

Instructions: Show all work. Use exact answers unless otherwise directed to round.

1. The table below shows the ballots cast for an election of a small club. Reorganize the preference ballots into a preference table.

Voter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1 st	B	A	E	B	A	B	B	E	C	E	A	B	D	C	B	A	E	B	E	C	D	B	E
2 nd	A	C	C	A	C	A	A	C	B	C	C	A	B	B	A	C	C	A	C	B	B	A	C
3 rd	E	D	D	E	D	E	E	D	D	D	D	E	C	D	E	D	D	E	D	D	C	E	D
4 th	D	B	B	D	B	D	D	B	A	B	B	D	A	A	D	B	B	D	B	A	A	D	B
5 th	C	E	A	C	E	C	C	A	B	A	E	C	E	B	C	E	A	C	A	B	E	C	A

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#	8	4	6	3	2
1 st	B	A	E	C	D
2 nd	A	C	C	B	B
3 rd	E	D	D	D	C
4 th	D	B	B	B	A
5 th	C	E	A	A	B

2. For the preference schedule shown below, find the winner of the election by the indicated method.

	18	12	10	9	4	2
Allen	Evert	Davis	Baker	Childs	Childs	
Baker	Childs	Evert	Davis	Evert	Davis	
Childs	Baker	Childs	Childs	Baker	Baker	
Davis	Davis	Baker	Evert	Davis	Evert	
Evert	Allen	Allen	Allen	Allen	Allen	

a. By Borda Count

$A: 18 \times 5 + 12 \times 1 + 10 \times 1 + 9 \times 1 + 4 \times 1 + 2 \times 1 = 127$
 $B: 18 \times 4 + 12 \times 3 + 10 \times 2 + 9 \times 3 + 4 \times 3 + 2 \times 3 = 191$ *Boris*
 $C: 18 \times 3 + 12 \times 4 + 10 \times 3 + 9 \times 3 + 4 \times 5 + 2 \times 5 = 189$
 $D: 18 \times 2 + 12 \times 2 + 10 \times 5 + 9 \times 4 + 4 \times 2 + 2 \times 4 = 162$
 $E: 18 \times 1 + 12 \times 5 + 10 \times 4 + 9 \times 2 + 4 \times 4 + 2 \times 2 = 156$

b. By Plurality with Elimination

Rnd 1	Rnd 2	Rnd 3	Rnd 4
A: 18	A: 18	A: 18	D: 39 ← D wins
B: 9	B: 9	D: 21	E: 26
C: 6	D: 12	E: 26	
D: 10	E: 16		
E: 12			

3. Describe the circumstances needed to check the Monotonicity Fairness criterion. What voting methods can violate it?

The monotonicity criterion says that if votes change strategically to give a candidate a better position (e.g., more first place votes) then the candidate should not perform worse.

To test this criterion we must have two vote counts: one before the change and one after. a candidate should get more votes but perform worse in the new count.

Plurality with Elimination (Instant Run-off Voting) can violate this condition.