Extensive-form games

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Extensive-form games

- Normal-form games do not incorporate the notion of sequence of actions or time
- Alternative representation which involves sequential decisions
- Perfect information
- Imperfect information
- Stochastic environment (Coin toss)
Strategies

- Pure strategies
- Mixed strategies
- Behavioral strategies
- Realization plans (next tutorial)
- Example
Conversion between EFG and NFG

- Every Extensive-form game has corresponding normal-form game (exponential blow-up)
- Not every normal-form game can be written as a perfect information extensive-form game (matching pennies)
- Every normal-form game can be written as an imperfect information extensive-form game
Nash equilibrium in EFG

- A strategy $\sigma^*_i$ is the best response to strategies $m_{-i}$, written as $m_i^* \in BR(m_{-i})$ iff

$$\forall m_i \in m_i : u_i(m_i^*, m_{-i}) \geq u_i(m_i, m_{-i})$$  \hspace{1cm} (1)

- Nash equilibrium
  - Strategy profile $P = \{m_1, ..., m_n\}$ is a Nash equilibrium iff

$$\forall i \in N : m_i \in BR(m_{-i})$$  \hspace{1cm} (2)
Every perfect information extensive-form game has a pure strategy Nash equilibrium

Convert to normal-form game and find NE there (example, past mistake)

Subgame perfect equilibrium
  - Not only non-credible threats but also consideration of mistakes in past

Backward induction (example, past mistake)
Finding Nash equilibrium in imperfect information EFG

- Existence of pure strategy Nash not guaranteed
- Convert to normal-form game and find NE there (example AoS)
- Backward induction does not work (example AoS)
- Subgames not well defined
Small poker

- Ante 1$
- Deck \{J, J, Q, Q\}
- Player 1 either folds or bets 2 $
- Player 2 either calls or folds