

Korea University International Summer Campus (KU ISC) 2018

Embark on a unique summer

June 26, 2018 ~ August 2, 2018

ISC230A - Introduction to Game Theory

I. Instructor

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Office Hours	:	Mondays, Tuesdays, Wednesdays and Thursdays 12:30pm-1:30pm (in room 313)

I. Textbook

Required Textbook : Avinash Dixit, Susan Skeath and David Reiley, Games of Strategy (4rd edition or any of the earlier editions), Norton, 2014. ISBN-13: 978-0393919684

> * There is only one textbook required for the class. You will need to buy it and bring it with you since ISC will not be selling any textbooks for summer classes. The fourth addition is quite expensive but you don't need to buy this edition. Older editions are very similar and perfectly equivalent for our purpose—and their prices are much lower. Any one of the older editions would be sufficient. All other readings will be posted online.

Recommended The following readings will all be posted online: : Joel Watson, Strategy (2nd edition), Norton, 2008 (excerpts from the 1st Additional edition posted online.) Robert Axelrod, The Evolution of Cooperation, Basic Readings Books, 2006 (excerpts posted online.) Other readings: David Kreps, Notes on the Theory of Choice, Westview Press, 1988, Raymond Wilder "The Axiomatic Method," pages 1621-1640 in The World of Mathematics, Simon and Schuster, 1956, Kenneth Williams, Game Theory a Behavioral Approach, Oxford University Press, 2013 and papers by Bendor and Swistak. * Since publishers allow access to about 25% of copyrighted materials I

took the liberty of scanning some of the required readings and posting them on the course web site. My selection is arbitrary and includes what I thought may be the most difficult parts of the material. These excerpts do not and cannot substitute for the entire reading.

SELECTED READINGS, AS WELL AS ALL OTHER CLASS MATERIALS (HOMEWORKS, HOMEWORK SOLUTIONS, LECTURE NOTES, ETC.) ARE POSTED ON THE WEB.

III. Course Description and Objectives

This is an introductory course in game theory, a branch of applied mathematics. Game theory is a general theory of behavior and as such it is also a part of social science. While it has long been used in all social sciences, its impact of the last three decades has been extraordinary and unprecedented. My objective is to provide a reasonably comprehensive introduction to modern game theory. We will cover theory of preferences, expected utility theory, and a variety of solutions concepts including iterated dominance, Nash equilibria, subgame perfect equilibria, evolutionary equilibria and others.

I strongly recommend that you watch *A Beautiful Mind* (winner of 4 Oscars in 2002 including the best picture) a thriller about John Nash, a game theorist. It watches like a James Bond movie, and Russell Crowe and Jennifer Connelly are brilliant as John Nash and his wife. I will make references to characters featured in this movie throughout the class since many of them made important contributions to game theory. The class will cover results of many prominent game theorists including John Nash, Tom Schelling, a colleague of mine at the University of Maryland, Reinhard Selten, and others. Nash, Schelling and Selten have all received Nobel Prizes for their contributions to game theory.

IV. Grading

Attendance and		20%
Participation	·	
Tests (five)	:	50%
Assignments	:	30%

V. Class Outline

Date	Торіс	Readings	
June 26 (Tue)	Orientation Day		
June 27 (Wed)	Introduction: Examples of Topics, Methods, and Solutions	Wilder, pp. 1621-40.	
June 28 (Thu)	Examples of Topics, Methods, and Solutions (cont.)	ibid.	
June 29 (Fri)	Choice under Certainty: Theory of Preferences	Dixit et al, Ch. 1 and Kreps, pp. 7-11 or Williams, pp. 47 and 49-50.	
July 2 (Mon) July 3 (Tue)	Choice under Risk: Von Neumann-Morgenstern Expected Utility Theory and the Foundations of Game Theory	Kreps, pp. 1-6 or Williams, pp. 63-68.	
July 4 (Wed) July 5 (Thu)	Game Theory: Primitive Terms, their Properties and Interpretations	Dixit et al, Ch. 2.	
July 9 (Mon) July 10 (Tue)	Simultaneous-Move Games: Dominance Solvability and Nash Equilibria	Dixit et al, Ch. 4.	

