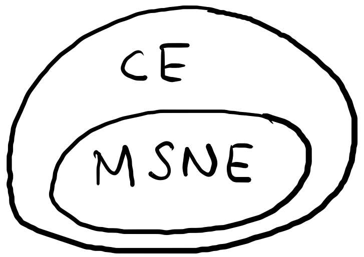
Lecture 6.3

- A correlated equilibrium can be computed in polynomial time.
- Every finite game has a CE.



- $\sigma \in \Delta\left(\bigtimes_{i=1}^{n} S_i\right)$
- A trusted third party samples $(s_i)_{i \in N} \sim \sigma$

- Tells s_i to player i.
- "Non-binding" contract.
- Binding contracts.

Coarse Correlated Equilibrium

- $\sigma \in \Delta\left(\bigtimes_{i=1}^{n} S_i\right)$

<u>**Def^n:**</u> $\Gamma = \langle N, (u_i)_{i \in N}, (S_i)_{i \in N} \rangle$. a probability distribution $\sigma \in \Delta\left(\bigtimes_{i=1}^{n} S_i\right)$ is called a coarse correlated equilibrium (CCE) if $\forall i \in N$

$$\mathop{\mathbb{E}}_{s \sim \sigma}\left[u_i(s)\right] \geq \mathop{\mathbb{E}}_{(s_i, s_{-i}) \sim \sigma}\left[u_i(s_i', s_{-i})\right] \quad \forall s_i' \in S_i$$

<u>Observation:</u> Every CE is also a CCE.

Corollary: Every finite game has a CCE.

Corollary: A CCE can be computed in polynomial time.

Linear program for finding a CCE:

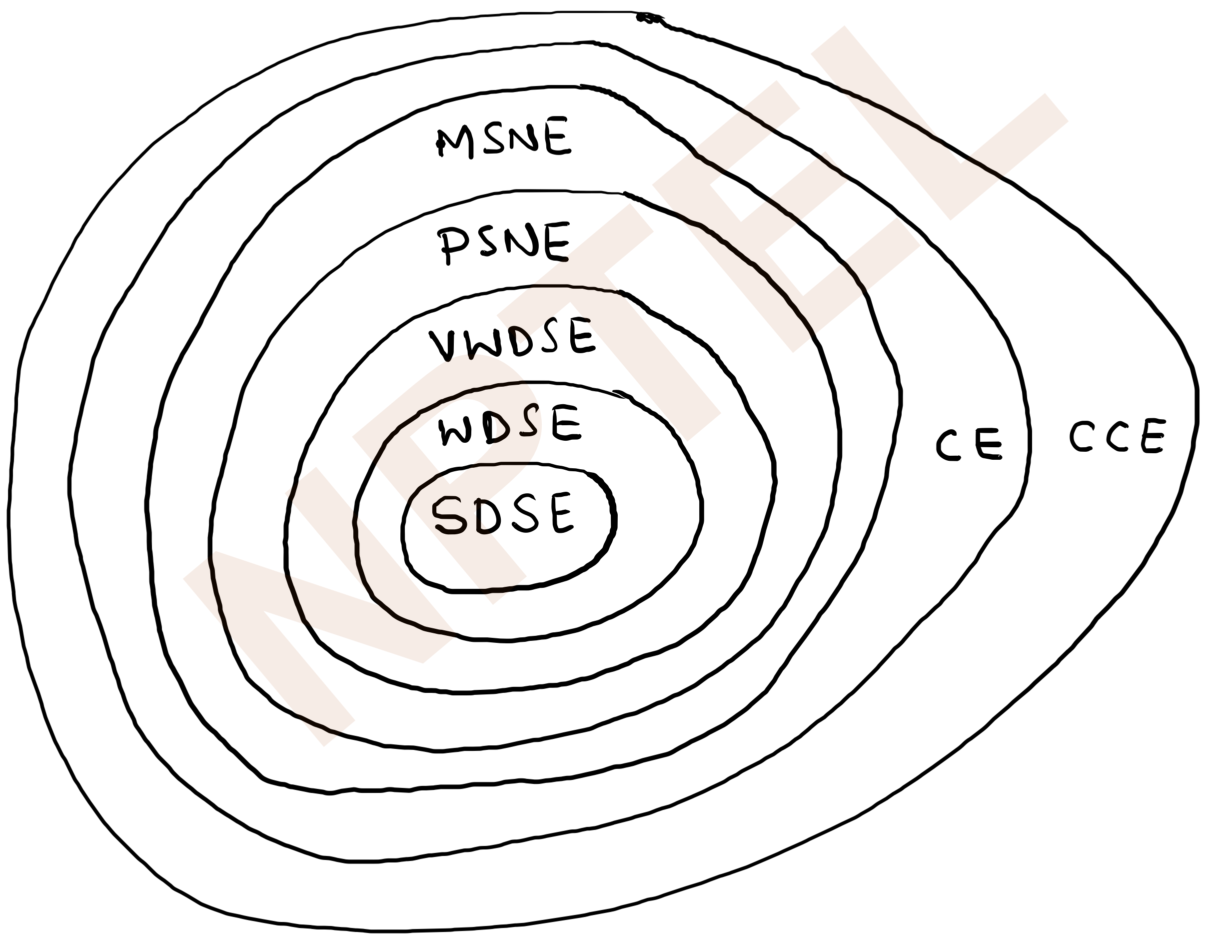
$$x_s \geq 0 \quad \forall s \in \bigtimes_{i=1}^{n} S_i$$

$$\sum_{s \in \bigtimes_{i=1}^{n} S_i} x_s = 1$$

$\forall i \in N \quad \underset{s \sim \sigma}{\mathbb{E}} [u_i(s)] \geq \underset{(s_i, s_{-i}) \sim \sigma}{\mathbb{E}} [u_i(s_i', s_{-i})] \quad \forall s_i' \in S_i$

<u>LP cont.</u>

$$\sum_{s \in \times_{i=1}^{n} S_i} x(s)\, u_i(s) \geq \sum_{(s_i, s_{-i}) \in \times_{i=1}^{n} S_i} x(s_i, s_{-i}) \cdot u_i(s_i', s_{-i})$$


MSNE
PSNE
VWDSE
WDSE
SDSE
CE
CCE

Qn: Does there exist any "natural algorithm" to find a CE or CCE?

Next lectures: Some "natural algorithm" learning dynamics which players can follow iteratively and converge to a CE or CCE.