** | **0** | **6** |
| **2** | **完全信息动态博弈**  Dynamic game with complete information | **6** | **0** | **0** | **6** |
| **3** | **不完全信息静态博弈**  Static game with incomplete information | **6** | **0** | **0** | **6** |
| **4** | **不完全信息动态博弈**  Static game with complete information | **6** | **0** | **0** | **6** |
| **5** | **委托-代理理论**  (Principal-Agent Problem) | **4** | **0** | **0** | **4** |
| **6** | **逆向选择与信号传递**  (Adverse Selection, Singling, and Screening) | **4** | **0** | **0** | **4** |
| **合计**  (Total) |  | **32** | **0** | **0** | **32** |

**四、教学内容（Content）**

第一章 导论

**Chapter 1: Introduction**

教学重点、难点：博弈论的研究内容

课程考核要求：**了解**博弈论的主要研究内容和方法，及其与传统微观经济学的联系与区别

思政教育：人与人之间的策略性互动是人类社会的一个基本特征；社会主义中的效率与公平

复习思考题：为什么博弈论成为当代微观经济学研究的重要领域？

**Key Points**：The main contents of game theory and its methodology

**Requirement:** Understand the main content and methodology of game theory, and its difference from traditional economics studies; efficiency and equity in socialism

**Ideological and Political Education:** Strategic interaction between people is an basic character of human society.

**Summary Problem:** Why game theory becomes the mainstream of modern microeconomics studies?

第二章 完全信息静态博弈

**Chapter 2: Static Game of Complete Information**

第一节 博弈论的基本概念及战略式表述

Section 1： The conceptual framework of game theory and its strategic form representation

第二节 纳什均衡

Section 2：Nash Equilibrium

第三节 纳什均衡应用

Section 3：Applications of Nash Equilibrium

第四节 混合战略纳什均衡

Section 4：Mixed strategy of Nash Equilibrium

第五节 纳什均衡的存在性和多重性的讨论

Section 5：Existence and Multiplicity of Nash Equilibrium

教学重点、难点：博弈的战略式表述、占优战略均衡和纳什均衡、Cournot寡头竞争模型、Hotelling价格竞争模型、混合战略纳什均衡、纳什均衡的存在性和多重性。

**Key Points**：The strategic form representation, dominant strategy equilibrium, Nash equilibrium, Cournot Model on Oligopolistic competition, Hotelling Model on price competition, mixed strategy Nash equilibrium, the existence and multiplicity of Nash equilibrium

思政教育：通过囚徒困境等经典博弈案例阐释个体利益可能与集体利益有冲突，引导学生思考如何设计博弈规则使得人们在追求自身利益的同时实现合作。

**Ideological and Political Education:** Illustrate the possible conflict between individual interest and collective interest through the classical example of Prisons’ dilemma, guide students to think how to design the game role to achieve cooperation.

课程的考核要求：掌握博弈的战略式表述，理解占优战略均衡和纳什均衡，熟练掌握并运用古诺模型和豪泰林模型，熟练掌握混合战略纳什均衡，理解纳什均衡的存在性和多重性。

**Requirement**：Grasp the strategic form representation, understand the dominant strategy equilibrium and the Nash equilibrium; fully understand and apply the Cournot model and Hotelling model as well as the mixed strategy Nash equilibrium, understand the existence and multiplicity of Nash equilibrium.

复习思考题：以囚徒困境为例解释博弈的相关概念，并求解纳什均衡。

**Summary Problem**：Using the example of Prisoners’ Dilemma, explain the relevant concepts in game theory and solve its Nash equilibrium.

