Lecture 1 Game Plan

- Introduce the course

- Logistics / expectations

- More examples

What are Games?

"No Man is an Island,

Entire of Itself"

- John Donne, 1624

What are Games?

"In War the Will Is Directed at an Animate Object That Reacts."

- *Karl Von Clausewitz in "On War", 1832*

What is Game Theory?

- Study of rational behavior in situations in which your choices affect others & their choices affect you (so-called "games")

- Bad news:

   Knowing game theory does not guarantee winning

- Good news:

   Framework for thinking about strategic interaction

Games We Play

- Driving   coordination
- Penalty Kicks   hunter & hunted
- GPA trap   prisoner's dilemma
- Doing the dishes   war of attrition
- Mean professors   commitment
- Group projects   free-riding
- Dating   hidden information

Games Businesses Play

- Standards adoption   coordination
- Audits   hunter & hunted
- Price wars   prisoner's dilemma
- Standards wars   war of attrition
- Capacity expansion   commitment
- Pollution abatement   free-riding
- External financing   hidden information
- FCC spectrum   auctions

Why Study Game Theory?

Because the press tells us to...

"As for the firms that want to get their hands on a sliver of the airwaves, their best bet is to go out first and hire themselves a good game theorist."
The Economist, July 23,1994 p. 70

"Game Theory, long an intellectual pastime, came into its own as a business tool."
Forbes, July 3, 1995, p. 62.

"Game theory is hot."
The Wall Street Journal, 13 February 1995, p. A14

Why Study Game Theory?

Because consultants tell us to:

- **John Stuckey & David White** – McKinsey Sydney

- **Tom Copeland** – Monitor

Why Study Game Theory?

Because business leaders tell us to:

- Raymond W. Smith (Bell Atlantic Chairman during 1990s)

  "At Bell Atlantic, we've found that the lessons of game theory give us a wider view of our business situation and provide us a more nimble approach to corporate planning. We call this system, quite simply, the 'manage the business' process."

  -- in *"Business as war game: a report from the battlefront",* Fortune, Sep. 1996

Why Study Game Theory?

- Because we can formulate effective strategy...

- Because we can predict the outcome of strategic situations...

- Because we can select or design the best game for us to be playing...

Game Theory

Administrivia

Course Information

- Materials on Sloan class server
- Instructor: David McAdams

Prerequisite: 15.010

- In particular, I assume that you are very comfortable
  - representing games with payoff matrix and/or decision tree
  - computing reaction curves
  - computing equilibrium given payoff matrix and/or decision tree

Grading

- Problem Set   <u>15</u>%
- Strategy Memo   <u>15</u>%
- Real-World Application   <u>25</u>%
- Game Participation   <u>20</u>%
- Final Exam   <u>25</u>%

Team Assignments

Target 3-4 students per team

1. *Problem Set*

2. *Strategy Memo*

3. *Real-World Application*

Group Assignments

1. *Problem Set*: Qwest Bond Swap

   "Design a debt tender offer to minimize the risk of bankruptcy and maximize shareholder equity."

Group Assignments

2. *Strategy Memo*: Airline Strategy

"American Airlines needs you to assess a plan to extend 'More Room Throughout Coach' to the older and smaller Super 80 fleet."

Group Assignments

3. *Real-World Application*

   "From your analysis, develop strategy advice for one of the players in the game or for a party interested in the outcome."

   a. *Mixed Strategies.*
   b. *Sequential / Repeated Games.*
   c. *Strategic Moves.*
   d. *Information.*

Online Games

- Six online games, prior to:
    - Lectures 2,3,4,5,9,10

- Participate _by midnight_ before lecture
- No preparation: 5-15 minutes to play
- Results revealed in class
- Graded for participation only

In-Class Games

- Four in-class games
  - Lectures 2,3,6,8

- Require preparation outside of class
  - 1-2 page worksheet for you to complete and hand in
  - graded for participation only

Final Exam

- Take-home exam
  - Open notes / Open book
  - Due at beginning of last class
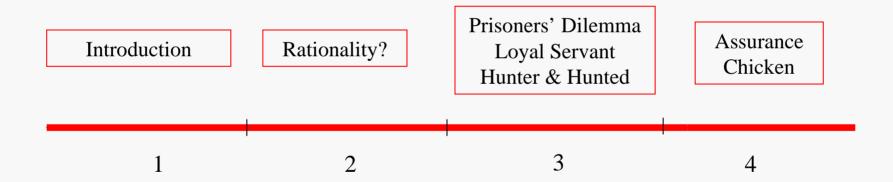 - Practice exam will be provided

