

## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 <b>Course Title</b>	人工智能与博弈论 Artificial Intelligence and Game Theory				
2.	授课院系 <b>Originating Department</b>	金融系 Department of Finance				
3.	课程编号 <b>Course Code</b>	FET305				
4.	课程学分 <b>Credit Value</b>	3				
5.	课程类别 <b>Course Type</b>	专业选修课 Major Elective Courses				
6.	授课学期 <b>Semester</b>	秋季 Fall				
7.	授课语言 <b>Teaching Language</b>	中英双语 English & Chinese				
8.	授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	刘鲁川、教学教授, 金融系 Andy LIU, Teaching Professor, Department of Finance 邮箱/Email: liulc@sustc.edu.cn				
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	曾思杰(助教), 金融系, 11749283@mail.sustc.edu.cn Sijie Zeng, Department of finance				
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>					
11.	授课方式 <b>Delivery Method</b>	讲授 <b>Lectures</b>	习题/辅导/讨论 <b>Tutorials</b>	实验/实习 <b>Lab/Practical</b>	其它(请具体注明) <b>Other (Please specify)</b>	总学时 <b>Total</b>
	学时数 <b>Credit Hours</b>	48	16			64

<b>12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements</b>	
<b>13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite</b>	
<b>14. 其它要求修读本课程的学系 Cross-listing Dept.</b>	

**教学大纲及教学日历 SYLLABUS**

**15. 教学目标 Course Objectives**

博弈论是研究多体交互决策的数学科学，是经济学和人工智能的一个理论基础。本门课由算法博弈论入手，介绍博弈论、计算机和机器学习的基本理论和方法，探索机器博弈、网络经济和金融科技中一些前沿课题。

Game theory, as one of mathematical foundations for economics and artificial intelligence, to study interactive decision with multi-agents. The course introduces game theory, theory of computation and machine learning in the perspective of algorithmic game theory. Some of cutting edge issues in AI games, network economy and Fintech could be explored.

**16. 预达学习成果 Learning Outcomes**

通过这门课程学生可以常握策略与合作博弈,和深度与强化学习中基本概念与方法，理解存在性、可计算性和复杂性的基本思想，能够运用算法博弈论和机器学习的方法解决机器博弈、网络经济和金融科技中一些问题。

In this course, students could learn the concepts and methods of noncooperative and cooperative game theory, as well deep and reinforcement learning. They could understand the thoughts of existence of solution concepts, computability and complexity of computation. Students could practice in the fields of AI games, network economy and Fintech through employing algorithmic game theory and machine learning.

**17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）  
Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

引论（3学时）

博弈论与人工智能学科概述；算法博弈论例题：婚姻匹配；课程介绍（3学时）

第一部分 博弈论

非合作博弈理论（3学时）

策略博弈的架构与解概念；纯和混合策略；纳什均衡和纳什存在性定理；相关均衡

动态和重复博弈理论（3学时）

动态博弈的架构和概念；信息；子级博弈完美均衡；重复博弈理论；自动机理论及其应用

合作博弈理论（3学时）

合作博弈的架构：可转效用与非可转效用；夏普利价值；核；讨价还价。

匹配理论及其应用（3学时）

两方匹配；算法；多元匹配；应用

拍卖和机制设计（3学时）

拍卖的架构：封闭与开发拍卖；第二价位拍卖；赞助搜索拍卖；机制设计规划；有效性和不可能

第二部分 计算理论导论

图灵机、可计算性和计算复杂性（3学时）

第三部分 机器学习

计算神经网络（3学时）

神经网络模型；激活函数；方向图形和反馈；网络架构；知识表达；学习的过程和任务。

深度学习（3学时）

深度正向网络；深度学习的规管；优化训练深度模型；卷积、循环和递归神经网络。

强化学习（3学时）

有限马尔可夫决策过程；动态规划；蒙特卡罗模拟；规划与学习

第四部分 应用

人工智能与游戏（3学时）

随机博弈理论，阿尔法围棋

分布式技术与区块链（6学时）

共识机制；拜占庭协议；事实统一与比特币；

项目工作室（6学时）

Introduction (3 hours)

An overview of game theory and artificial intelligence; Marriage game as an example of algorithmic game theory; An outline of the course

Part One. Game Theory

2. Strategic Games (3 hours)

Strategic game format and solutions; Pure and mixed strategies; Nash equilibrium and Nash existence theorem;

Correlated equilibrium.

3.. Dynamic and repeated game theory (3 hours)

Game format and notations; Information; subgame perfect equilibrium; Repeated games; Automaton theory and its application.

4. Cooperative game theory (3 hours)

Cooperative game format: TU and NTU; Shapley Value; Core; Bargaining

5. Matching and its application (3 hours)

Two partite matching; algorithms; Multipartite matching; Application

6. Auction and Mechanism Design (3 hours)

Auction format: sealed and open; Second-price auction; Sponsored Search auction; The mechanism agenda; Efficiency and impossible

Part Two. Theory of Computation

7. Turing machine, computability and complexity (3 hours)

Part Three. Machine Learning

8. Neural network (3 hours)

Models of Neural network; Activation Function; Directed graph and feedback; Network Architecture; Knowledge presentation; Learning processes and tasks.

9. Deep learning (3 hours)

Deep feed forward network; Regularization for deep learning; Optimization for training deep models; Convolutional, recurrent and recursive networks.

10. Reinforcement Learning (3 hours)

Finite Markov Decision Processes; Dynamic Programming; Monte Carlo Methods; Planning and Learning

Part Four. Application

11. AI and Games (3 hours)

Stochastic game theory; Alpha Go

12. Distributed Ledger Technology and Blockchain (6 hours)

Consensus; Byzantine Agreement; Eventual Consistency and Bitcoin

13. Project workshop (6 hours)

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

Algorithmic Game Theory

David Parkes, et al. Economics and Computation (Draft)

AI and Deep Learning

Stuart Russell, et al. Artificial Intelligence: A modern approach, 3rd. ed.

Ian Goodfellow, et al. Deep Learning, MIT

Simon Haykin, Neural Networks and Learning Machines, 3rd. Ed.

Reinforcement Learning

Richard S. Sutton and Andrew G. Barto: Reinforcement Learning:

An Introduction

Southern University  
of Science and  
Technology

课程评估 **ASSESSMENT**

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance				
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects	16week	40		
平时作业 Assignments	16week	30		
期中考试 Mid-Term Test	8week	30		
期末考试 Final Exam				
期末报告 Final Presentation				
其它 (可根据需要 改写以上评估方				

式)  
Others (The  
above may be  
modified as  
necessary)

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20. 记分方式 GRADING SYSTEM

- A. 十三级等级制 Letter Grading  
 B. 二级记分制 (通过/不通过) Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过  
This Course has been approved by the following person or committee of authority

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