

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

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

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

$$\forall i \in N : m_i \in BR(m_{-i}) \quad (2)$$

Finding Nash equilibrium in perfect information EFG

- 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

Example

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