PREFERENCE BALLOT

A preference ballot is a ballot in which the voter ranks the choices in _____ _____.

Example

A group of friends is deciding on a movie to watch for their monthly movie night. They have three options: Action (A), Comedy (C), and Drama (D). Here are their preferences:

	Alice	Bob	Lisa	Dave	Eric	Fiona	Greg	Hannah	Ian	Jessica
1st choice	A	A	C	D	C	C	D	D	A	A
2nd choice	C	C	A	C	D	D	A	A	C	C
3rd choice	D	D	D	A	A	A	C	C	D	D

	Action (A)	Comedy (C)	Drama (D)
1st choice	4	3	3
2nd choice	3	5	2
3rd choice	3	2	5

Plurality Method

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Ties are possible, and would have to be settled through some sort of run-off vote.

	Alice	Bob	Lisa	Dave	Eric	Fiona	Greg	Hannah	Ian	Jessica
1st choice	A	A	C	D	C	C	D	D	A	A
2nd choice	C	C	A	C	D	D	A	A	C	C
3rd choice	D	D	D	A	A	A	C	C	D	D

	Action (A)	Comedy (C)	Drama (D)
1st choice	4	3	3
2nd choice	3	5	2
3rd choice	3	2	5

Action (A) won 4 out of 10 votes: It won in the plurality method but not majority

Question

In a student council election, three candidates are vying for the position of president: Alex (A), Brooke (B), and Chris (C). The voting schedule is provided below. Who wins under the plurality method?

	32	20	10	20	40
1st	A	B	C	C	A
2nd	B	C	B	A	C
3rd	C	A	A	B	B

	Alex (A)	Brooke (B)	Chris (C)
1st choice			
2nd choice			
3rd choice			

What's Wrong with Plurality?

	2	2	3	3
1st choice	A	A	O	H
2nd choice	O	H	H	A
3rd choice	H	O	A	O

Anaheim vs Orlando: 7 out of the 10 would prefer Anaheim over Orlando

Anaheim vs Hawaii: 6 out of 10 would prefer Hawaii over Anaheim

This doesn't seem right, does it? Anaheim just won the election, yet 6 out of 10 voters, 60% of them, would have preferred Hawaii!

FAIRNESS CRITERIA (Marquis de Condorcet)

The fairness criteria are statements that seem like they _____ _____.

Condorcet Criterion

If there is a choice that is preferred in every one-to-one comparison with the other choices, that choice should be the winner. We call this winner the _____ , or _____ _____ .

Question

In a potluck party, attendees are voting for their preferred dish to be included in the menu. The options are Lasagna (LA), Tacos (TA), and Sushi (SU). Here's the preference schedule:

	1	3	3	3
1st choice	LA	LA	TA	SU
2nd choice	TA	SU	LA	TA
3rd choice	SU	TA	LA	LA

Lasagna (LA) vs Tacos (TA): _____ voters prefer
Lasagna (LA) vs Sushi (SU): _____ voters prefer
Tacos (TA) vs Sushi (SU): _____ voters prefer

_____ is the Condorcet winner

Example

Let's consider a scenario where a group of friends is voting for the destination of their next vacation. The options are Paris (PA), Rome (RO), and Tokyo (TO). Here's the preference schedule:

	1	3	3	3
1st choice	PA	PA	PA	TO
2nd choice	RO	TO	RO	PA
3rd choice	TO	RO	TO	RO

Paris (PA) vs Rome (RO): __out of 10 voters prefer Paris over Rome.
Paris (PA) vs Tokyo (TO): __ out of 10 voters prefer Paris over Tokyo.
Rome (RO) vs Tokyo (TO): __ out of 10 voters prefer Rome over Tokyo.
Based on these comparisons, Paris (PA) emerges as the Condorcet winner since it is preferred over both Rome and Tokyo in head-to-head matchups.

Example

Let's consider a university student government election in a campus with a diverse student body. In this election, there are three candidates: Sarah and Mike, both representing progressive ideologies, and Emily, a conservative candidate. The preference schedule for the votes looks as follows:

	375	245	234
1st choice	Emily	Sarah	Mike
2nd choice	Sarah	Mike	Sarah
3rd choice	Mike	Emily	Emily

We can see a total of 854 voters participated in this election. Computing the percentage of first-place votes: Sarah: ___/854 = 28.7%
Mike: ___/854 = 27.4% Emily: ___/854 = 43.9%

So in this election, the progressive voters split their votes between Sarah and Mike, allowing the conservative candidate Emily to win under the plurality method with 43.9% of the vote.

