Good Afternoon, Colleagues

Are there any questions?
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- Diseconomies of scale?
- Indep of irrel alternatives? (why desirable)
- Dictatorial scheme?
- Implications of impossibility results
- Clarke tax alg — how does it improve things? example - how did collusion help
Auctions vs. voting

- Auctions: maximize profit
  - result affects buyer and seller

- Voting: maximize social good
  - result affects all
Gibbard-Satterthwaite

- Example: Bush, Gore, or Nader?
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- Assume your preference is Nader > Gore > Bush
- For whom should you vote?
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- Plurality, Binary, Borda?
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  - One person appointed
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Assumption: no restrictions on preferences
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What about Clarke tax algorithm?
Michael Romer on tactical voting
Types of Tactical Voting

- Compromising: Rank someone higher to get him/her elected
  - e.g. Gore instead of Nader
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Types of Tactical Voting

- **Compromising:** Rank someone higher to get him/her elected
  - e.g. Gore instead of Nader

- **Burying:** Rank someone lower to get him/her defeated
  - e.g. in Borda protocol

- **Push-over:** Rank someone higher to get someone else elected
  - e.g. in a protocol with multiple rounds
Arrow’s Theorem

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**Pareto optimality.** If everyone prefers X to Y, then the outcome should rank X above Y.

**Criterion of independence of irrelevant alternatives.** If one set of preference ballots would lead to an overall ranking of alternative X above alternative Y and if some preference ballots are changed without changing the relative rank of X and Y, then the method should still rank X above Y.
Citizen Sovereignty. Every possible ranking of alternatives can be achieved from some set of individual preference ballots.
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Non-dictatorship. There should not be one specific voter whose preference ballot is always adopted.
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Universality.
Arrow’s Theorem

Universality. Complete rankings

Peter Stone
Arrow’s Theorem

Universality. Complete rankings

Pareto optimality.
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Pareto optimality. $X > Y$ if all agree
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Not all possible!
Condorcet Voting

- Strategy proof under weaker irrelevant alternatives criterion
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- A pairwise method
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- Smith set: smallest set of candidates such that each candidate in the set preferred over each candidate not in the set
Condorcet Voting

- Strategy proof under weaker irrelevant alternatives criterion
- A pairwise method
- Smith set: smallest set of candidates such that each candidate in the set preferred over each candidate not in the set
- Every candidate in the Smith set is relevant
Condorcet Example

- 48: A > B > C
- 40: B > C > A
- 12: C > B > A
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- A vs. B:
Condorcet Example

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- A vs. B: 48 – 52 \[\implies\] B > A
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- A vs. B: 48 – 52 \(\Rightarrow\) B > A
- A vs. C: 48 – 52 \(\Rightarrow\) C > A
- B vs. C: 88 – 12 \(\Rightarrow\) B > C
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- Does that solve everything?
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- A vs. B: 48 – 52 \rightarrow B > A
- A vs. C: 48 – 52 \rightarrow C > A
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- Does that solve everything? What about cycles?
General Equilibrium

Consumers: utilities, endowments
Producers: production possibility sets
Variables: prices on goods
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**Equilibrium:** allocation (prices) such that consumers maximize preferences, producers maximize profits
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  - Only true if market is infinitely large
  - Else, strategic bidding (like bargaining) possible
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  - Braess’ paradox
Bargaining

small market, both can come out favorably
Bargaining

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• Two people bargaining, each with a preference over outcomes $O$
• Let $o^*$ be the selected outcome
Bargaining

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Bargaining

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- Example: “split the dollar”
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  - If rejects, both get nothing
- Another version
  - One person makes an offer
  - Other accepts, rejects, or counters
  - If counters, $.05 lost
  - Game ends with an accept or reject
Nash Bargaining Solution

Unique solution that satisfies:
Nash Bargaining Solution

Unique solution that satisfies:

**Invariance:** only preference orders matter

**Anonymity:** no discrimination

**Pareto efficiency:** if one does better, other does worse

**Independence of irrelevant alternatives:** removing outcomes doesn’t change things
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\[
\text{Maximize } u_1(o) \times u_2(o)
\]
Other DRDM

- Contract nets: task allocation among agents
Other DRDM

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  - Contingencies
  - Leveled commitment (price)
Other DRDM

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- Coalitions
Other DRDM

- Contract nets: task allocation among agents
  - Contingencies
  - Leveled commitment (price)

- Coalitions
  - Formation
  - Optimization within
  - Payoff division
Contract Nets

Task allocation among agents
Contract Nets

Task allocation among agents

- OCSM-contracts: original, cluster, swap, multiagent
  - Hill-climbing leads to optimum
  - Without any type, may be no sequence to optimum
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Contract Nets

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  - Contingency (future events)
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- Backing out of contracts
  - Contingency (future events)
  - Leveled commitment (price)
  - What are some of the tradeoffs?
Contingency vs. leveled commitment

Contingency problems:
Contingency vs. leveled commitment

Contingency problems:

1. Hard to track all contingencies
Contingency vs. leveled commitment

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2. Could be impossible to enumerate all possible contingencies
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3. What if only one agent observes that relevant event happened?
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1. Breacher’s gain may be smaller than victim’s loss
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Leveled commitment problems:

1. Breacher’s gain may be smaller than victim’s loss
2. May decommit insincerely (wait for other) - inefficient contracts executed.
Coalitions

- Formation
- Optimization within
- Payoff division
DRDM Summary

For many agents: voting, general equilibrium, auctions

For fewer agents: auctions, contract nets, bargaining

Possible in all: coalitions
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All self-interested, rational agents