第三章 完全信息动态博弈

**Chapter 3: Dynamic Game of Complete Information**

第一节 博弈的扩展式表述

Section 1：The extensive form representation

第二节 子博弈精炼纳什均衡

Section 2：Sub-game perfect Nash Equilibrium

第三节 子博弈精炼纳什均衡的应用

Section 3：Applications of Sub-game perfect Nash Equilibrium

第四节 重复博弈和无名氏定理

Section 4：Repeated Game and Nash Folk Theorem

教学重点、难点：博弈的扩展式表述、子博弈精炼纳什均衡、逆向归纳法、Stackelberg寡头竞争模型、政策的动态一致性、讨价还价模型、无限次重复博弈、无名氏定理。

**Key Points**：The extensive form representation, sub-game perfect Nash equilibrium, backward induction, Stackelberg Model, Dynamic Consistency, Bargaining Model, Infinite repeated game, Nash folk theorem

思政教育：通过重复博弈来展示可以改变博弈规则来实现人们之间的合作；通过坏孩子定理来展示如何通过设计博弈规则使得社会主义社会中个体愿意利他。

**Ideological and Political Education:** Illustrate that cooperation can be achieved in the repeated game; Through the Rotten Kids Theory to show how to design the game to make individuals in the socialism society to act with altruism.

课程的考核要求：掌握博弈的扩展式表述，理解子博弈精炼纳什均衡并能够熟练掌握并运用逆向归纳法求解，熟练掌握并运用Stackelberg模型，掌握重复博弈以及无名氏定理。

**Requirement**：Grasp the extensive form representation, understand the sub-game perfect Nash equilibrium and use the backward induction to find it, fully understand and apply the Stackelberg model, as well as the repeated game and the Nash folk theorem.

复习思考题：以房地产开发博弈为例解释子博弈精炼纳什均衡，并用逆向归纳法求解。

**Summary Problem**：Using the example of real estate development, explain the sub-game perfect Nash equilibrium and find all the SPNE via backward induction.

第四章 不完全信息静态博弈

**Chapter 4: Static Game of Incomplete Information**

第一节 不完全信息博弈和贝叶斯纳什均衡

Section 1：Game with incomplete information and Bayesian Nash equilibrium

第二节 贝叶斯纳什均衡的应用

Section 2：Application of Bayesian Nash Equilibrium

第三节 贝叶斯博弈与混合战略均衡

Section 3：Bayesian game and mixed strategy equilibrium

第四节 机制设计理论与显示原理

Section 4：Mechanism design and revelation principle

教学重点、难点：贝叶斯纳什均衡、混合战略均衡、机制设计理论。

**Key Points**：Bayesian Nash equilibrium, backward induction, mechanism design and revelation principle

思政教育：介绍社会主义论战以及机制设计理论的起源；如何通过机制设计实现社会经济的计划；计划经济的可行性与难点。

**Ideological and Political Education:** To introduce the debate about socialism and the origin of mechanism design; the mechanism design to achieve the social planning; the feasibility and difficulty of planning in socialism.

课程的考核要求：掌握贝叶斯纳什均衡的概念，理解Harsanyi转换和不完全信息静态博弈的战略式表述，熟练掌握并运用不完全信息条件下的Cournot模型，掌握一级价格密封拍卖和双方竞价拍卖的最优解的推导，理解机制设计和显示原理。

**Requirement**：Grasp the concept of Bayesian Nash equilibrium, and the Harsanyi transformation. Understand the Cournot model with incomplete information. Grasp the first price sealed bid auction and double auction and derive the optimal solution. Understand the mechanism design and relation principle.

复习思考题：以不完全信息Cournot模型为例解释贝叶斯纳什均衡；解释并比较一级价格密封拍卖和竞价拍卖的区别。

**Summary Problem**：Using the example of prisoners’ dilemma to explain the concept of Bayesian Nash equilibrium; Explain and compare first price sealed auction and the double auction.

第五章 不完全信息动态博弈

**Chapter 5: Dynamic Game of Incomplete Information**

第一节 精炼贝叶斯纳什均衡

Section 1：Sub-game perfect Bayesian Nash equilibrium

第二节 信号传递博弈及其应用

Section 2：Signaling game and its application

第三节 精炼贝叶斯纳什均衡的再精炼

Section 3：More refined sub-game perfect Bayesian Nash equilibrium

第四节 不完全信息重复博弈与声誉模型

Section 4：Repeated game with incomplete information and reputation model

教学重点、难点：精炼贝叶斯纳什均衡、信号传递博弈、声誉模型。

**Key Points**：Sub-game Bayesian Nash equilibrium, signaling game, reputation model

思政教育：通过声誉模型介绍社会主义荣誉观对实现社会合作的重要性。

**Ideological and Political Education:** To illustrate the importance of socialism value for attaining social cooperation through the reputation model.

