Handout 15
Worries about Backward Induction

DECISIONS, GAMES & RATIONAL CHOICE

Last time we learned how to use *backwards induction* to find equilibria. It turns out when we do this we always find subgame perfect equilibria. But we left open the question: what assumptions about rationality are needed for players to take subgame-equilibrium startegies?

Let's just focus on the use of dominance in backwards induction. An argument for the importance of using backwards induction in conjunction with dominance reasoning:

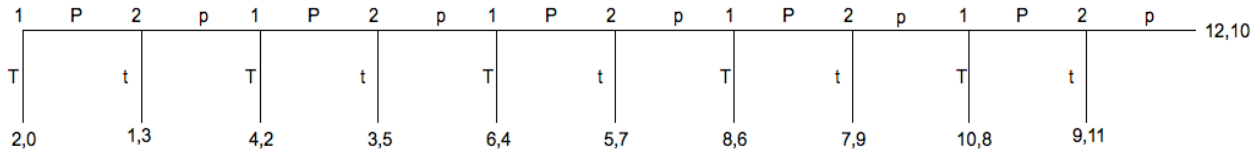
> Suppose rational players never play dominated strategies, and suppose all players are rational with mutual awareness of it. Then all players can reason that if the last possible move violated dominance, this would show that one player was irrational, contradicting their knowledge of rationality. So all players can assume no dominated strategies will be played on the last move, and this is common knowledge. Once the move is eliminated the players are effectively in a new game in which we can ask of any other later moves whether they are dominated. These can be ruled out as before, and so on...

A Problem For Backwards Induction?

Consider...

> ***The Centipede Game***. There are two pots of money, A and B. A starts with 2 dollars and B with 0. Player 1 has the option to take the largest pot (leaving the smaller pot for player 2) or "pass". When any player passes, you take one dollar from the larger post and move it to the smaller pot, and then add two dollars to that pot. After passing, the second player has the opportunity to take the largest pot or pass. This goes on for some finite number of moves, after which point some player is forced to take the largest pot.

The extensive form for the game with 10 iterations might look like this



First, how should we play this game? What is the "most rational" strategy to play in this game? (Is this a good question? Cf. "Stuck in Hell")

What are the Nash-equilibria for the Centipede Game?

What are the subgame perfect Nash equilibria?

The equilibria seem odd to many. Is there a problem with the reasoning we gave before?

This kind of reasoning matters for repeated games. Consider playing prisoner's dilemma ten times. What strategies are allowed by backwards induction?