# Preference Aggregation by Voting: Algorithmics and Complexity

## Präferenzaggregation durch Wählen: Algorithmik und Komplexität

Pingo

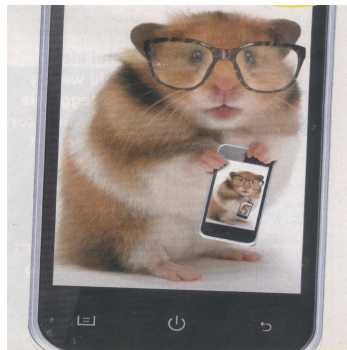Wintersemester 2020/2021

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# Website

https://pingo.coactum.de/

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## Question 1

Which of the following assertions is/are true for the following
preference profile?

$$
\begin{array}{cccc}
A & D & C & B \\
C & D & B & A \\
C & D & B & A \\
B & D & A & C \\
A & C & D & B \\
A & C & B & D
\end{array}
$$

- A  It shows the Condorcet paradox.
- B  It shows the Borda paradox.
- C  If Borda is used, it shows the winner-turns-loser paradox.
- D  It shows that plurality fails the reversal symmetry criterion.

## Question 2

Are there two candidates who are clones of each other in this election?

$$
\begin{array}{cccc}
A & D & C & B \\
C & D & B & A \\
C & D & B & A \\
B & D & A & C \\
A & C & D & B \\
A & C & B & D
\end{array}
$$

A Yes: *A* and *C*.

B Yes: *C* and *D*.

C Yes: *B* and *D*.

D No.

## Question 3

Which candidate is a maximin winner?

$$
\begin{array}{cccc}
A & D & C & B \\
C & D & B & A \\
C & D & B & A \\
B & D & A & C \\
A & C & D & B \\
A & C & B & D
\end{array}
$$

A *A*

B *B*

C *C*

D *D*

## Question 4

Which candidate is an STV winner? Ties are broken lexicographically:
$A > B > C > D$.

$$\begin{array}{cccc} A & D & C & B \\ C & D & B & A \\ C & D & B & A \\ B & D & A & C \\ A & C & D & B \\ A & C & B & D \end{array}$$

A *A*

B *B*

C *C*

D *D*

## Question 5

Can a single voter manipulate the election to prevent that *A* is an STV winner? Ties are broken lexicographically: $A > B > C > D$.

| | | | |
|---|---|---|---|
| A | D | C | B |
| C | D | B | A |
| C | D | B | A |
| B | D | A | C |
| A | C | D | B |
| A | C | B | D |

A Yes, the first voter.

B Yes, the third voter.

C Yes, the fourth voter.

D No, none of them.

## Question 6

Can a single voter manipulate the election to prevent that *A* is an STV winner? Ties are broken reverse-lexicographically: $D > C > B > A$.

$$
\begin{array}{cccc}
A & D & C & B \\
C & D & B & A \\
C & D & B & A \\
B & D & A & C \\
A & C & D & B \\
A & C & B & D
\end{array}
$$

A Yes, the first voter.

B Yes, the third voter.

C Yes, the fourth voter.

D No, none of them.

## Question 7

Can a single voter manipulate the election to prevent that *A* is a
maximin winner?

$$
\begin{array}{cccc}
A & D & C & B \\
C & D & B & A \\
C & D & B & A \\
B & D & A & C \\
A & C & D & B \\
A & C & B & D
\end{array}
$$

- A Yes, the first voter.
- B Yes, the third voter.
- C Yes, the fourth voter.
- D No, none of them.

## Question 8

Can the unique plurality winner *A* be dethroned with destructive control
by run-off partition of candidates in the TP model?

$$
\begin{array}{cccc}
A & D & C & B \\
C & D & B & A \\
C & D & B & A \\
B & D & A & C \\
A & C & D & B \\
A & C & B & D
\end{array}
$$

A  Yes, with the partition $C_1 = \{A, B\}$ and $C_2 = \{C, D\}$.

B  Yes, with the partition $C_1 = \{A, C\}$ and $C_2 = \{B, D\}$.

C  Yes, with the partition $C_1 = \{A, D\}$ and $C_2 = \{B, C\}$.

D  No, with none of them.

## Question 9

Can the unique plurality winner *A* be dethroned with destructive control
by run-off partition of candidates in the TE model?

$$
\begin{array}{cccc}
A & D & C & B \\
C & D & B & A \\
C & D & B & A \\
B & D & A & C \\
A & C & D & B \\
A & C & B & D
\end{array}
$$

A  Yes, with the partition $C_1 = \{A, B\}$ and $C_2 = \{C, D\}$.

B  Yes, with the partition $C_1 = \{A, C\}$ and $C_2 = \{B, D\}$.

C  Yes, with the partition $C_1 = \{A, D\}$ and $C_2 = \{B, C\}$.

D  No, with none of them.

# Question 10

Suppose your exam grades are determined by voting according to the following preferences:

| Christian: | 3 | 2 | 5 | 4 | 1 |
|---|---|---|---|---|---|
| Joanna: | 3 | 1 | 5 | 4 | 2 |
| Tessa: | 3 | 1 | 4 | 2 | 5 |
| Marc: | 1 | 4 | 5 | 3 | 2 |
| Jörg: | 1 | 2 | 4 | 5 | 3 |

# Question 10

Suppose your exam grades are determined by voting according to the following preferences:

| Christian: | 3 | 2 | 5 | 4 | 1 |
|---|---|---|---|---|---|
| Joanna: | 3 | 1 | 5 | 4 | 2 |
| Tessa: | 3 | 1 | 4 | 2 | 5 |
| Marc: | 1 | 4 | 5 | 3 | 2 |
| Jörg: | 1 | 2 | 4 | 5 | 3 |

Which voting system would you use?

- A Plurality
- B Borda
- C Condorcet
- D Veto