CSC304 Lecture 22

REVIEW
(Of most concepts)

Part I: Game Theory

- Normal (matrix) form games
- Strategies: pure & mixed
- Weak/strict dominance
  - Strategy A dominates strategy B
  - Iterated elimination of dominated strategy
  - Strategy A is dominant
- Nash equilibrium: pure and mixed
  - Nash's theorem

Part I: Game Theory

- Price of anarchy and stability
  - Anarchy: Worst NE vs social optimum
  - Stability: Best NE vs social optimum
  - PoA $\geq$ PoS ≥ 1
- Potential functions
  - Cost-sharing games
  - Braess' paradox
- Zero-sum games
  - The minimax theorem
- Stackelberg games, Stackelberg equilibrium

Part II: Mech Design w/ Money

- Goals: social welfare or revenue
- Incentive guarantees:
  - Strategyproofness
  - Bayes-Nash incentive compatibility (BNIC)
- VCG mechanism
  - Strategyproof + maximizes social welfare on every instance
  - $\sqrt{m}$ approximation for single-minded bidders
  - Sponsored search, comparison to GSP
- Myerson's auction
  - Strategyproof + maximizes expected revenue among all BNIC mechanisms

Part II: Mech Design w/ Money

- Revelation principle
- Revenue equivalence principle
- 1st price auction and its equilibrium
- Ascending auction

Part III: Mech Design w/o Money

- Facility location
- Social cost
  - The median mechanism
- Maximum cost
  - The left-right-middle mechanism

- Stable matching
  - Gale-Shapley deferred acceptance algorithm

Part IV: Voting

- Ranked voting
- Voting rules
- Gibbard-Satterthwaite theorem
- Axiomatic approach to voting
  - Strategyproofness, strong / weak monotonicity, consistency, Condorcet consistency
- Utilitarian approach to voting
- Impartial selection

Part V: Fair Division

- Cake-cutting
  - Proportionality and envy-freeness
  - Robertson-Webb model
- 2-players
  - Cut-and-choose
- 3+ players proportional
  - Dubins-Spanier protocol (moving knife)
  - Even-Paz protocol
- Pareto optimality
- Strategyproofness via perfect partition

Part V: Fair Division

- Indivisible goods
  - Envy-freeness up to one good
  - Maximum Nash Welfare allocation