CAS EC403 (SA1) **Boston University**
Game Theory **Summer I, 2022**

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OFFICE HOURS: TW 12 NOON -1:30 PM RM.309, 270 BAY STATE RD.
Office hours on Tuesdays are also accessible online.
Web link will be provided on the course website.

LECTURES: MTW 6-8:30PM CAS B36
(*Class meets on F 6/03 in observance of Substitute Monday Schedule.)

TEXT: Avinash Dixit, Susan Skeath & David McAdams,
Games of Strategy (5th ed.), W.W. Norton 2021

GRADE: Exam 1 [40%] + Exam 2 [60%]
*** No make-up exams will be given. ***
(Format and logistics of the exams will be announced in class and on the course website.)

COURSE DESCRIPTION:

The origins of modern game theory and its application to economics can be traced back to the 1830's, when the mathematician Antoine Augustin Cournot wrote his now famous model of duopoly, but for a century its development was fitful and slow. After the appearance of John von Neumann and Oskar Morgenstern's 'Theory of Games and Economic Behavior' in 1944, interest and research in the subject underwent a phase of rapid and extensive growth. It is now regarded by economists and social scientists as a central theory of human strategic interaction, and in recent years it has even entered the conversations of an educated public.

In this introductory course, we will study the logical and analytic underpinnings of game theory. From the rigorous formulation of models of interaction and the concept of strategies, we will move on to the positive and normative assertions of game theory – Nash Equilibrium, Iterated Deletion of Dominated Strategies, Rationalizability, Sub-game Perfection, Evolutionary Stability, etc., and examine assumptions about human decision and social institutions that may support these assertions. Many of these ideas have been motivated by economic phenomena, which still provide the best illustrations of game theory as well as inspirations for game theorists.

It is also well known that game theory frequently makes predictions which appear to be at odds with observed human behavior, whether seen in natural settings or deliberate experiments. We will discuss some of these findings, and may occasionally engage in experimentation ourselves. However, even when we feel that game theory fails to deliver empirically sound predictions or prescriptions, a useful way to understand why it may be so is to scrutinize its assumptions and logic as closely and deeply as we can.

Being an advanced undergraduate course intended for economists, the student is assumed to come equipped with basic knowledge of economic theory and mathematics (including some calculus and probability theory), but most important of all is his/her ability and willingness to think clearly and logically.

COURSE SCHEDULE: See attached.

COURSE WEBSITE: http://learn.bu.edu/ (BLACKBOARD)

ACADEMIC CONDUCT: It is the student's responsibility to read, understand and observe the *Academic Conduct Code* (http://www.bu.edu/academics/resources/academic-conduct-code/, also available from CAS Advising and Student Academic Life or the BU Summer Term Office). Cases of suspected misconduct will be referred to the Dean's Office. Furthermore, acts of plagiarism or cheating will also be penalized with failing grades.

BU HUB LEARNING OUTCOMES:
EC403 can fulfill the learning outcome of any one of the following Hub areas.

- **Social Inquiry II –**

  In a *strategic interaction*, outcomes are determined jointly and not unilaterally. Thus the success of an individual's decision will depend on her correct beliefs about the actions (and beliefs) of *other* decision-makers. This is a fundamental aspect of social and economic phenomena, and Game Theory is a systematic analysis of strategic interactions. Formal theoretical models are constructed to understand the complex realities of economic, social and political interactions and institutions.

  The exact conclusions drawn from these models can then be used to predict behavior, guide decisions, or inform policies. Applications range from industrial organization (e.g. the competitive or collusive behavior of powerful firms in different industries, and the regulation of such industries), corporate governance (e.g. the design of effective contracts), financial markets (e.g. the origins of speculative trades), to the understanding of social norms (e.g. how repeated interactions or third-party sanction can sustain cooperative behavior even amongst selfish agents).

  These models also provide testable conclusions: by comparing the 'rational' predictions of game theory with observed phenomena (under natural or experimental conditions) the student can gauge the soundness and realism of the model's underlying assumptions, and reveal deep-seated complexities of human behavior.

- **Quantitative Reasoning II –**

  In this course, students are given ample opportunities to hone their quantitative and analytical skills. Formally, 'games' are precise mathematical constructs; and they are the theoretical models used to understand the socio-economic phenomena or questions that arise in specific applications. In order to make predictions or derive conclusions according to game theory, rigorous logical analyses are conducted and mathematical methods are used. These include algebra, calculus, and probability theory. Symbolic manipulations, graphical representation, and computations form an integral part of the exposition and processing of game-theoretical ideas. However, a full appreciation of the intellectual source and power of game theory also calls for imagination, intuition, and an abiding interest in society, economy, and human nature.

- **Critical Thinking (from the Intellectual Toolkit) –**

  Game theory provides a perfect illustration on how the scientific method is applied to social science. It is a rigorous, elegant, and insightful exercise in translating real-life experience and informal observations about social and strategic interactions into formal language and formal theories.

  This practice inspires and enables the student to undertake critical examination of a wide range of socio-economic phenomena, as well as intuitive ideas that have been advanced to explain or regulate social phenomena (including a lot of conventional wisdom, dogmas and gut-reactions). For example: "Does the enlightened pursuit of individual self-interests lead to socially efficient outcomes?" The analysis of competitive markets suggests that this can be true, whereas the "prisoners' dilemma" exposes conditions under which it may fail.