Example

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However, analyzing this election closer, we see that it violates the _____ _____. Analyzing the one-to-one comparisons:Emily vs Sarah: 375 prefer Emily; 479 prefer Sarah: Sarah is preferred Emily vs Mike: 375 prefer Emily; 479 prefer Mike: Mike is preferred Sarah vs Mike: 620 prefer Sarah; 234 prefer Mike: Sarah is preferred So even though Sarah had the smallest number of first-place votes in the election, she is the Condorcet winner, being preferred in every one-to-one comparison with the other candidates.

Question

Is there a Condorcet winner in the following?

	30	20	10	40	20	30
1st choice	A	A	B	C	C	B
2nd choice	B	C	C	B	A	A
3rd choice	C	B	A	A	B	C

Candidate A vs B:
Candidate A vs C:
Candidate B vs C:

Insincere voting

Situations when there are more than one candidate that share somewhat similar points of view, can lead to insincere voting. Insincere voting is when a person casts a ballot _____

_____

_____.

Example of insincere voting

Imagine a fictional election for the Student Council President at a university. There are three candidates: Alice, Bob, and Claudia. Alice and Bob are both popular candidates and have similar platforms, while Claudia is less well-known and has different views.

A group of students strongly supports Alice but realizes that if they split their votes between Alice and Bob, Claudia might win.
To prevent Claudia from winning, some of Alice's supporters decide to strategically vote for Bob instead, even though they prefer Alice, to consolidate support behind one candidate. Similarly, some of Bob's supporters may also vote for Alice instead of Bob to ensure that Claudia doesn't win.

Instant Runoff Voting

_____ (IRV), also called Plurality with Elimination, is a modification of the plurality method that attempts to address the issue of _____. In IRV, voting is done with preference ballots, and a preference schedule is generated. The choice with the least first-place votes is then eliminated from the election, and any votes for that candidate are redistributed to the voters' next choice. This continues until a choice has a majority (over 50%).
(IRV can violate the Condercet Criterion)

Example of Instant Runoff Voting

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

There are a total of 22 voters. If this was a plurality election, B (with ___out of 22) of first choice would win. So no one has a majority (12). Thus A is eliminated as A has no first place votes.

Example of Instant Runoff Voting

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

We next eliminate C as C only has 2 first choice votes.
And the 2 first votes for C are distributed to D as D are these two voters' second choice.

Example of Instant Runoff Voting

	5	2	4	6	1	4
1st choice	B	D	B	D	B	E
2nd choice	D	B	D	E	E	D
3rd choice	E	E	E	B	D	B

	9	2	6	1	4
1st choice	B	D	D	B	E
2nd choice	D	B	E	E	D
3rd choice	E	E	B	D	B

Example of Instant Runoff Voting

	9	2	6	1	4
1st choice	B	D	D	B	E
2nd choice	D	B	E	E	D
3rd choice	E	E	B	D	B

We next eliminate E as it has 4 first choice votes

	9	2	6	1	4
1st choice	B	D	D	B	E
2nd choice	D	B			D
3rd choice			B	D	B

Example of Instant Runoff Voting

	9	2	6	1	4
1st choice	B	D	D	B	D
2nd choice	D	B	B	D	B

	10	12
1st choice	B	D
2nd choice	D	B

Thus D wins

Question

Number of voters	3	10	5	1	13	8	22
1st choice	W	W	C	C	D	X	W
2nd choice	X	C	W	X	X	C	D
3rd choice	C	D	X	D	W	D	C
4th choice	D	X	D	W	C	W	X

How many voters voted in this election?

How many first place votes are needed for a majority?

Which candidate/choice had the most first-place votes?

Which candidate/choice has the least first-place votes?

Which candidate/choice had the most last-place votes?

Which candidate/choice has the least last-place votes?

Question

Number of voters	8	13	12	7	12	7
1st choice	B	C	A	A	B	D
2nd choice	A	A	D	B	C	C
3rd choice	C	D	B	D	D	B
4th choice	D	B	C	C	A	A

Find the winner of this election under the plurality method.

Question

If there are 3 candidates in an election with a total of 25 votes, what is the minimum number of first-place votes a candidate could win with under the Plurality method?