

## Econ 301: Microeconomic Analysis

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## Game Applications

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### The Prisoner's Dilemma

- ▶ Recall Prisoner's Dilemma from last lecture:
  - ▶ Two suspects are being interrogated in two separate rooms
  - ▶ If they both Deny, go to jail for 2 years
  - ▶ If one Confesses, he gets 1 year while other gets 5
  - ▶ If they both Confess, go to jail for 4 years

	<i>Deny</i>	<i>Confess</i>
<i>Deny</i>	$(-2, -2)$	$(-5, -1)$
<i>Confess</i>	$(-1, -5)$	$(-4, -4)$

- ▶ What will happen in this setting?

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### Cooperation in Prisoner's Dilemma

- ▶ Is this outcome the most preferred for both players?
- ▶ Why doesn't this outcome get played?
- ▶ How can we modify game to make this a sustainable outcome?

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## Finitely Repeated Prisoner's Dilemma

- ▶ Suppose prisoners are interacting for 10 rounds
- ▶ Each round's payoffs are given by the standard one-period game
- ▶ What is predicted outcome of the game?

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## Game Theory with Firms

- ▶ Suppose we have a duopoly: just two firms producing in market
- ▶ Firms have just two strategies: pricing high or pricing low
- ▶ If both price high, split monopoly profits (3 each)
- ▶ If both price low, each gets competitive market profit of 2
- ▶ If one prices high and one prices low, profits are 1 for high price and 4 for low price firm
- ▶ How do we represent this as a game?

- ▶ What is Nash equilibrium of this game?

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## Entry Deterrence

- ▶ Now suppose we have a monopoly, but a new firm is considering entering market
- ▶ Two players: incumbent and entrant
- ▶ Entrant chooses to enter or not enter (out)
- ▶ If Entrant does enter, monopolist can fight or allow
  - ▶ If fight, both firms get payoff 0
  - ▶ If allow, payoffs are 2 for entrant and 1 for incumbent
- ▶ If entrant does not enter, gets payoff 1 while incumbent gets payoff 3

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## Entry Deterrence (cont)

- ▶ How do we represent this game?
- ▶ What is SPNE of this game?

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## Making the Threat Credible

- ▶ Suppose that incumbent monopolist has previously invested in technology that allows it to better fight off competition
  - ▶ If entrant enters and incumbent fights, payoffs now 0 for entrant and 2 for incumbent
- ▶ How do we represent this game?
- ▶ What is SPNE now?

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## Penalty Kicks

- ▶ Consider a game between a penalty kicker and a goalie in soccer
- ▶ Kicker can kick either left or right
- ▶ Goalie simultaneously decides whether to defend left or right
- ▶ Suppose kicker's accuracy is as follows:
  - ▶ 50% if kick left and goalie defends left
  - ▶ 80% if kick left and goalie defends right
  - ▶ 90% if kick right and goalie defends left
  - ▶ 20% if kick right and goalie defends right
- ▶ Assume kicker payoff is probability that she scores
- ▶ This is a *zero-sum game*: Player's payoffs sum to zero in each outcome
- ▶ How do we represent this game?

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## Penalty Kicks: Solution

- ▶ What is/are pure strategy Nash equilibrium/a?
- ▶ What is/are mixed strategy Nash equilibrium/a?

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