



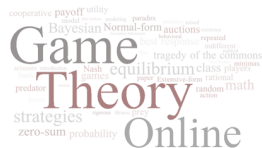
Strictly Dominated Strategies & Iterative Removal

Game Theory Course:
Jackson, Leyton-Brown & Shoham



“Rationality”

- A basic premise: players maximize their payoffs



“Rationality”

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- What if all players know this?



“Rationality”

- A basic premise: players maximize their payoffs
- What if all players know this?
- And they know that other players know it?



[illegible]

- [illegible]

[illegible]

cooperative payoff utility

Bayesian Normal-form auctions

Game Theory

equilibrium class rational

math

Online

probability

zero-sum

strategies

predator

Nash equilibria

tragedy of the commons

repeated

indifferent

paradox

cooperative

payoff

utility

auctions

behavioral

social choice

modeling

decision theory

game theory

economics

formal

mathematics

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Game Theory

Bayesian Normal-form auctions equilibrium class players Nash games predator strategies zero-sum probability Online

cooperative payoff utility rational maxim paper Extensive-form random action game theory 1997

tragedy of the commons rational math action repeated indifferent paradox cooperative payoff utility rational maxim paper Extensive-form random action game theory 1997

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Strictly Dominated strategies



- A strategy $a_i \in A_i$ is strictly dominated by $a'_i \in A_i$ if

$$u_i(a_i, a_{-i}) < u_i(a'_i, a_{-i}) \quad \forall a_{-i} \in A_{-i}$$


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[illegible][illegible]

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Iterated Removal of Strictly Dominated Strategies: Example

Game Theory Online

A word cloud containing various terms related to game theory and economics, including: Bayesian, Normal-form, auctions, repeated, tragedy of the commons, Nash, equilibrium, class, players, rational, random, action, math, strategies, zero-sum, probability, paradox, utility, payoff, iterative, model, decision, making, behavior, indifferent, multiple, paper, extensive-form, and predator.

	L	C
U	3, 0	2, 1
M	1, 1	1, 1
D	0, 1	4, 2

Iterated Removal of Strictly Dominated Strategies: Example



	L	C
U	3, 0	2, 1
M	1, 1	1, 1
D	0, 1	4, 2

- M is strictly dominated by U .

Iterated Removal of Strictly Dominated Strategies: Example



	L	C
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[illegible]

	L	C
U	3, 0	2, 1
D	0, 1	4, 2

- L is strictly dominated by C .

[illegible]C

U

 $2, 1$

D

4, 2

[illegible]

2, 1
4, 2

- D is strictly dominated by U .

[illegible][illegible]

[illegible]

[illegible]

[illegible]

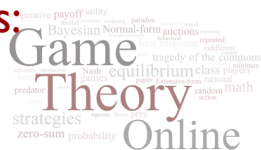
Iterated Removal of Strictly Dominated Strategies: Another Example

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Iterated Removal of Strictly Dominated Strategies: Another Example



	L	C
U	3, 1	0, 1
M	1, 1	1, 1
D	0, 1	4, 1

- M is dominated by the mixed strategy that selects U and D with equal probability.

[illegible]D

- M is dominated by the mixed strategy that selects U and D with equal probability.
- Can use mixed strategies to define domination too!

Iterated Removal of Strictly Dominated Strategies: Another Example



	L	C
U	3, 1	0, 1
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[illegible][illegible]

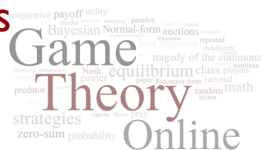
- [illegible]

[illegible]

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- No other strategies are strictly dominated.
- What are the Nash Equilibria?

Iterated Removal of Strictly Dominated Strategies



- This process **preserves Nash equilibria**.
 - It can be used as a **preprocessing step** before computing an equilibrium
 - Some games are solvable using this technique - those games are **dominance solvable**.

Iterated Removal of Strictly Dominated Strategies



- This process **preserves Nash equilibria**.
 - It can be used as a **preprocessing step** before computing an equilibrium
 - Some games are solvable using this technique - those games are **dominance solvable**.
- What about the **order of removal** when there are multiple strictly dominated strategies?
 - doesn't matter.

cooperative payoff utility paradoxes adverse selection evolution game theory mechanism design information incentive compatibility Bayesian Normal-form auctions repeated tragedy of the commons Nash equilibrium class rational math predator strategies zero-sum probability Online

- $$u_i(a_i, a_{-i}) \leq u_i(a'_i, a_{-i}) \text{ for all } a_{-i} \in A_{-i}, \text{ and}$$

- Can remove them iteratively too, but:

Weakly dominated strategies:

- They can be best replies.
- Order of removal can matter.
- At least one equilibrium preserved.
- Remember the Keynes Beauty Contest Game? Can you solve it via iterative elimination of Weakly Dominated Strategies?



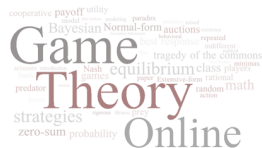
Summary: Iterative Strict and Rationality

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Summary: Iterative Strict and Rationality



- Players maximize their payoffs
 - They don't play *strictly* dominated strategies
 - They don't play *strictly* dominated strategies, given what remains...
- Nash equilibria are a subset of what remains
- Do we see such behavior in reality?