

AMS Assignment: Strategic Voting



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Introduction

In **honest voting** the outcome follows from the true voting preferences expressed by all voters.

Strategic voting means that at least one of the involved voters supports an alternative (possible outcome, candidate) other than her/his sincere (true) preference in order to achieve a voting outcome that is more desirable (in terms of voter happiness level) for this voter than the outcome that would result from non-strategic (honest) voting.

Strategic Voting: Types

Strategic voting aims at resulting in the change (increase or decrease) of the overall score of at least one alternative. (NOTE: “aims at” !)

Different types:

- *Compromising* – ranking an alternative insincerely higher than another
- *Burying* – ranking an alternative insincerely lower than another
- *Bullet voting* – voting for just one alternative, despite having the option to vote for several
- *Push-over* (only in round-based voting) – ranking an “easy to beat” alternative insincerely higher than another in the first round(s) in order to increase the chance to win of the true preference in the final round
→ We do only consider single-round voting

Voting Schemes

- **Plurality voting** (voting for one)

$\{1, 0, \dots, 0\}$ (length m , m = number of alternatives)

- **Voting for two**

$\{1, 1, 0, \dots, 0\}$

- **Anti-plurality voting**

$\{1, 1, \dots, 1, 0\}$

- **Borda voting**

$\{m - 1, m - 2, \dots, 1, 0\}$

Example 1 – (Anti-)Plurality Voting

Voting situation: Consider preference matrix below

(5 voters, and 4 alternatives A, B, C and D)

	1st Voter	2nd Voter	3rd Voter	4th Voter	5th Voter
1st Preference	C	B	C	B	B
2nd Preference	A	D	D	D	C
3rd Preference	D	C	A	A	D
4th Preference	B	A	B	C	A

Plurality voting: B wins

Antiplurality voting: D wins (A:3, B:3, C:4, D:5)

Our convention: tie of votes is resolved lexicographically

(„A before B before C before ...“)

Example 2 – Borda and Strategic Voting

Voting situation: Consider preference matrix below

(5 voters, and 4 alternatives A, B, C and D), and assume Borda voting is used.

	1st Voter	2nd Voter	3rd Voter	4th Voter	5th Voter
1st Preference	C	B	C	B	B
2nd Preference	A	D	D	D	C
3rd Preference	D	C	A	C	D
4th Preference	B	A	B	A	A

Question: Are there possibilities for strategic voting?

Example 2 (cont.)

First, check how the „true“ voting outcome looks like:

	1st Voter	2nd Voter	3rd Voter	4th Voter	5th Voter	Outcome
1st Preference	C	B	C	B	B	C:10
2nd Preference	A	D	D	D	C	B:9
3rd Preference	D	C	A	C	D	D:8
4th Preference	B	A	B	A	A	A:3

Next, check whether any voter (V) is unhappy about this outcome → V2, V4, V5

Let's first focus on V5. What can she do to be „happier“?

Example 2 (cont.)

If **V5** would *compromise* **C** in favor of **A**:

	1st Voter	2nd Voter	3rd Voter	4th Voter	5th Voter	Outcome
1st Preference	C	B	C	B	B	B:9
2nd Preference	A	D	D	D	A	C:8
3rd Preference	D	C	A	C	D	D:8
4th Preference	B	A	B	A	C	A:5

- **Note:** **V2** and **V4** together could have achieved the same result (by making **C** their least preferred alternative).

-- Borda: „My scheme is only intended for honest men!“

Voter collusion makes things even more complex (and even more interesting:)

Example 2 (cont.)

Carefully considering the resulting voting situation:

	1st Voter	2nd Voter	3rd Voter	4th Voter	5th Voter	Outcome
1st Preference	C	B	C	B	B	B:9
2nd Preference	A	D	D	D	A	C:8
3rd Preference	D	C	A	C	D	D:8
4th Preference	B	A	B	A	C	A:5

„Strategic voting in response to strategic voting“?

- Now **V1** and **V3** are „unhappy“ (as they prefer winner **B** the least)
- **V1** (or **V1** and **V3**) can make **D** win (with 10 (or 11) points)
- In response to this, **V2** and/or **V4** may think about *burying D* ...

Thus ... In a Nutshell

- **Strategic voting highly depends on what the agents know!**

In the above example, what does each of the voters need to know in order to be able to decide (rationally) whether she has an incentive to vote strategically?

- **Voter collusion and „counter-strategic voting“ increases complexity considerably**
- Limiting possibilities of strategic voting is done by design of voting mechanisms (“mechanism design”)

Important theoretical result: Gibbard theorem (1978) shows that, if there are more than two voting alternatives, the only system which eliminates strategic voting is dictatorship.

Goal

Design and implement a software agent called “Tactical Voting Analyst” (TVA) that analyzes the happiness levels and the risk of strategic voting for

- different voting schemes and
- different voting situations (voter-preference matrices).

Output delivered by TVA

TVA should analyze voting-scheme&situation constellations and generate as output:

- Non-strategic voting outcome
- Individual and overall voter happiness levels
- Strategic voting options for each voter
- Overall risk of strategic voting

Basic TVA vs. Advanced TVAs

Complexity-reducing Simplifications:

1. TVA only analyses single-voter manipulations (no voter collusion)
 2. TVA does not deal with the issue of counter-strategic voting
 3. TVA has perfect information about the true preferences of voters
 4. TVA only considers single tactical votes (no concurrent tactical voting)
- A TVA that is based on these four simplifications is called **Basic TVA** or **BTVA**
 - A TVA that drops any of these simplifications is called **Advanced TVA** or **ATVA**
 - Four variants of an ATVA: **ATVA-x** where x is the limitation this ATVA drops.
 - Good news: We do **not** consider ATVAs that eliminate more than one simplification.

Report

You find all relevant information about the report (including e.g. structure, content, length, etc.) in two documents available on Canvas:

- Detailed description of this lab assignment
(“Strategic_Voting_Description_2024-25.pdf”)
- Description of the lab task (report) assessment
(„Lab_Task_Assessment_2024-25.pdf“)

How to start?

- Get in touch with your group members.
- Read the detailed lab task description.
- Work on your lab task without delay.
 - Follow the timeline (see lab task description).
 - Stick to the mandatory report structure.
 - Continuously decide on task distribution within your group.
- If any of you experiences any problem within your group of which you think it will impact your group grade, let me know as soon as possible in person or by email.
 - Free riders

Questions?