

1. Complete the Borda Method on the preference schedule below. Is there anything that bothers you about the winner?

points		21	19
3	1st	A	B
2	2nd	B	C
1	3rd	C	A

Borda Count

$$A: 21(3) + 19(1) = 82$$

$$B: 21(2) + 19(3) = 99$$

$$C: 21(1) + 19(2) = 59$$

highest sum

So B wins using a Borda count.

However, the number of voters is: $21 + 19 = 40$.

So candidate A has a majority of the vote!

Majority Criterion

A candidate who receives a majority of 1st place votes should win the election!

2. (Example 11) Below is a preference schedule (left) and the results from all one-to-one matchups (right).

	5	5	6	4	matchup	A vs. B	A vs. C	A vs. D	B vs. C	B vs. D	C vs. D
1st	D	A	C	B	tally	A : 10	A : 14	A : 5	B : 4	B : 15	C : 11
2nd	A	C	B	D		B : 10	C : 6	D : 15	C : 16	D : 5	D : 9
3rd	C	B	D	A	winner	tie	A	D	C	B	C
4th	B	D	A	C							

Copeland's tally: $A: 1 + \frac{1}{2} = \frac{3}{2}$, $B: 1 + \frac{1}{2} = \frac{3}{2}$, $C: 2$, $D: 1$

C wins under Copeland's Method.

Suppose candidate D was not there?

	5	5	6	4
1st	A	A	C	B
2nd	A	C	B	D
3rd	C	B	D	A
4th	B	D	A	C

A vs B 10 to 10 tie

A vs C 14 to 6 A wins

B vs C 4 to 16 C wins

A wins!

Copeland

$$A = \frac{1}{2} + 1$$

$$B = \frac{1}{2}$$

$$C = 1$$

Independence of irrelevant alternatives

- If you eliminate a non-winning candidate from the ballot it shouldn't change the outcome of the election, or
- If candidate X is preferred over candidate Y, that shouldn't change just because candidate Z is included

3. Recap of Fairness Conditions

Condition	Pass	Fail
IIA		Copeland, Borda, IRV, Plurality
Majority	IRV, Copeland, Plurality	Borda
Monotonicity	Copeland, Plurality, Borda	IRV
Condorcet	Copeland*	Plurality, IRV, Borda

(Wikipedia has a great chart — see Borda Count article)

Arrow's Impossibility Theorem

You can't have a voting method that satisfies all the fairness conditions simultaneously!

4. Approval Voting

	30	15	10	10
Anchorage	X	X		
Bettles	X		X	X
Chevak		X		X

Voters vote for all the choices they approve of!

Count the total # of approvals:

X = approve

□ = disapprove

$$A = 30 + 15 = 45$$

$$B = 30 + 10 + 10 = 50 \leftarrow \text{winner}$$

$$C = 15 + 10 = 25$$

* Vulnerable to insincere voting!

If the 30 voters in column 1 only vote for A (because they prefer A to B) then they will guarantee A wins (even though they in reality are also ok with² B)