Byzantine Preferential Voting

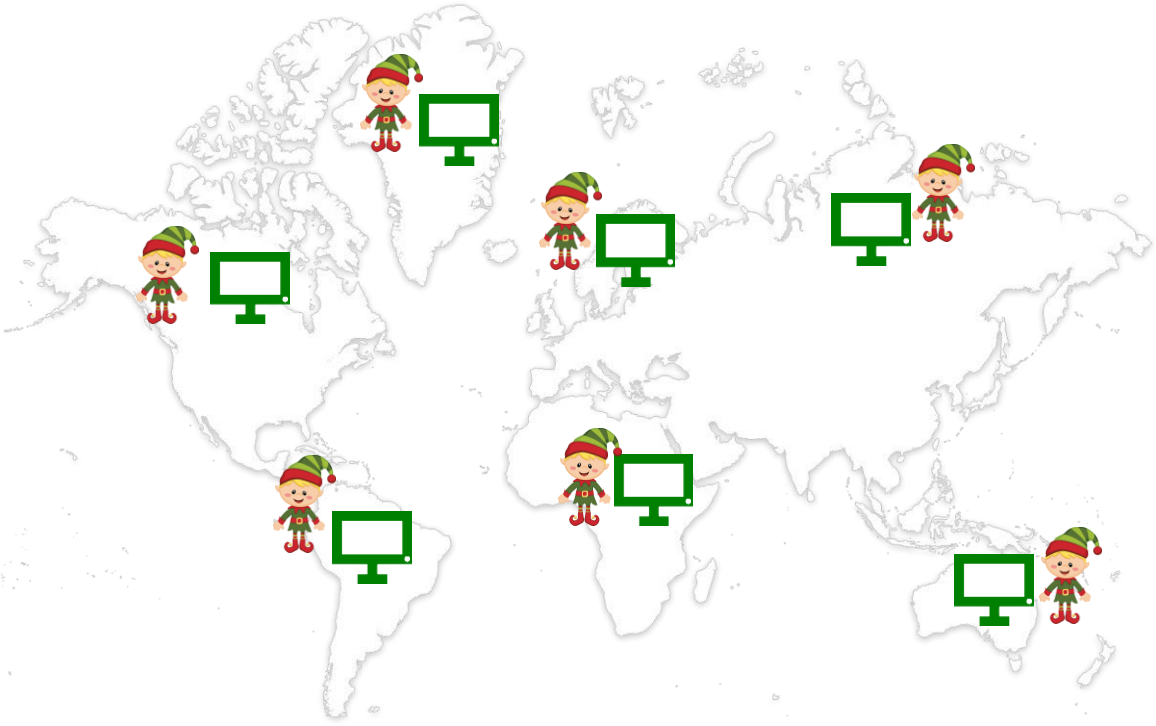
Darya Melnyk, Yuyi Wang, Roger Wattenhofer

