Econ 211

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Failure of Standard Solution Concepts in Beauty Contest Game

▶ Clearly Nash equilibrium does not hold
▶ Many players even choose dominated strategies
▶ Yet clearly subjects are not playing (completely) randomly

Iterative Thinking

▶ For illustration, let $p = \frac{1}{2}$
▶ Suppose that we believe all other players to completely naive, and thus guessing randomly. What should we guess?

▶ However, we might realize that the other players will see this logic. Then what should we guess?

▶ We might then realize that the other players will see this logic. Then what should we guess?

▶ We can repeat ad infinitum
▶ What is the limit of this process?

New Solution Concept: Level k

▶ Define recursive set of strategies:
  ▶ Level 0: Naive or non-strategic play
    ▶ Guessing randomly in guessing game, but other assumptions make sense in other games
  ▶ Level 1: best-respond to level 0
  ▶ Level 2: best-respond to level 1 ...
  ▶ Level k: best-respond to level $k - 1$
▶ New solution concept: players will select one of the level k strategies, typically for $k = 1, 2$, or 3
▶ Note that Level k converges to NE as $k \to \infty$

Level k Predictions in Guessing Games

- Note that level-k predicts we should see behavior cluster at 50, $50p$, $50p^2$, and so on
- Examining the data from Nagel (1995), we see
  - $p = \frac{1}{2}$: clusters at 25, 12.5
  - $p = \frac{2}{3}$: clusters at 33, 22
    - Also note cluster at 67: what is going on here?
  - $p = \frac{4}{3}$: clusters at 67, 88

Another Kind of Guessing Game

- Suppose you are playing with a partner
- You and your partner both submit guesses between 1 and 19
- Your payoffs:
  - Always get your guess in dollars
  - If your guess is exactly 3 less than opponent's guess, you get an additional bonus of 50 dollars
  - If your guess is exactly equal to opponent's guess, you get an additional bonus of 25 dollars

Analysis

- What is $L0$ guess?

- $L1$?

- $L2$?

- What is/are NE?

- Are any guesses dominant or dominated?

Summary

- Solution concepts make predictions about what strategies will be played:
  - Nash Equilibrium: mutual best response
  - Dominant strategy: always a best response
  - Dominated strategy: never a best response
  - Level k: iterative best responses
- In experiments, we see that people
  - do not always play Nash
  - sometimes choose dominated strategies
  - often play $L1, L2,$ or $L3$