ECONOMICS DEPARTMENT OUTCOMES:
EC403 can fulfill the elective requirements for the following undergraduates majors: BA in Economics, BA in Economics and Mathematics, and (the BA portion of) BA/MA in Economics; and also for the undergraduate minor in Economics. Majors in other fields should consult academic advisors in their own departments.

COURSE SCHEDULE Details of this schedule are subject to change. Registered students can log into the course website at http://learn.bu.edu/. You should visit this website frequently to get the latest course schedule, check announcements, obtain class material and verify your personal grading record.

- LECTURE complements READING and self-study. They are not substitutes. To do well in this course, you must understand both thoroughly.
- HOMEWORK problems are specified as follows: "S2.1" refers to Solved Exercise S1 at the end of Chapter 2 of Dixit-Skeath-McAdams, while U2.3 refers to the Unsolved Exercise U3 in the same chapter. "S3.1- 3.5" means "S3.1, S3.2, S3.3, S3.4 and S3.5". Additional problems may be given out in class or on the course website from time to time.
- SOLUTION to the homework problems and exams will be posted on the course website. But you will not benefit from the solutions unless you have worked seriously on the problems.
- An EXAM will test your comprehensive understanding of the course material up to the time of the exam.

(!!) ATTENDANCE: This course is very intensive and each class in the summer session is almost equivalent to one week's instruction during a regular semester. *Regular attendance is therefore essential.* Also, there will be *no make-up for missed exams.*

DATE	LECTURE	READING	HOMEWORK
	Game Theory and Strategic Interactions		
T5/24	Model of Strategic Interactions:	Ch. 1, 2	S2.1-2.2, U2.3-2.4
	(1) Game Form and Payoffs		
	(2) Predicting Play and Giving Strategic Advice		
	Extensive-form/ Sequential-move Games & Backward Induction		
W5/25	Backward Induction and the problems it raises	Ch. 3	S3.1-3.5
	Model of the Decision Maker:		
	(1) Individual preference and optimizing behavior		U3.5-3.9
	(2) Knowing the preferences and rationality of others		
	What is a Strategy? Actions by self and Beliefs about others		
M5/30	*<Holiday: No Class>*		
	Strategic-form (Normal-form)/Simultaneous-move Games & Nash Equilibrium		
T5/31	Normal-form Games with Complete Information	Ch. 4	S4.1-4.8, U4.1-4.8
	Nash Equilibrium and the problems it raises		S4.9-4.14
W6/01	Dominant and Dominated Strategies		U4.9-4.14
	Iterated Deletion of Dominated Strategies		
F6/03	*<Substitute Monday Schedule>*		
	Relationship between Games in Extensive and Strategic Forms		
	Maximin and Rationalizable Strategies	Ch. 5	S5.4-5.6, U5.5-5.7

DATE	LECTURE	READING	HOMEWORK
	Game Theory and Economic Behavior		
M6/06	Continuous strategies and best-response functions	Ch. 5	S5.1-5.3, S5.7-5.9, U5.8-5.10
	Cournot's Model of Oligopoly	Review relevant parts of your	
	Bertrand and Hotelling's Models of Oligopoly	Intermediate Microeconomics textbook	
T6/07	Economic Externalities and Collective Actions	Ch. 11	S11.1, S11.4, U11.4-11.6
	Auctions	Ch. 15	S15.3-15.6, U15.3 -15.6
	Public Decisions and Voting	Ch. 16	S16.1-16.2, U16.5, U16.7
	Rubinstein's Bargaining Model	Ch. 17	S17.1, U17.1, U17.3
W6/08 EXAM 1	*Exam covers course material through 6/07*		
	Extensive-form Games with Imperfect Information		
M6/13	Multi-stage Games, Inferences about the Past	Ch. 6	S6.1-6.6, U6.1-6.6
	Subgame Perfect Equilibrium and Sequential Rationality		S6.7-6.11, U6.7-6.11, U6.12-6.13
	Mixed Strategy		
T6/14	Mixed Strategies: Tax Evasion and Random Audits	Ch. 7	S7.1-7.10
	Interpretations of Mixed Strategies		U7.1-7.12
	Correlated Equilibrium		
	Strategic-form Games with Incomplete Information		
W6/15	Decision under Uncertainty:	Ch. 8, 9	S8.2-8.4, S8.6-8.8
	(1) Expected Payoffs		U8.2-8.4, U8.7-8.9
	(2) Prior Beliefs and Factual Information		S9.3-9.6, U9.7-9.8
M6/20	Promises and Threats: Are they credible?		
	Signaling and Screening		U9.6, U9.9
	Brinkmanship and Commitment	Ch. 13	S13.1, S13.4-13.5, U13.1
	Repeated Interaction and Social Interaction		
T6/21	Reward and Punishment	Ch. 10	S10.1-10.2, S10.4, S10.6
W6/22	Repeated Games & Mutual Sanction		U10.1, U10.4-10.7
	Social Norms & Third-party Sanction		
	Evolution of Behavior and Belief		
M6/27	Population Dynamics:	Ch. 12	S12.2, S12.7-12.8
	(1) Replication & Statistical Equilibrium		
	(2) Random Perturbation & Selection		S12.9-12.11
T6/28	Evolutionary Stability		U12.1, U12.2, U12.6, U12.8
W6/29 EXAM 2	*Exam covers material from the whole course*		