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Game Theory

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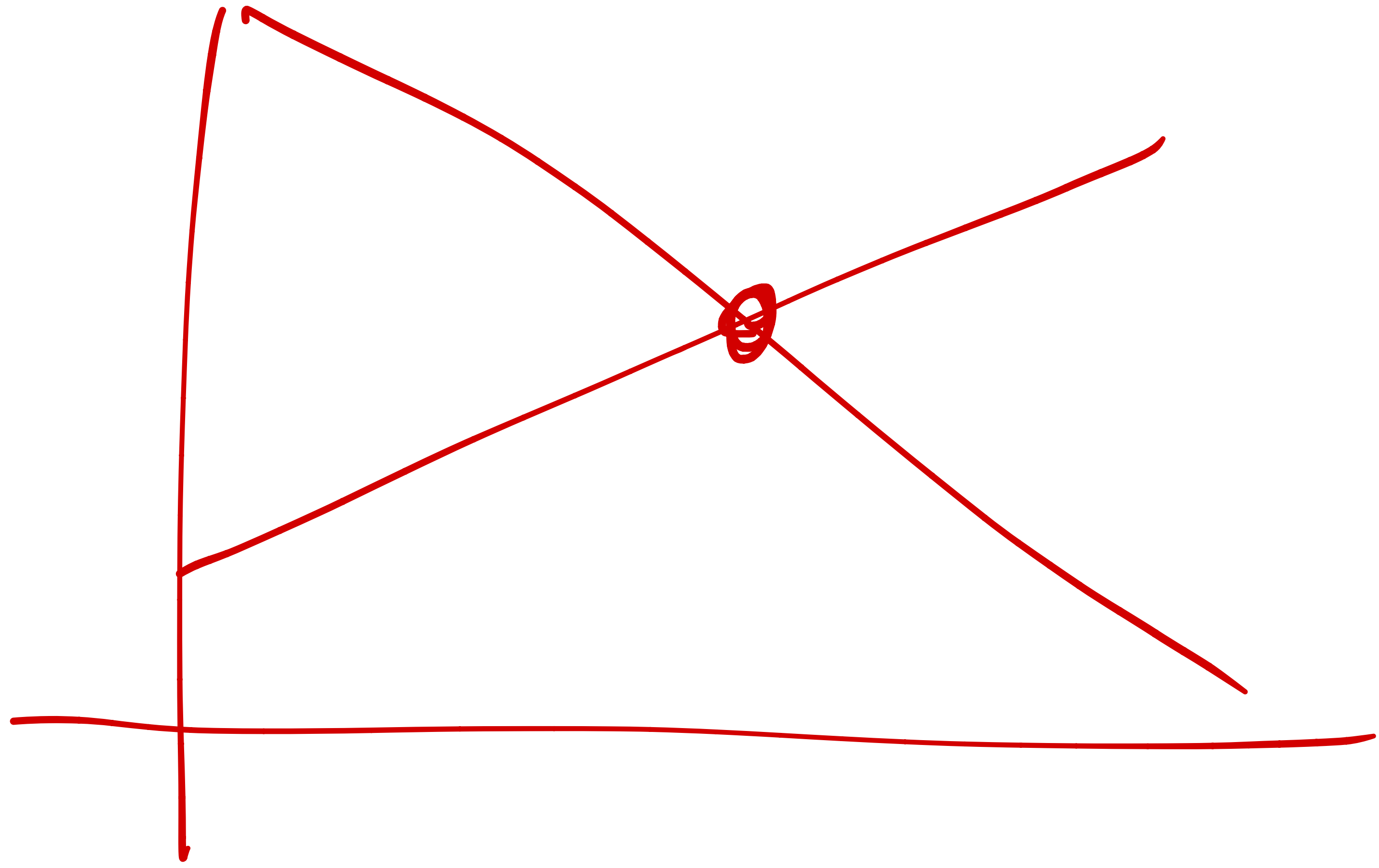
Game (Remembering...)



- **Initial State** (S_0): Where the game starts
- **To-Move(s):** The player whose turn it is to move at state s
- **Actions**: Set of legal moves
- **Transition model**: The effect of applying the action
- **Is-Terminal(s):** Returns true if the game is over
- **Utility(s,p)**: A function that assigns a numeric value to the final state

A Simple Game

- 100 players
- Select a number $s_i \in [20, 60]$

if $a_i \le 40$
$s_i = \frac{3}{2} a_i$
else
$s_i = 60$

$$u_i(s_i, s_{-i}) = 100 - (s_i - \frac{3}{2}a_{-i})^2$$

$2(s_i - \frac{3}{2}a_{-i}) = 0$

$\boxed{s_i} = \frac{3}{2} a_{-i}$

Another Example

Coke Wars

		Coke's strategies: Advertise	Coke's strategies: Don't advertise
Pepsi's strategies	Advertise	Coke $20m; Pepsi $20m	Coke –$10m; Pepsi $80m
	Don't advertise	Coke $80m; Pepsi –$10m	Coke $50m; Pepsi $50m

Dominant Strategy

A strategy $a_i \in A_i$ is strictly dominated by $\delta_i \in \Delta A_i$ if

$$V_i(\delta_i, a_{-i}) > V_i(a_i, a_{-i}), \forall a_{-i} \in A_{-i}$$

Nash Equilibrium

A joint strategy $\delta \in \Delta(A)$ is a Nash equilibrium if for every $i \in N$

$$V_i(\delta_i, \delta_{-i}) \geq V_i(a_i, \delta_{-i}), \forall a_i \in A_i$$

Nash Equilibrium

Prisioner Dilemma

one speaking

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