Econ 110/PoliSci 135
Section 8 Notes

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1 Bargaining Games

Bargaining games introduce two new concepts:[1]

1. Discounting: What hapens when players value the future less than the present. The discount factor tells us by how much.

2. Writing out equilibrium strategies: Because players can propose *any* division, we have to specify strategies that deal with an infinite number of possible histories.

The good news is that these innovations can be folded into the framework we've been using without too much hassle. To deal with the continuum action problem, we just specify strategies in the form "accept any x $\geq x_o$, reject any x $< x_o$. We'll always assume that players accept when they're indifferent between accept and reject.

We find the subgame perfect equilibrium in a finite bargaining game in the same way we find a SGPN in any game with perfect information. USE BACKWARDS INDUCTION. Start with the final subgame and work your way back up the tree.

1.1 An example

Question 3 of the Fall 2011 Midterm.

2 Min-Max Strategies

In order to achieve "cooperation" in infinitely-repeated games, we'll want players to be able to threaten punishments if their opponents cheat. We'll set aside the question of credibility for a moment – assume players are able to precommit to any strategy. *We're only dealing with Nash Equilibria right now; we'll deal with SGPN later.*

What would be the worst punishment that Player 1 could threaten Player 2 with? Since Player 2 is a clever person, she'll try to maximize her own payoff under any punishment player 1 will impose. In other words, Player 2 will always play her best response. The worst thing that Player 1 can do to Player 2 is to choose the action that minimizes Player 2's payoff when she is best responding.

More formally, given players' sets of possible strategies $\mathbb{S}_1$ and $\mathbb{S}_2$, Player 1's **minmax strategy** is the solution to:

[1]Material in this handout borrows from Matt Levy and Josh Tasoff's 2007 notes

$$\min_{s_1 \in \mathbb{S}_1} \left[\max_{s_2 \in \mathbb{S}_2} u_2(s_1, s_2) \right] = \min_{s_1 \in \mathbb{S}_1} u_2(s_1, \text{BR}_2(s_1))$$

Where the right hand side makes use of the fact that Player 2's uses her best response function. The payoff that Player 2 gets when she's being punished by Player 1, but still making the best of a bad situation, is her **minmax payoff**. It's exactly the quantity calculated above. If you are confused, no worries, the example below should help to clarify.

2.1 Example: Finding minmax strategies for a static game

To find Player 1's minmax strategy, we look at Player 2's payoffs, and follow this algorithm:

1. Use the underline method to find Player 2's best payoff for each action that Player 1 has.
2. Circle the lowest number out of all the payoffs that were underlined in step 1. This is Player 2's minmax payoff.
3. Circle Player 1's action that corresponds to the number you found in step 2. This is Player 1's minmax strategy.

	E	**F**	**G**	**H**
A	2,5	10,3	4,5	3,9
B	3,7	1,4	6,8	7,7
C	1,1	0,0	0,3	4,1
D	4,6	5,5	8,8	2,6

P1 must play C to minmax P2. P2 must play E to minmax P1. P1's minmax payof is 4. P2's minmax payoff is 3.