Date	Торіс	Readings	
July 11 (Wed) July 12 (Thu)	Sequential Games and Rollback Equilibria	Dixit et al, Ch. 3.	
July 16 (Mon) July 17 (Tue)	Simultaneous-Move Games: Mixed Strategies	Dixit et al, Ch. 6. (Watson Ch. 14, 15, 16)	
July 18 (Wed) July 19 (Thu)	Sequential versus Simultaneous-Move Games and Subgame-Perfect Equilibria; Repeated Games	Dixit et al, Ch. 11.	
July 23 (Mon) July 24 (Tue)	Repeated Games and Folk Theorems	Axelrod (excerpts), Watson, Ch. 22.	
July 25 (Wed) July 26 (Thu)	Evolutionary Games	Bendor and Swistak (1997)	
July 30 (Mon) July 31 (Tue)	The Evolutionarily Stable Strategies and the Evolution of Cooperation	Bendor and Swistak (2001)	
Aug 1 (Wed)	Optional Final Exam		
Aug 2 (Thu)	No Class, Graduation Ceremonies		

SCHEDULE OF TOPICS AND RELATED READINGS

June 27 & 28

Introduction: Examples of Topics, Methods, and Solutions

Related readings: Raymond Wilder, pages 1621-1640 (online.)

June 29

Choice under Certainty: Theory of Preferences

Related readings: Dixit, Skeath and Reiley Chapter1 and Kreps, pages 7-11 (for those who like it short and mathematical) and Williams pages 47 and 49-50 (for those who want something less mathematical than Kreps.)

July 2 & 3

Choice under Risk: Von Neumann-Morgenstern Expected Utility Theory and the Foundations of Game Theory

Related readings: pages 1-6 from D. Kreps' "A Course in Microeconomic Theory" or Williams pages 63-68 (for those who want something less mathematical than Kreps.) Both are online.

July 4 & 5

Game Theory: Primitive Terms, their Properties and Interpretations

Related readings: Dixit, Skeath and Reiley Chapter 2 (excerpts from previous edition are on online.)

July 9 & 10

Simultaneous-Move Games: Dominance Solvability and Nash Equilibria

Related readings: Dixit, Skeath and Riley Chapter 4 (excerpts from an older edition are online.)

July 11 & 12

Sequential Games and Rollback Equilibria

Related readings: Dixit, Skeath and Riley Chapter 3 (excerpts from an older edition are online.)

July 16 & 17

Simultaneous-Move Games: Mixed Strategies

Related readings: Dixit, Skeath and Riley Chapter 6 (Watson Chapters 14, 15 and 16 are recommended.)

July 18 & 19

Mixed Strategies (cont.) and Sequential versus Simultaneous-Move Games and Subgame-Perfect Equilibria; Repeated Games

Related readings: Dixit, Skeath and Riley Chapter 11 (excerpts from an older edition are online; Watson Chapter 22 is recommended.)

July 23 & 24

Repeated Games and Folk Theorems

Related readings: Axelrod (online excerpts), Watson Chapter 22.

July 25 & 26

Evolutionary Games

Related readings: Axelrod (online excerpts), Watson Chapter 22.

July 31 & August 1

The Evolutionarily Stable Strategies and the Evolution of Cooperation

Related readings: Bendor and Swistak (1997) and Bendor and Swistak (2001); both are online.