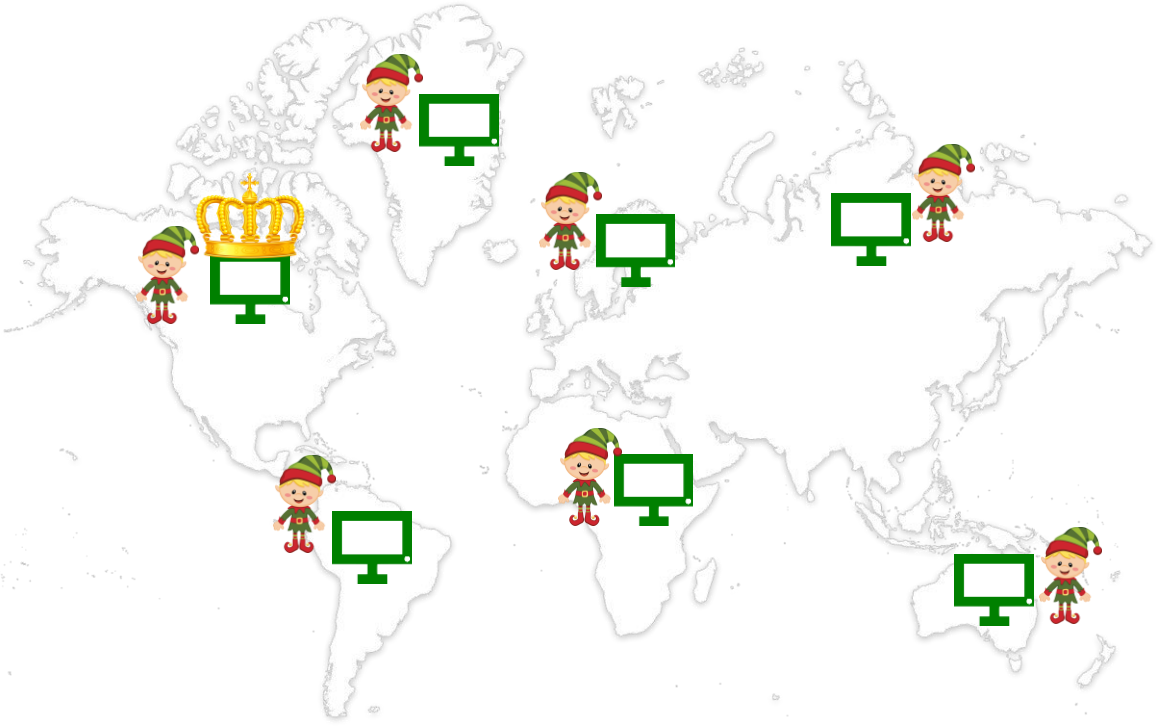
ETH Zurich – Distributed Computing Group

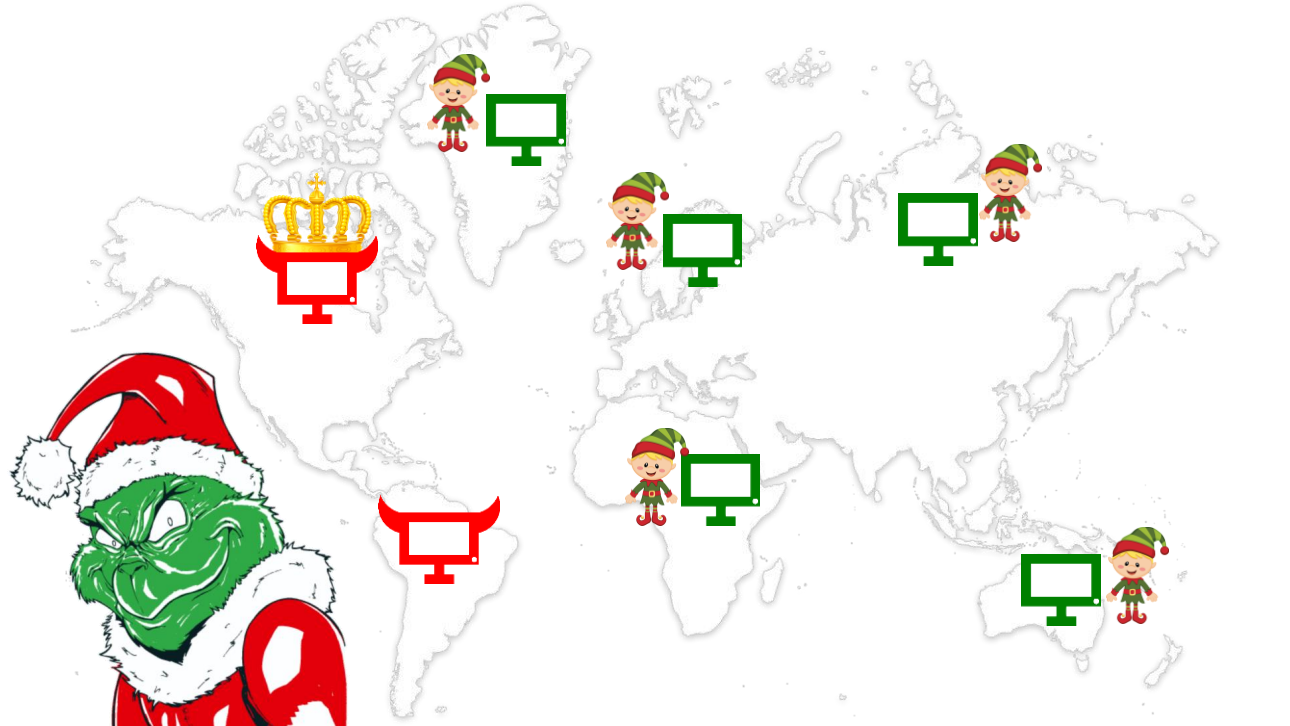
Wishlist for Christmas

1. 
2. 
3. 

