Module 2: "Static games of complete information"

Lecture 5: "How to solve a game?Use of Dominated strategies"

The Lecture Contains:

- Dominated strategy: Definition & Examples
- Solve a game: Iterated Elimination of Dominated Strategies [IEDS]
- IEDS- Examples

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How to solve a game?
Use of dominated strategies

Crucial Assumption: Each player is rational i.e. he/she maximizes the payoff

Dominated Strategies

- Consider the Prisoner's Dilenna Game

		Player 2 C	Player 2 NC
Player 1	C	-6, -6	0, -9
Player 1	NC	-9, 0	-1, -1

Suppose prisoner 2 decides to confess (C)

- Prisoner 1 will confess $[\because -6 > -9]$

Suppose prisoner 2 decides to not confess (NC)

- Prisoner 1 will confess $[\because 0 > -1]$

- Irrespective of prisoner 2's choice, prisoner 1 will always want to confess
- Strategy "Not Confess" is said to be dominated by "Confess" for prisoner 1

1. Concept of domination requires pair wise comparison.
2. You choose a strategy pair for player and check whether one strategy dominates the other.
3. One can eliminate the dominated one among the pair if it is found

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Dominated strategy: Definition & One more Example

For player i, a strategy
$\bar{s}_i \in S_i$ is said to be dominated by $s_i * \in S_i$ if
$\pi^i(s_i^*, s_{-i}) \geq \pi^i \bar{s}_i, s_{-i}$ for all possible s_{-i}

Here s_{-i} refers to the strategy set of all the players other then i.

		Player 2 L	Player 2 R
Player 1	U	3, 1	2, 2
	B	1, 0	0, 2

For player 1, U strictly dominates B (> holds)
For player 2, R strictly dominates L
If instead the game is,

		Player 2 L	Player 2 R
Player 1	U	3, 1	2, 2
	B	3, 0	0, 2

For player 2, R strictly dominates L
For player 1,U weakly dominates B

Note the following:

1. Concept of domination requires pairwise comparison.
2. You choose a strategy pair for player and check whether one strategy dominates the other.
3. One can eliminate the dominated one among the pair if it is found.

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Solve a game: Iterated Elimination of Dominated Strategies [IEDS]

- No rational player will play a dominated strategy
- Each player holds a belief that the rival is rational & hence will never play a dominated strategy
- Hence, the process of successively eliminating the dominated strategies from the players' strategy space will go on unless one cannot proceed anymore /gets the solution.

Example: Prisoner Dilemma

		Player 2	
		C	NC
Player 1	C	-6, -6	0, -9
	NC	-9, 0	-1, -1

- For player 1, NC is dominated by C.
- Player 2 knows that player 1 is rational & hence will never play NC.

- Hence player 2 faces the truncated game

		Player 2	
		C	NC
Player 1	C	(-6, -6)	(0, -9)

- Player 2 is rational & will choose confess
- So by iterated elimination of dominated strategies, solution/equilibrium becomes (C,C)

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IEDS- Other Examples

		Player 2		
		L	M	R
Player 1	U	(1, 0)	(1, 2)	(2, 1)
	D	(0, 3)	(0, 1)	(3, 0)

Fig I

Step1:

- For player 1, no strategy is strictly dominated.
- For player 2, M strictly dominates R.
- Rational Player 2 will never play R

- Player 1 knows that player 2 is rational and will never play R hence if player 1 knows that player 2 is rational then player 1 can play the following game.

		Player 2	
		L	M
Player 1	U	(1, 0)	(1, 2)
	D	(0, 3)	(0, 1)

Fig II

IEDS-Other Examples [Contd.]

Step 2:

- For player 1, U strictly dominates D
- Player 1 is rational (and player 1 knows that player 2 is rational & hence the truncated game in fig II applies.) and hence will never play D.

- If player 2 knows that player 1 is rational and player 2 knows that player 1 knows that player 2 is rational (so that player 1 knows that the truncated game in fig. II applies) then player 2 strikes off D from strategy space & faces the truncated game fig. III.

		Player 2	
		Left	Middle
Player 1	Up	(1, 0)	(1, 2)

Fig III

Step 3

For player 2, left is strictly dominated by middle.

- Outcome is (Up, Middle)

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IEDS-Another Example

		Player 2		
		L	M	R
Player 1	U	4, 3	5, 1	6, 2
	M	2, 1	8, 4	3, 6
	D	3, 0	9, 6	2, 8

By IEDS method, the outcome is (U, L)

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