Domination

ISCI 330 Lecture 10

February 8, 2007

ISCI 330 Lecture 10, Slide 1

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Lecture Overview





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Domination

• Let s_i and s'_i be two strategies for player i, and let S_{-i} be is the set of all possible strategy profiles for the other players

Definition

 s_i strictly dominates s'_i if $\forall s_{-i} \in S_{-i}$, $u_i(s_i, s_{-i}) > u_i(s'_i, s_{-i})$

Definition

 s_i weakly dominates s'_i if $\forall s_{-i} \in S_{-i}$, $u_i(s_i, s_{-i}) \ge u_i(s'_i, s_{-i})$ and $\exists s_{-i} \in S_{-i}$, $u_i(s_i, s_{-i}) > u_i(s'_i, s_{-i})$

Definition

 s_i very weakly dominates s'_i if $\forall s_{-i} \in S_{-i}$, $u_i(s_i, s_{-i}) \ge u_i(s'_i, s_{-i})$

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Equilibria and dominance

- If one strategy dominates all others, we say it is dominant.
- A strategy profile consisting of dominant strategies for every player must be a Nash equilibrium.
 - An equilibrium in strictly dominant strategies must be unique.

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Equilibria and dominance

- If one strategy dominates all others, we say it is dominant.
- A strategy profile consisting of dominant strategies for every player must be a Nash equilibrium.
 - An equilibrium in strictly dominant strategies must be unique.
- Consider Prisoner's Dilemma again
 - not only is the only equilibrium the only non-Pareto-optimal outcome, but it's also an equilibrium in strictly dominant strategies!

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Dominated strategies

 No equilibrium can involve a strictly dominated strategy (why?)

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Dominated strategies

- No equilibrium can involve a strictly dominated strategy (why?)
 - Thus we can remove it, and end up with a strategically equivalent game
 - This might allow us to remove another strategy that wasn't dominated before
 - Running this process to termination is called iterated removal of strictly dominated strategies.
- If we remove weakly dominated strategies, we might miss an equilibrium (why?)
 - However, if all we want is to find some equilibrium, we can use this procedure—it never adds equilibria, so it must leave at least one
 - Also, it can make it easier to find an equilibrium by removing more strategies.

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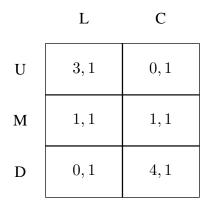
Iterated domination example

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Iterated domination example



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Iterated domination example

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Extensive Form Games

ISCI 330 Lecture 10

February 8, 2007

Extensive Form Games

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Lecture Overview

Perfect-Information Extensive-Form Games

Subgame Perfection

Extensive Form Games

ISCI 330 Lecture 10, Slide 2

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Introduction

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- The normal form game representation does not incorporate any notion of sequence, or time, of the actions of the players
- The extensive form is an alternative representation that makes the temporal structure explicit.
- Two variants:
 - perfect information extensive-form games
 - imperfect-information extensive-form games

Represents a finite sequential game as a rooted tree

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- Parts of the tree are labeled as follows:
 - Internal nodes (including the root) are labeled with player identifiers

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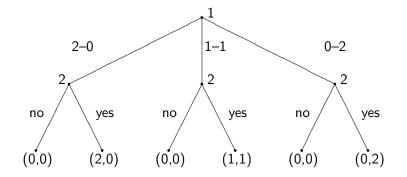
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 - Terminal nodes are labeled with utility outcomes

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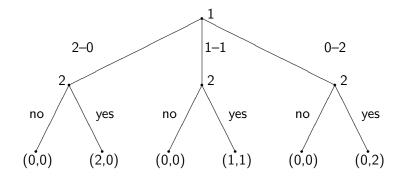
Example: the sharing game



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Example: the sharing game



Get with a partner and decide on a simple sequential game (e.g. tic-tac-toe) and represent it in extended form