Wait List & Auditing

- TA will be managing the wait list
- As a courtesy, please inform the TA
  - if you want off the wait list
  - if you think there's 50% or more chance you will drop
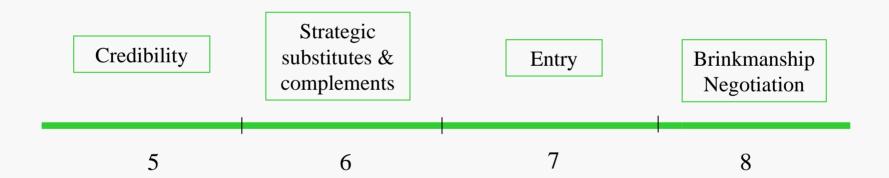
- No auditors please

Outline of Course

FOUNDATIONS	COMMITMENT	INFORMATION
1–4	5-8	9-11

Part I: Foundations

| Introduction | Rationality? | Prisoners' Dilemma
Loyal Servant
Hunter & Hunted | Assurance
Chicken |

1   2   3   4

Part II: Commitment

Credibility	Strategic substitutes & complements		Entry		Brinkmanship Negotiation

5   6   7   8

Part III: Information

Auctions

Signaling
Incentives

Reputation

9   10   11

Game Theory = Interactive Decision Theory

- **Decisions**
  - You take the world as given and make the best decision for yourself

- **Games**
  - Your best decision depends on what others do, and what they do may depend on what they think you do …

Overview

1. Key elements of a game
2. Anticipating others' behavior
3. Acquiring advantage

Key Elements of a Game

- **Players**: Who is interacting?
- **Strategies**: What are their options?
- **Payoffs**: What are their incentives?
- **Information**: What do they know?
- **Rationality**: How do they think?

How to anticipate others' behavior in a game

- **Evolution**: If non-strategic and adaptive, play repeatedly (or observe past play)
- **Dominance**: If never play a strategy that is always worse than another
- **Rationalizability**: If play optimal given some beliefs about what others play (and what others believe)
- **Equilibrium**: If play optimal given *correct* beliefs about others

Themes for acquiring advantage in games

1. **Commitment / strategic moves:** Credibility, threats, and promises

2. **Leveraging limited rationality:** Reputation and surprise

3. **Exploiting incomplete information:** Signaling, selection, and info cascades

Cigarette Advertising on TV

1964

1970

- All US tobacco companies advertised heavily on television

- Surgeon General issues official warning
  - Cigarette smoking may be hazardous
- Cigarette companies' reaction
  - Fear of potential liability lawsuits

- Companies strike agreement
  - Carry the warning label and cease TV advertising in exchange for immunity from federal lawsuits.
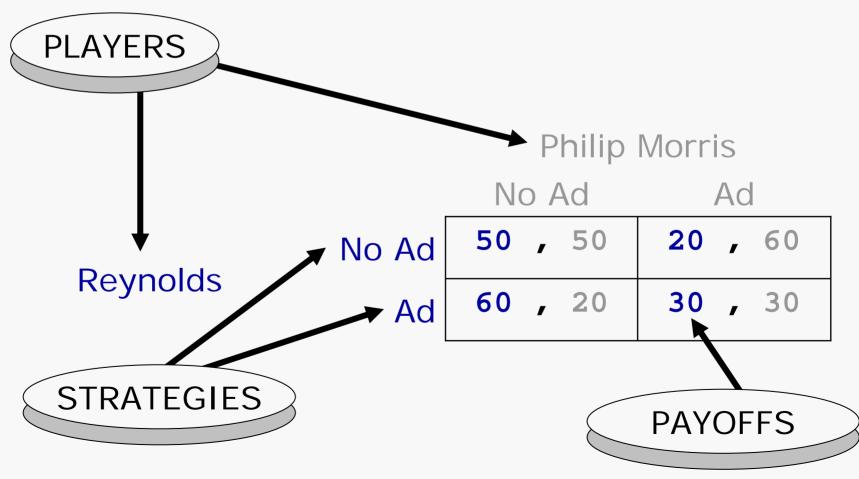
Strategic Interactions

- Players: Reynolds and Philip Morris
- Strategies: { Advertise , Do Not Advertise }
- Payoffs: Companies' Profits

- Each firm earns $50 million from its customers
- Advertising costs a firm $20 million
- Advertising captures $30 million from competitor

- How to represent this game?

