

Instant Runoff Voting (IRV):

process of eliminating candidates with fewest 1<sup>st</sup> place votes one at a time until someone gets a majority

Plurality-With-Elimination-Method:

another name for IRV

- 1) Count 1<sup>st</sup> place votes. If no majority - eliminate candidate w/ fewest 1<sup>st</sup> place votes.
- 2) Cross out and redo preference schedule of elimination. Repeat.
- 3) Repeat until a majority of 1<sup>st</sup> place votes go to one candidate.

Monotonicity Criterion:

If candidate X is a winner of an election, in a reelection, if the only changes are favorable to X, then X should remain a winner.

84 voters are asked to rank four brands of cereal: A, B, C, and D. The votes are summarized in the following preference table.

Number of Voters	37	22	13	12
1 <sup>st</sup> Choice	D	A	B	C
2 <sup>nd</sup> Choice	A	B	C	D
3 <sup>rd</sup> Choice	B	C	A	A
4 <sup>th</sup> Choice	C	D	D	B

1. Determine the winner using the plurality-with-elimination method.

D, with  $37 + 12 = 49$  votes

2. Suppose that before the votes are counted candidate B withdraws from the election. Find the new preference schedule for an election without candidate B.

	37	22	13	12
1 <sup>st</sup>	D	A	C	C
2 <sup>nd</sup>	A	C	A	D
3 <sup>rd</sup>	C	D	D	A

3. Use the plurality-with-elimination method to find the winner of the new election without candidate ~~A~~ B.

C - with  $22 + 25 = 47$  votes.

Three cities, Athens (A), Barcelona (B), and Calgary (C), are competing to host the Summer Olympic Games. The final decision is made by a secret vote of the 29 members of the Executive Council of the International Olympic Committee, and the winner is to be chosen using the plurality-with-elimination method.

Number of Voters	7	8	10	4
1 <sup>st</sup> Choice	A	B	C	A
2 <sup>nd</sup> Choice	B	C	A	C
3 <sup>rd</sup> Choice	C	A	B	B

4. Determine the winner using the plurality-with-elimination method.

*C, with 18 votes*

5. In the official vote everyone votes the same as in the straw poll except for the 4 voters in the last column of the table – they switch their votes and move C ahead of A in their ballots. Use the plurality-with-elimination method to find the winner of the official vote.

*B, with 15 votes*

6. Are there any fairness criterion that are violated? If so, which one(s)?

*Monotonicity Criterion*

7. An election is held among four candidates (A, B, C, and D). Each column in the following preference schedule shows the percentage of voters voting that way. Find the winner of the election under the plurality-with-elimination method.

Number of Voters	45%	20%	20%	15%
1 <sup>st</sup> Choice	D	C	B	B
2 <sup>nd</sup> Choice	A	B	A	C
3 <sup>rd</sup> Choice	B	A	D	A
4 <sup>th</sup> Choice	C	D	C	D

*B, with 55% of the vote.*