Game Plan

- Game theory review
- Review of some basics
- Questions before the final

Answering GT Questions

- Equilibrium is a set of strategies, not payoffs
  - Ex: The Nash equilibrium is (Up, Left), NOT (4, 3)

	Left	Right
Up	4, 3	5, 2
Down	2, 2	1, 1

  - Mixed equilibrium example: "Row plays Up with probability 3/4 and Down with probability 1/4. Column plays Left with probability 1/2 and Right with probability 1/2."

Answering GT Questions

- Nash equilibria can be either pure or mixed strategy equilibria

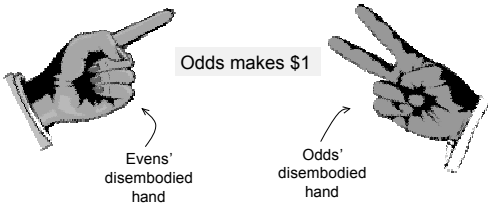
Why do you need to make other person indifferent?

- "Odds and Evens"
  - Two people: "Odds" and "Evens"
  - Each hold out 1 or 2 fingers, if total number is odd, Evens gives Odds a dollar, otherwise Odds gives Evens a dollar

		Odds: 1 finger	Odds: 2 fingers
Evens	1 finger	1, -1	-1, 1
	2 fingers	-1, 1	1, -1

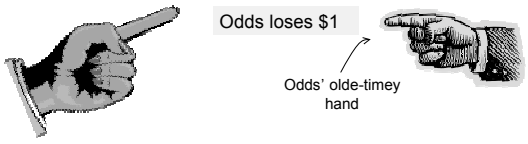
Why do you need to make other person indifferent?

- Obviously, mixing is necessary
- Let's say "Evens" plays 1 finger 3/4 of the time, 2 fingers 1/4 of the time



Why do you need to make other person indifferent?

- Expected value to Odds of playing 2 fingers: 3/4 (1) + 1/4 (-1) = 1/2
- Expected value to Odds of playing 1 finger: 3/4 (-1) + 1/4 (1) = -1/2



Why do you need to make other person indifferent?

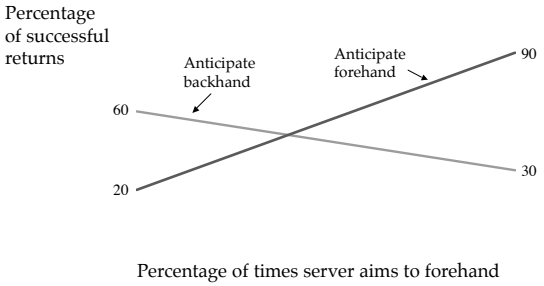
- Expected value to Odds of playing 2 fingers: $3/4\ (1) + 1/4\ (-1) = 1/2$
- Expected value to Odds of playing 1 finger: $3/4\ (-1) + 1/4\ (1) = -1/2$
- So Odds would always play 2 fingers
- But then, Evens would always want to play 2, and we know this isn't an equilibrium

Another way to think of it

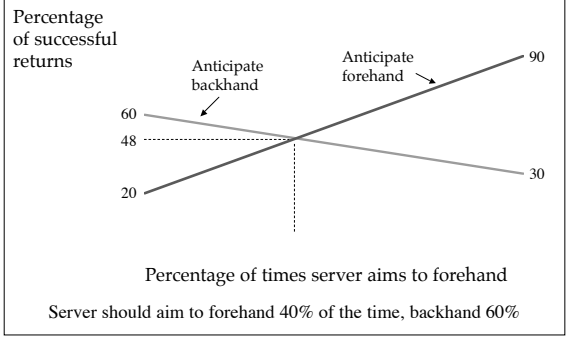
- Tennis: Server deciding to serve to the forehand or backhand
- Probability that receiver returns serve:

		Server's Aim: Forehand	Server's Aim: Backhand
Receiver's Move	Forehand	90%	20%
	Backhand	30%	60%

Another way to think of it



Another way to think of it



Server should aim to forehand 40% of the time, backhand 60%

Another way to think of it

- Examples taken from Thinking Strategically by Avinash K. Dixit and Barry J. Nalebuff