Help from Elfs



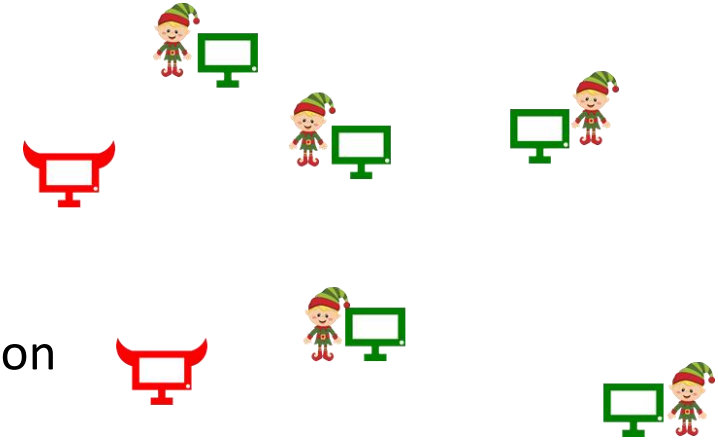




Synchronous Communication

One round:

- broadcast input
- receive input from neighbors
- do local computation

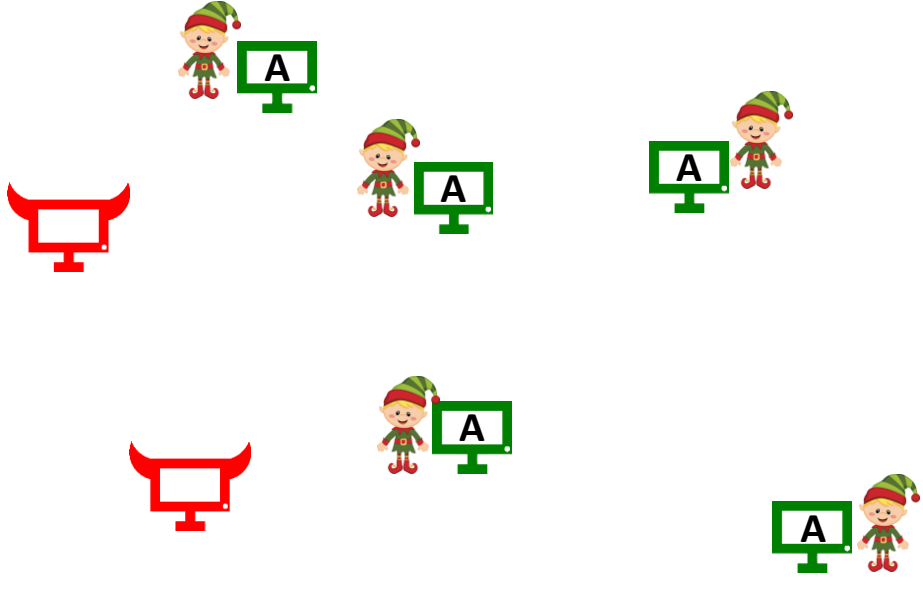


While the Grinch...