课程的考核要求：掌握子博弈精炼贝叶斯纳什均衡的概念，理解信号传递模型及垄断限价模型，理解序贯均衡的概念，掌握并运用声誉模型。

**Requirement**：Grasp the concept of sub-game Bayesian Nash equilibrium. Understand the signaling game and Milgrom–Roberts Model. Understand Kreps-Wilson sequential equilibrium. Understand and apply the KMRW reputation model.

复习思考题：以市场进入阻扰模型为例解释子博弈精炼纳什均衡的概念；阐述Milgrom-Roberts垄断限价模型。

**Summary Problem**：Using the example of Entry-Deterrence to explain the concept of sub-game Bayesian Nash equilibrium; Explain Milgrom-Roberts monopoly-pricing Model.

第六章 委托-代理理论

**Chapter 6: The Principal-Agent Problem**

第一节 信息经济学引论

Section 1：Introduction to Information Economics

第二节 委托-代理理论的分析框架

Section 2：The Framework of Principal-Agent Theory

第三节 信息对称情况下的最优合同

Section 3：Optimal contract with symmetric information

第四节 信息不对称情况下的最优合同

Section 4：Optimal contract with asymmetric information

第五节 多阶段动态博弈-棘轮效应

Section 5：Optimal contract with asymmetric information: Ratchet Problem

第六节 道德风险与锦标制度

Section 6：Moral hazard and rank order tournaments

第七节 效率工资和监督力度

Section 7：Efficiency wage and Monitoring

教学重点、难点：委托代理问题的分析框架、棘轮效应、道德风险。

**Key Points**：Framework of Principal-Agent problem, Ratchet Problem, Moral Hazard

课程的考核要求：掌握委托代理问题的分析框架，理解不同条件下的最有合同，掌握并运用棘轮效应模型，运用道德风险解释现实问题。

思政教育：介绍信息不对称下社会主义计划经济面临的激励问题以及如何通过设计合同来实现激励。

**Ideological and Political Education:** To introduce the incentive issue faced by the socialism planner when there is asymmetric information and show how to design the contract to overcome the incentive issue.

**Requirement**：Grasp the framework of principal-agent problem. Understand the optimal contract under symmetric/asymmetric information. Understand and apply the ratchet model. Apply the moral hazard to explain problems in real life.

复习思考题：描述并解释委托代理问题中的参与约束和激励相容约束；以一个两阶段动态模型解释棘轮效应是如何弱化激励机制的。

**Summary Problem**：Please describe and explain the participation constraint and incentive compatibility constraint; Use a two-stage dynamic model to explain how the Ratchet effects weaken the incentive mechanism.

第七章 逆向选择与信号传递

**Chapter 7: Adverse Selection and Signaling**

第一节 逆向选择：旧车市场

Section 1：Adverse selection: used-car market

第二节 逆向选择：保险市场

Section 2：Adverse selection: insurance market

第三节 信号传递：Spence劳动力市场模型

Section 3：Screening and signaling: Spence labor market model

教学重点、难点：逆向选择，Spencer模型。

**Key Points**：Adverse selection, Spence labor market model

思政教育：社会道德价值观对社会效率的影响

**Ideological and Political Education:** The importance of socialism value for the social efficiency

课程的考核要求：掌握并运用逆向选择的概念解释现实生活的问题，运用Spencer劳动力市场模型解释现实问题。

**Requirement**：Understand and apply the concept of adverse selection to real life; Explain the Spence labor market model to explain some problems in real life.

复习思考题：以旧车市场和保险市场为例解释逆向选择；描述并解释Spence劳动力市场模型及其应用。

**Summary Problem**：Please describe and explain the participation constraint and incentive compatibility constraint; Use a two-stage dynamic model to explain how the Ratchet effects weaken the incentive mechanism

**六、主要参考书（Textbooks）**

[1] Drew Fudenberg, Jean Tirole. Game Theory. USA: MIT Press, 1991

[2] Andrew Mas-Colell, Michael Whinston, and Jerry Green. Microeconomic Theory. UK: Oxford University Press, 1995

[3] 张维迎. 博弈论与信息经济学. 上海：格致出版社，上海三联书店，上海人民出版社. 2004年

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