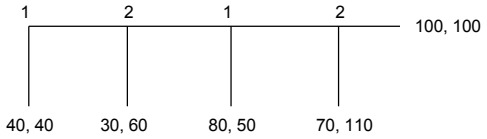
Tips for simultaneous move games

- If you find only one pure strategy equilibrium, there shouldn't be a mixed eq.
- If you find two pure strategy equilibria (like in Battle of the Sexes), look for a mixed one
- In a given square, ask if anyone could do better by moving if the other guy stays

	Baseball	Ballet
Baseball	3, 2	1, 1
Ballet	0, 0	2, 3

Sequential games

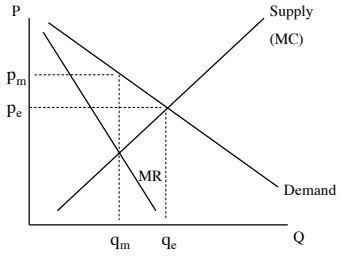
- Work your way backwards!



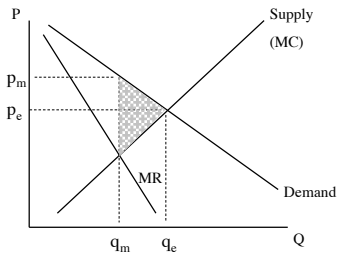
Comparison of Industry Types

	Perfect Competition	Monopoly	Cournot Oligopoly
# of Firms	Large	1	Small
Price	Given	Function of q	Function of Q (industry total)
How quantity is chosen	Choose q s.t. p = MC	Choose q s.t. MR = MC	Max profit, given what other firm(s) does (do)
Profit function	pq - c(q)	p(q)q - c(q)	$p(Q)q_i - c_i(q_i)$
Profit level	0 in long run	High	Between PC and monopoly
Dead weight loss	None	Triangle from q_m to q_e, below p_m and above MR at q_m	Triangle between Q_o and Q_e and p_o and p_e, plus production inefficiency

Monopoly Deadweight Loss



Monopoly Deadweight Loss



Cournot Example

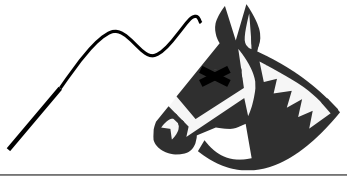
- 2 firms, with marginal costs $MC_1 = 3$, $MC_2 = 2$
- $p(Q) = 5 - 2Q$ (Q is total quantity)
- Want to find q_1 and q_2, total quantity, and price
- Steps:
  - Find FOC's for firms 1 and 2
  - Solve for q_1 in terms of q_2 and vice versa
  - Plug one quantity into the expression for the other

Cournot Example

- What is Deadweight Loss?
- Efficient solution occurs where price = lowest marginal cost
- Two components:
  - Lost gains from trade
  - Excess cost paid for quantity of goods made by higher cost producer

Remember!

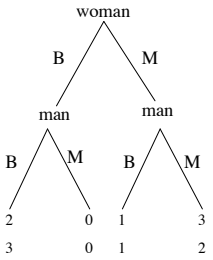
- Read questions carefully
- Make sure you answer all parts of a question
- Show us your work, explain thought process



(Extra slides; not used in recitation)

Sequential Battle of the Sexes

man \ woman	Baseball	Movie
Baseball	3, 2	1, 1
Movie	0, 0	2, 3



Monopoly problem (last year's final)

- Consider a monopolist with constant marginal cost facing linear demand. A unit tax of *t* is imposed on the monopolist. By how much does the price rise?
- Linear demand: q(p) = a - bp
- Let marginal cost be "c"
- Without tax, profits are (p-c)*q(p) = (p-c)(a-bp)

Monopoly problem (last year's final)

$\pi = (p-c)(a-bp)$

$d\pi/dp = a-2bp+cb = 0$

$2bp = a+cb$

$p = 1/2\ (c + a/b)$

Tax is part of marginal cost, so imagine $c = c + t$.

Then price rises by $1/2\ t$.

Could also write out $\pi = (p-c-t)(a-bp)$ and solve as above.