- lies about inputs
- pretends to have different inputs
- knows all other rankings
- knows the protocol
- is unpredictable

Synchronous Byzantine Agreement

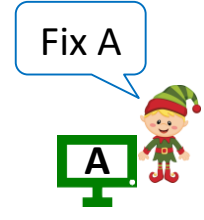
Agreement, Termination, Validity



Agreement, Termination, Validity

t < n/3 Byzantines

King-Algorithm



- pick t+1 kings
- check validity

King-Algorithm

King round:

- adapt input

King-Algorithm

King round:

- adapt input

Rankings vs. Top Alternatives

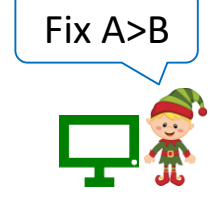
				
1.	**A**	**B**	**A**	**C**
2.	B	A	C	B
3.	C	C	B	A

Pareto-Validity

				
1.	**A**	B	**A**	C
2.	B	**A**	**C**	B
3.	**C**	**C**	B	A

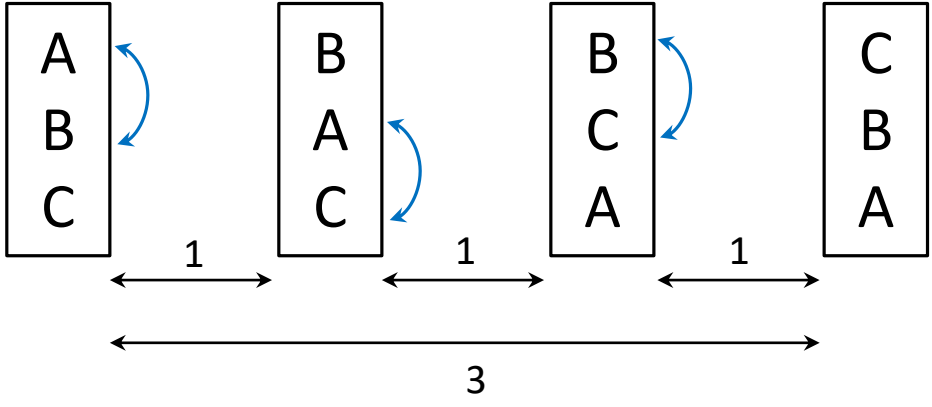
