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 results in the change (increase or decrease) of the overall score of at least one alternative.

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

Voting Schemes

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

$$\{1, 0, \ldots, 0\} \quad (\text{length } m, m = \text{number of alternatives})$$

- **Voting for two**

$$\{1, 1, 0, \ldots, 0\}$$

- **Anti-plurality voting**

$$\{1, 1, \ldots, 1, 0\}$$

- **Borda voting**

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

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** <u>together</u> 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 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

- Overall risk of strategic voting

Basic vs. Advanced TVA

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)

5. TVA only considers single-round voting schemes (no two- or multi-round voting schemes)

A TVA based on these simplifying assumptions is called a **Basic TVA**.

A TVA that drops these assumptions (at least partially), is called an **Advanced TVA**.

Note: In the report to be delivered, considerations on the above simplifications are expected, no matter whether your group implements an Advanced TVA.

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_v2.pdf")

- Description of the lab task (report) assessment ("Lab_Task_Assessment_v2.pdf")

How to start?

- Read the detailed lab task description. Understand the task.

- Form groups of 6 members.

- Start with your lab work without any delay.

Questions?