THEORY OF VOTING

CMSC828M - Spring 2018

*social choice functions
MAJORITY RULES
**Potential Wishlist**

- **Responsive**: If tied, and a voter switches, should be unique winner.
- **Monotonic**: Adding votes to the winner shouldn’t change winner.
- **Pareto**: If everyone favors x to y, y cannot win.
- **Anonymous**: Roles of voters should be interchangeable.
- **Neutral**: “Treats all candidates fairly.”
- **Resolute**: Single winner.
DO WE HAVE TO SATISFY THEM ALL?

Not really…

Should constitutional amendment require a simple majority?

What about electing committees? Pick progressively lower vote counts?

Not really…
MAJORITY RULES
HANDLING TIES

- Fixed Ordering of Alternatives:
  - breaks neutrality

- Designated Voter?:
  - breaks anonymity

- Randomized:
  - indeterminate voting rules

- Directly deal with Sets:
  - prioritize individuals?

- La-la-la-la: fine for narrow proofs, not elections
Let's make some assumptions:

Every voter plays an equal role
Every alternative is treated equally
There are only 2 alternatives
May's Theorem (1952):
- We'll relax this
- Responsive
- Monotonic
- Neutral
- Anonymous
- Resolute

Even | Odd
--- | ---
Responsive |    |
Monotonic |    |
Neutral   |    |
Anonymous |    |
Resolute  |    |
MORE SUBTLE PROBLEMS

6

5

4
MORE SUBTLE PROBLEMS

Plurality $\neq$ Majority
MORE SUBTLE PROBLEMS

Majority Preference is not Transitive Condorcet (1785)
Condorcet Winner

Not guaranteed

Winner must win majority of the vote in all head-to-head matches against other candidates.
IT GETS WORSE

> X > Y must still be true

> Change votes, but not relative ordering of X and Y

> Assume X > Y

**Independent of Irrelevant Alternatives**

**Non-dictatorial** (there is no single voter whose rankings are always followed)

**Pareto efficient** (if all voters prefer X to Y, the rule prefers X to Y)

Given 3 alternatives, there is no rule that is simultaneously:

Arrow's Impossibility Theorem (1951)
BORDEAUX COUNT (1435)

Pros:
- All candidates you support get credit.
- Every vote matters.
- Most points wins.
- Last place gets one point, 2nd to last 2 points, ...

Cons:
- Rarely used.
- Still harm your first choice.
- Encourages insincere voting... you can.
- Tends to elect "acceptable" candidates rather than majority-approved.
- All candidates you support get credit.
- Rarely used.
COPELAND’S METHOD (1299)

**Pros:**
- Easy to calculate
- Familiar to populous
- Round robin tournaments
- Best score wins

**Cons:**
- Often leads to ties
- Doesn’t account for magnitude of victory or defeat
- Doesn’t account for number of defeat
- Order candidates by pairwise victories minus defeats
RANKED CHOICE VOTING

choice voting in state primates

Marie Secretary of State proceeds with plans for ranked-

choice voting
Electoral Systems of the World
RANKED CHOICE VOTING - BENEFITS

- Promotes majority support
- Undermines Gerrymandering since candidates have to get at least 50% of the vote or are progressively eliminated
- Discourages negative campaigning
- Provides more voter choice
- Minimizes strategic voting
- Lower costs all around
- Minimize campaigning
- Higher voter participation - 2.7x turnout in some municipalities
- Don't have to bank on "lesser of two evils"
- Don't have to fear splitting the vote
- Provides more democratic campaigns based on poll of user sentiment
- Promotes majorities since candidates have to get at least 50% of the vote or are progressively eliminated
- No need for primaries, increases viability of grassroots campaigns
RANKED CHOICE VOTING - ISSUES

- Model Applicability - How would this apply to abstract votes?
- Computational Complexity – NP-Hard (applied to hundreds of millions of votes?)
- Spatial Complexity – What if topics are interrelated, not independently exponentially growing space
- Human Factors – Do you have to rank all? What is the difference between 4th and 5th place?
- Model Applicability – How would this apply to abstract votes?

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