King-Algorithm

- pick t+1 kings
- check validity

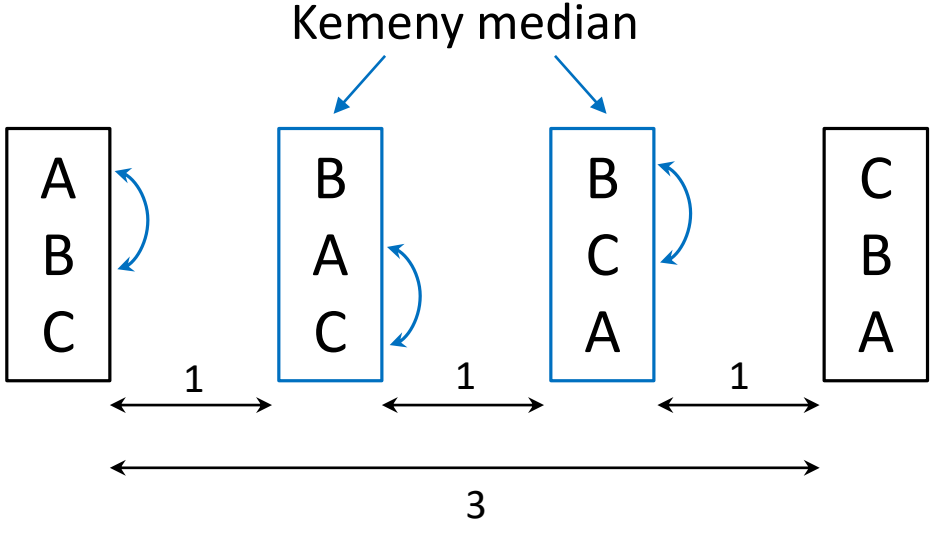


Better: Kemeny Median

Kendall tau Distance



Kendall tau Distance



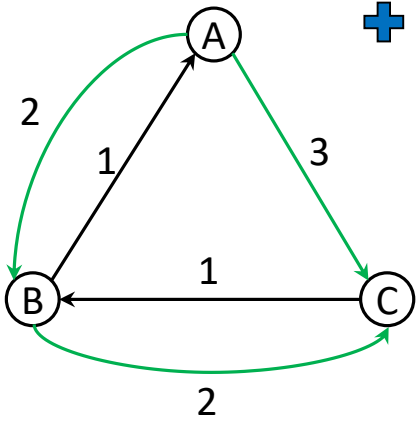
				
1.	A	B	A	C
2.	B	A	C	B
3.	C	C	B	A

A
B
C

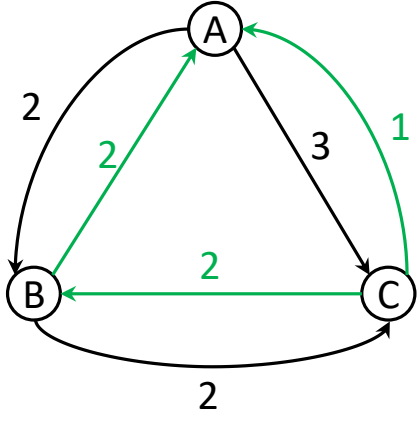
1.	A	B	A	C
2.	B	A	C	B
3.	C	C	B	A

A
B
C

B
A
C
,
A
B
C
,
A
C
B

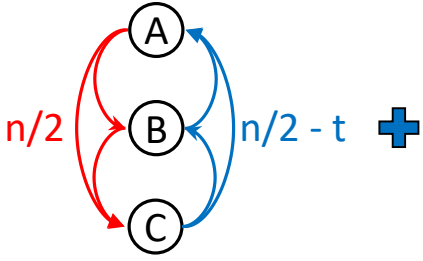


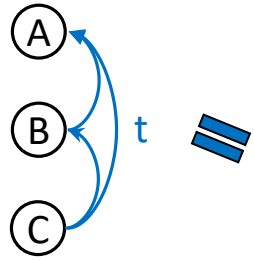
C
B
A

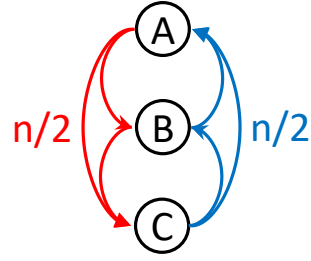


Best Possible Approximation of the Kemeny-Median

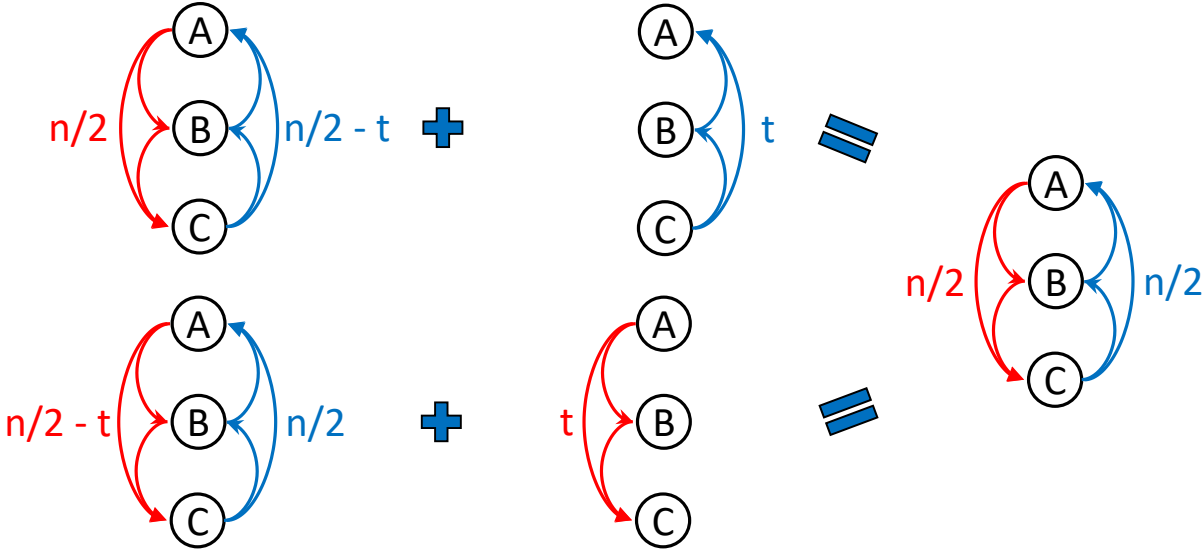
Binary Rankings



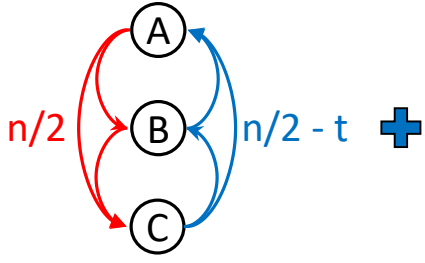