Payoff Table

PLAYERS

Philip Morris

	No Ad	Ad
No Ad	**50** , 50	**20** , 60
Ad	**60** , 20	**30** , 30

Reynolds

STRATEGIES

PAYOFFS

Best responses

Philip Morris

	No Ad	Ad
No Ad	**50** , 50	**20** , 60
Ad	**60** , 20	**30** , 30

Reynolds

- **Best response for Reynolds:**
  - If Philip Morris advertises: advertise
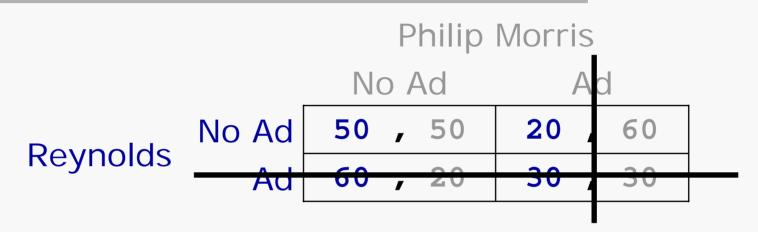 - If Philip Morris does not advertise: advertise

- **Advertise is dominant strategy!**

- **This is another Prisoners' Dilemma**

What Happened?

- After the 1970 agreement, cigarette advertising decreased by $63 million

- Profits rose by $91 million

- Why/how were the firms able to escape from the Prisoner's Dilemma?

Changing the Game thru Gov't-Enforced Collusion?

	No Ad	Ad
No Ad (Reynolds)	**50** , 50	**20** , 60
Ad	**60** , 20	**30** , 30

- The agreement with the government *forced* the firms not to advertise.

- The preferred outcome (No Ad, No Ad) then was all that remained feasible

Example: MBA Recruitment

- The message at Sloan orientation: "start looking immediately for a job"
  - It could be worse: in the 1920's, people admitted to Law School were being offered clerkships *before ever setting foot on campus*

- Why does recruitment start so early?

Vicious Cycle of Adverse Selection

- Early-moving firms will hire students who tend to be above-average

- The remaining population of students is on average worse than before, which increases the incentive to move early!

- Why doesn't Sloan administration act as third-party enforcer to allow us to escape this Prisoners' Dilemma?

Third-Party Enforcement?

- Firms and students have no incentive to report an early hire, if this will be punished
  - No way for Sloan to be effective enforcer since it can't identify deviants

- Does this mean that "unraveling" is inevitable in the MBA recruitment market?

Jump the Gun or Not?

- <u>Downside of moving early</u>: firm gets less precise information about student quality

- <u>Upside of moving early</u>: more students are available to be hired

- Jumping the gun is not a dominant strategy if downside outweighs upside. For example:
  - students can provide strong signals while in school
  - students outnumber job openings

Strategies for Studying Games

- **Two general approaches**
  - **Case-based**
    - Pro: Relevance, connection of theory to application
    - Con: Generality
  - **Theory**
    - Pro: General principle is clear
    - Con: Applying it may not be

Approach of this course

- Between theory and cases
- Lectures organized around general principles
- Illustrated with cases and game-playing
  - Cases are "stripped down" to essentials
- Frequent reality checks
  - When does theory work?
  - When doesn't it?
  - Why doesn't it?

The Uses of Game Theory

- Explanatory
  - A lens through which to view and learn from past strategic interactions
- Predictive
  - With many caveats
- Prescriptive
  - The main thing you'll take out of the course is an ability to think strategically

Online Game #1

- Play Online Game #1 prior to midnight before next lecture.
- Follow instructions on handout
  - Sign up / create password on game site
  - Then play the game (no preparation)

In-Class Game Next Time

- Prepare for "Urn Game" to be played in class next lecture.
  - See handout