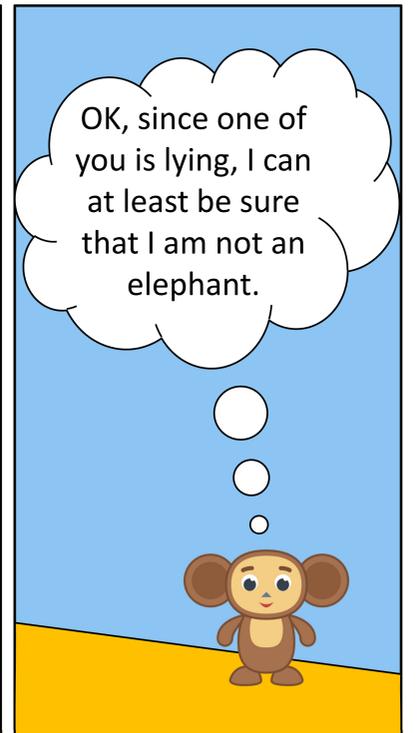
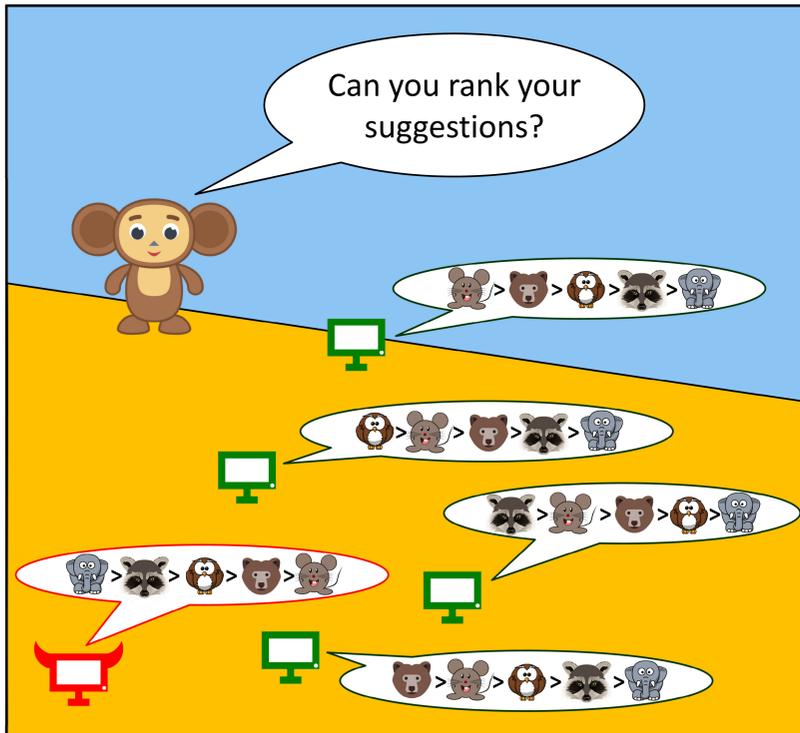
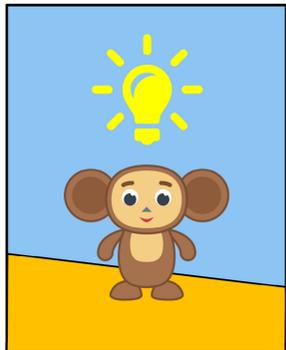
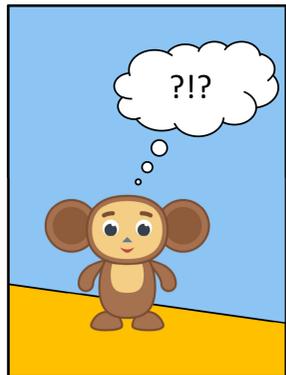
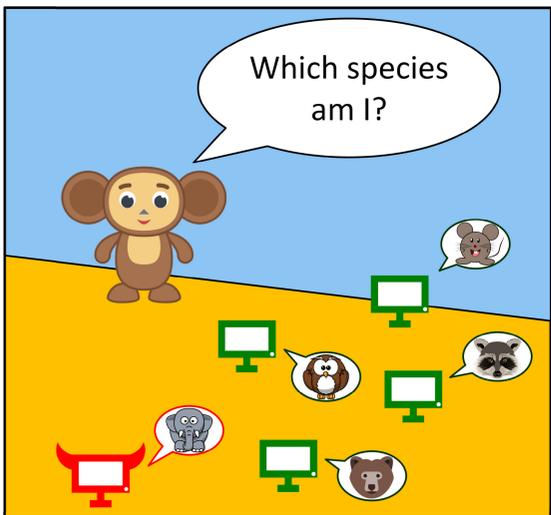


Byzantine Preferential Voting

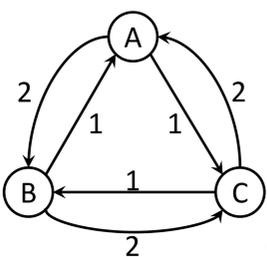
Cheburashka is trying to find out which species he is and asks his friends. But one of his friends is Byzantine and constantly gives mean answers.



Insights into Voting Theory

Terminology

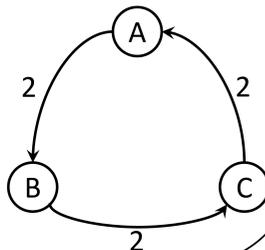
Tournament graph:



Preference profile:

	V_1	V_2	V_3
1.	A	B	C
2.	B	C	A
3.	C	A	B

Majority graph:



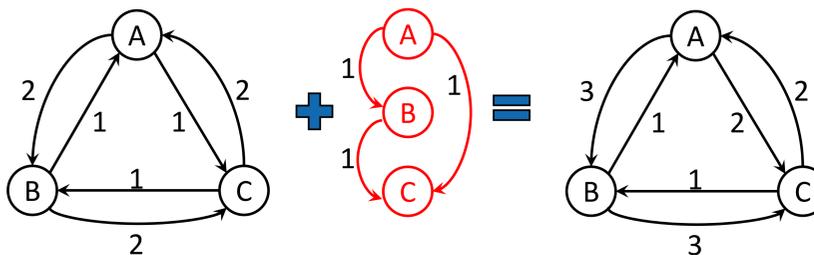
The resulting majority graph forms a so called **Condorcet cycle**

How Powerful are Byzantine Nodes in Preference Profiles?

	V_1	V_2	V_3	V_4
1.	A	B	C	A
2.	B	C	A	B
3.	C	A	B	C

Byzantine nodes can manipulate the vote by...

- redirecting majority preferences
- breaking ties in Condorcet cycles



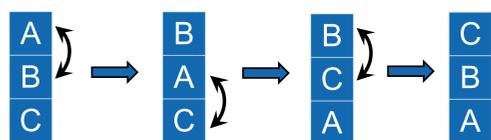
Byzantine are restricted to adding...

- a transitive directed graph
- a graph which satisfies the triangle inequality on directed edges

Agreement on the Kemeny Median

What is a Kemeny Median?

Kendall's tau distance between two rankings is the minimum number of pairwise swaps to get from one ranking to the other. The distance from $A > B > C$ to $C > B > A$ is 3:



The **Kemeny Median** is a ranking that minimizes the Kendall's tau distance to a preference profile:

	V_1	V_2	V_3
1.	A	B	A
2.	B	A	C
3.	C	C	B

→

A
B
C

Indistinguishable Views for the Kemeny Median