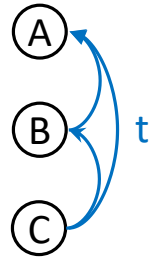


Binary Rankings

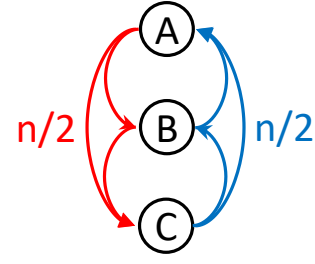


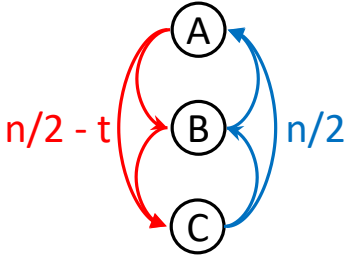
Binary Rankings

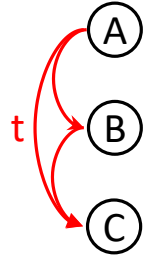




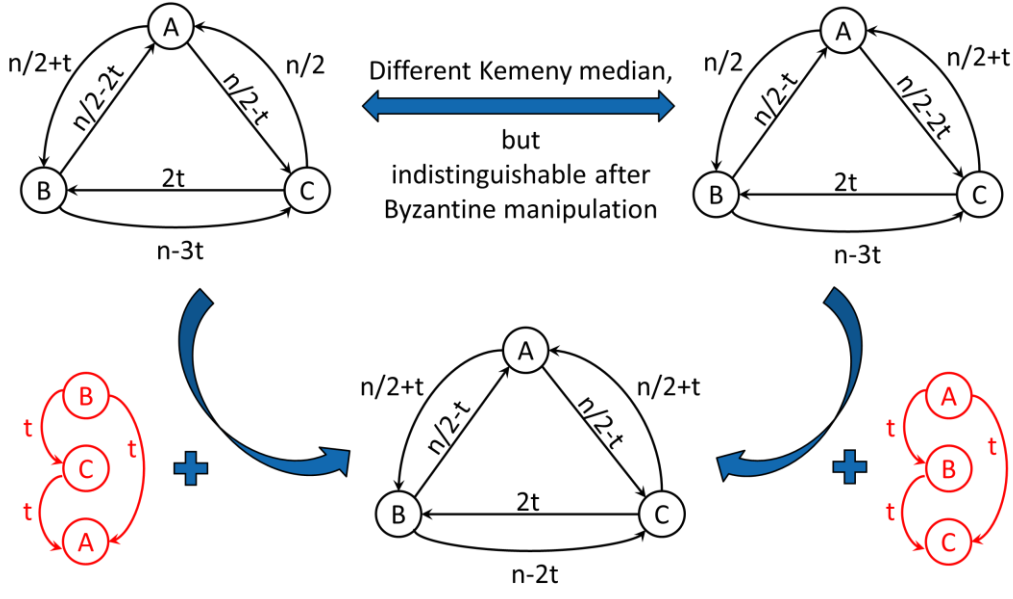
$$\frac{n/2}{n/2 - t} < 3$$







Non-Binary Rankings



Algorithm for Kemeny-Median

- Broadcast own ranking
- Choose Kemeny Median locally
- Apply King algorithm with Pareto-Validity

Byzantine Preferential Voting

- Other voting rules
  - e.g. Scoring rules

- Alternative communication models
  - Asynchronous model
  - graphs

Thank You!

Questions & Comments?

Thanks to my co-authors
Yuyi Wang, Roger Wattenhofer