

# Social Choice

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# Simple Voting Example

Assume there are 7 agents with following preferences:

- 3 agents:  $a > b > c$
- 2 agents:  $b > c > a$
- 2 agents:  $c > a > b$

Which of the candidates is selected if we use different voting protocols:

- plurality
- Borda
- pairwise elimination with ordering: a)  $(a, b, c)$ , b)  $(b, c, a)$ , c)  $(c, a, b)$

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Assume that we want to include a fourth candidate  $d$  into the profiles. Is there a modification of the current preference profiles such that  $c$  can be the winner under Borda voting rule?

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How the situation changes if we use Borda voting protocol?

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For example, Kemeny voting rule corresponds to maximal-likelihood estimation principle – we are seeking for a model (truth), for which it is the highest probability that the evidence (gathered votes) is as observed.

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# alternatives # manipulators	unweighted votes, constructive manipulation			weighted votes,					
			constructive	destructive					
	1	$\geq 2$	2	3	4	$\geq 5$	2	3	$\geq 4$
plurality	P	P	P	P	P	P	P	P	P
plurality with runoff	P	P	P	NP-c	NP-c	NP-c	P	NP-c	NP-c
veto	P	P	P	NP-c	NP-c	NP-c	P	P	P
cup	P	P	P	P	P	P	P	P	P
Copeland	P	P	P	P	NP-c	NP-c	P	P	P
Borda	P	NP-c	P	NP-c	NP-c	NP-c	P	P	P
Nanson	NP-c	NP-c	P	P	NP-c	NP-c	P	P	NP-c
Baldwin	NP-c	NP-c	P	NP-c	NP-c	NP-c	P	NP-c	NP-c
Black	P	NP-c	P	NP-c	NP-c	NP-c	P	P	P
STV	NP-c	NP-c	P	NP-c	NP-c	NP-c	P	NP-c	NP-c
maximin	P	NP-c	P	P	NP-c	NP-c	P	P	P
Bucklin	P	P	P	NP-c	NP-c	NP-c	P	P	P
fallback	P	P	P	P	P	P	P	P	P
ranked pairs	NP-c	NP-c	P	P	P	NP-c	P	P	?
Schulze	P	P	P	P	P	P	P	P	P

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Design an algorithm for manipulating Borda rule.



# Games and Social Choice

Design an algorithm for manipulating Borda rule.

Design an algorithm for manipulating STV.