Economics 414
Game Theory

Professor Peter Cramton
Spring 2005

Outline

Introduction
Syllabus
Web demonstration
Examples

About Me: Peter Cramton

B.S. Engineering, Cornell University
Ph.D. Business & Economics, Stanford University
Associate Professor, Yale University, 1984-93
National Fellow, Hoover Institution, Stanford University, 1992-93
Professor of Economics, University of Maryland, since 1993
Chairman, Market Design Inc., since 1995
Chairman, Spectrum Exchange, since 1999
President, Criterion Auctions, since 2000

Course Objectives

To understand the importance of competitive and cooperative factors in a variety of decision problems
To learn how to structure and analyze these problems from a quantitative perspective

Course Outline

Strategic-Form Games
Extensive-Form Games
Repeated Games
Bayesian Games and Bayesian Equilibrium
Dynamic Games of Incomplete Information
Bargaining Theory
Auction Theory (and Practice)

Logistics

Meet Tuesday and Thursday, 9:30 - 10:45
Problem Sets (about 6) and Web Exercises [20% of grade]
Must be own work; don't look at past solutions
Small discussion groups fine
Midterm Exam [30% of grade]
Final Exam [50% of grade]
Tuesday, May 17, 8:10 am
Office Hours Tues 7:30 to 9:30 am
Tydings 4101a
301.405.6987 or cramton@umd.edu
**Did you get my email?**

- Email sent to econ414-0101-spr05@coursemail.umd.edu
- If you did not get it, then either:
  - University has wrong email address for you
  - You are not registered for this class (e.g. you are on the waitlist)
  - Your mail quota is exceeded

**Web exercises**

- Register at [http://gametheory.tau.ac.il/](http://gametheory.tau.ac.il/) (student’s registration in upper right)
- Your login name will be:
  - CR479U<student e-mail>
    where <student e-mail> is your full email.
- The class password is:
  - e139288Zt
- I will send an email with assignments

**Readings**

- Web site: www.cramton.umd.edu

**Introduction and Examples**

**Definition**

*Game theory* is the study of mathematical models of conflict and cooperation between *intelligent* and *rational* decision makers.

- *Rational*: each individual maximizes her expected utility
- *Intelligent*: individual understands situation, including fact that others are intelligent rational decision makers

**Game 1**

- Each of three players simultaneously picks a number from [0,1]
- A dollar goes to the player whose number is closest to the average of the three numbers
- In case of ties, the dollar is split equally
**Game 1 in Normal Form (Strategic Form)**

- player $i \in N = \{1, \ldots, n\}$
- strategy $s_i \in S_i$
- strategy vector (profile) $s = (s_1, \ldots, s_n) \in S = S_1 \times \ldots \times S_n$
- payoff function $u_i(s) : S \rightarrow \mathbb{R}$, which maps strategies into real numbers
- game in normal form $\Gamma = \{S_1, \ldots, S_n; u_1, \ldots, u_n\}$

**Game 2: Both Pay Auction**

- $10 is auctioned to highest of two bidders
- Players alternate bidding
- At each stage, bidding player must decide either to raise bid by $1 or to quit
- Game ends when one of the two bidders quits in which case the other bidder gets the $10, and both bidders pay the auctioneer their bids

**Game in Extensive Form**

- Who plays when?
- What can they do?
- What do they know?
- What are the payoffs?

**Game 2 in Extensive Form (Game Tree)**

**Game 3**

**Game 4**
Definitions

- **Strategy**: a complete plan of action (what to do in every contingency)
- **Information Set**: for player i is a collection of decision nodes satisfying two conditions: player i has the move at every node in the collection, and i doesn't know which node in the collection has been reached

Game 3: How many info sets?

Game 4: How many info sets?

More Definitions

- **Perfect Information**: each information set is a single node (Chess, checkers, go, ...)
- **Finite games of perfect information can be “solved” by backward induction in the extensive form or elimination of weakly dominated strategies in the normal form
- **Imperfect Information**: at some point in the tree some player is not sure of the complete history of the game so far

Game 3: Backward Induction

Looking ahead and reasoning back