# Math of Elections #5

Plurality with Elimination Method (continued)

## Exercise

There is an election with 3 candidates: Amber (A), Brittany (B), and Chris (C). The ballots are collected separately from two districts.

*District 1*

| **Ranking** | **Ballot** | **Ballot** | **Ballot** | **Ballot** | **Ballot** | **Ballot** | **Ballot** | **Ballot** |
|---|---|---|---|---|---|---|---|---|
| *1st* | A | A | A | B | B | B | C | C |
| *2nd* | B | C | C | C | C | C | A | A |
| *3rd* | C | B | B | A | A | A | B | B |

*District 2*

| **Ranking** | **Ballot** | **Ballot** | **Ballot** | **Ballot** | **Ballot** | **Ballot** | **Ballot** |
|---|---|---|---|---|---|---|---|
| *1st* | A | A | A | B | C | C | C |
| *2nd* | B | B | C | A | A | B | B |
| *3rd* | C | C | B | C | B | A | A |

1. Who would win in **District 1** using plurality with elimination.

2. Who would win in **District 2** using plurality with elimination.

3. Who would win using plurality with elimination with **both districts combined**.

4. What happened, and why might some people call it a paradox?

# Exercise

There is an election with 3 candidates: Alejandro (A), Baobao (B), and Corrina (C). The preference schedule is below.

| **Number of Voters** | **6** | **4** | **3** | **2** | **2** |
|---|---|---|---|---|---|
| *1st* | A | C | B | B | C |
| *2nd* | B | B | A | C | A |
| *3rd* | C | A | C | A | B |

1. Determine the winner using plurality with elimination.

2. Show that this election violate Condorcet's Criterion.

3. Show that this election violates the Independence of Irrelevant Alternatives Criterion.

4. There were two voters that ranked Corrina first and Alejandro second. Suppose they changed their ballots at the last minute to help Alejandro win. Determine the new winner using plurality with elimination. Compare the result of the election before and after the two voters changed their ballots—why might voters dislike that this is possible in an election?

| **Number of Voters** | **6** | **4** | **3** | **2** | **2** |
|---|---|---|---|---|---|
| *1st* | A | C | B | B | ~~C~~ A |
| *2nd* | B | B | A | C | ~~A~~ C |
| *3rd* | C | A | C | A | B |

> We've learned about the Majority, Condorcet, and IIA criteria. Another desirable criterion for a voting method is the following; however, plurality with elimination might violate it.
>
> - The **monotonicity criterion** states: if a candidate would win, they would still win if a voter moved them higher on their preference ballot.