

# Math of Elections #4

## Plurality with Elimination Method

### Definition

The **plurality with elimination method** (or **instant run-off voting**) works as follows. Check if there is a *majority candidate*—if so, they win; if not, remove the candidate(s) with the least first place votes and shift the remaining candidates up to fill the gaps. Repeat: if there is a majority candidate they win; if not, again remove the candidate(s) with the least first place votes. Repeat until there is a majority candidate.

### Exercise

There is an election with 4 candidates: Alejandro (A), Baobao (B), Corrina (C), and Destiney (D). Let's find the winner using the *plurality with elimination method*.

Ranking	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot
1st	A	A	A	A	B	B	B	B	B
2nd	B	C	C	D	A	C	C	C	C
3rd	C	B	D	C	C	A	A	A	D
4th	D	D	B	B	D	D	D	D	A
Ranking	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot
1st	B	C	C	C	D	D	D	D	D
2nd	D	A	D	D	A	B	C	C	C
3rd	C	D	A	A	C	C	A	A	A
4th	A	B	B	B	B	A	B	B	B

- **Round 1.** Show there is *not* a majority candidate. Who received the least amount of first place votes? Cross them off the ballots.
- **Round 2.** Imagine shifting the candidates up on the ballots to fill the gaps left by the one who was eliminated in Round 1. Show there still is *not* a majority candidate. Who received the least amount of first place votes? Cross them off the ballots.
- **Round 3.** Again imagine shifting the candidates up to fill the gaps. Show that there is now a majority candidate. Who is it? They are the winner.

## Exercise

Back to the Club Election Example. The preference schedule is below. We saw Candy wins using the Plurality method, and Emma wins using a Borda count. Determine the winner using plurality with elimination. How many rounds did it take to determine the winner?

Number of Voters	14	10	8	4	1
1st	C	L	N	E	L
2nd	E	E	L	N	N
3rd	L	N	E	L	E
4th	N	C	C	C	C

## Exercise

This election has many candidates: Alejandro (A), Baobao (B), Corrina (C), Destiney (D), Ernie (E), Frankie (F)

Ranking	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot
1st	A	A	A	A	A	A	B	B	B
2nd	F	F	F	F	E	E	C	D	D
3rd	E	E	E	E	F	F	D	C	C
4th	C	C	C	D	D	D	E	E	E
5th	D	D	D	C	C	C	F	F	F
6th	B	B	B	B	B	B	A	A	A
Ranking	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot	Ballot
1st	B	C	C	C	D	D	E	E	F
2nd	E	B	B	D	B	C	C	D	E
3rd	C	D	D	B	C	E	F	B	A
4th	D	E	E	E	E	B	A	F	C
5th	F	A	F	F	F	A	B	C	D
6th	A	F	A	A	A	F	D	A	B

1. Who would win using (basic) plurality? What percent of the total first-place votes did they get?

2. Who wins using plurality with elimination. How many rounds did it take?