Monday	Tuesday	Wednesday	Thursday	Friday
		June 27	June 28	June 29
		First day of class es		Hwk 1 posted, due Tue July 3
July 2	July 3	July 4	July 5	July 6-8
	Hwk 1 due in class	Hwk 2 posted, due Tue July 10	Graded Hwk 1 handed out Sample Test 1 questions posted	No classes
July 9	July 10	July 11	July 12	July 13-15
	Hwk 2 due in class Test 1 on the content of Hwk 1	Hwk 3 posted, due Tue July 17	Graded Test 1 handed out Graded Hwk 2 handed out Sample Test 2 questions posted	No classes
July 16	July 17	July 18	July 19	July 20-22
	Hwk 3 due in class Test 2 on the content of Hwk 2 Hwk 4 posted, due Tue July 24		Graded Test 2 handed out Graded Hwk 3 handed out Sample Test 3 questions posted	No classes
July 23	July 24	July 25	July 26	July 27-29
	Hwk 4 due in class Test 3 on the content of Hwk 3	Hwk 5 posted, due Mon Jul 30 Graded Hwk 4 handed out	Graded Test 3 handed out Sample Test 4 & 5 ques. posted	No classes
July 30	July 31	Aug 1	Aug 2	
Hwk 5 due Test 4 on the content of Hwk 4	Test 5 on the content of Hwk 5 Review session (no lecture)	Final exam (optional) No lecture	No class Graduation ceremonies	

Important Dates and Deadlines

VI. Class Policy

GRADING

TESTS (50%): There will be five short tests, about 15 minutes each. Tests are an imperfect measure of comprehension. To make sure that the test grade is a fair measure of comprehension you will have an opportunity to prove that your mistakes were "typos" rather than errors of understanding. We will meet for a few minutes so you can explain to me the nature of your mistakes and show me (solve an ad hoc problem or two) that you understand the concepts and are able to use them. These "make-ups," for the lack of better term, will count as 50% of your test grade. (Assume, for example, that your score on Test 1 was 70% and you convince me that all your mistakes were glitches and hence your level of understanding is really at 100%. In that case your total score for Test 1 will be determined as: 0.5*70% + 0.5*100% = 85%.) The average of the five test grades will count as 50% of your class grade.

HOMEWORKS (30%): There will be five homeworks. The average of your homework grades (all homeworks carry the same weight) will count as 30% of your grade.

CLASS ATTENDANCE AND PARTICIPATION (20%).

EXTRA CREDIT

One notorious problem that leaves everyone upset are borderline grades. 89%, for instance, is a B+ while 90% is an A-. This feels unreasonable, to say the least, and in my opinion it is both unreasonable and unfair. To solve this problem we will use two tie-breaking tools: extra credit points for in-class competitions and the final exam.

CLASS PERFORMANCE—THE EXTRA CREDIT POINTS: Class performance, measured by in-class competitions, will count as follows: All extra credit points you have accumulated, if any, will be classified into four categories. Students in the top category will get an extra 3%, second highest, 2%, third highest, 1%, and lowest, 0%. To get extra credit percentage points you will need to have an above average number of points.

PERCENTAGE GRADES WILL TRANSLATE INTO LETTER GRADES as follows: A for 90-94%, A+ for 95% up; and analogously for B (80's), C (70's) and D (60's).

FINAL EXAM: An <u>optional</u> way to improve your grade is by taking the final exam. Final exam will count for 50% of your <u>test grade</u>. For example, suppose your average test score is 86%. If you decide not to take the final exam, your class grade will be calculated with the 86% test average counting as 50% of your class grade. If, however, you take the final exam and score 94% on it, your class grade will be calculated with 0.5*86% + 0.5*94% = 90% counting as 50% of your class grade.

OTHER ISSUES

CRIB SHEET: All testing is closed book but you ARE ALLOWED to have a **crib sheet**—a single standard size sheet of paper with whatever information you want to put on it (both sides.)

LECTURES VERSUS READINGS: A good part of the material will not be contained in the readings and will only be presented in class. Most of the readings are not a substitute for what we do in class—they are **supplementary**.

Use of NOTE(NET)BOOKS/LAPTOPS, PHONES and other electronic devices is not allowed in class.