

| | | | |
|-----------|-----------|-----------|-----------------------------|
| <u>25</u> | <u>37</u> | <u>38</u> | |
| A | B | A | Looks like A should win. |
| B | A | C | |
| C | C | B | |

Sometimes it's hard to say:

| | | | |
|----------|----------|----------|----------------------------|
| <u>3</u> | <u>3</u> | <u>3</u> | Looks like a 3-way tie. |
| A | B | C | |
| B | C | A | |
| C | A | B | |

Consider pairs of candidates

A vs B 6 prefer A, 3 prefer B.

A vs C 6 prefer C, 3 prefer A.

B vs C 6 prefer B, 3 prefer C.

In general, they prefer A over B,
and they prefer B over C,
and they prefer C over A.

So $A > B$ & $B > C$ & $C > A$

This is nonsensical!

The Condorcet Paradox

↑
French
math/politics

Transitive if $a=b$ and $b=c$, then $a=c$
or if $a>b$ and $b>c$ then $a>c$

"The transitive property"

Individual preferences are transitive.

If I like pepperoni better than plain,
and plain better than anchovy,
then I must like pepperoni better
than anchovy.

Condorcet's Paradox

Individual preferences are transitive,

but group preferences are not always transitive.

(e.g. for a group, it's possible to have

$A > B$ and $B > C$ and $(C > A)$

Group preferences are not guaranteed to make logical sense.

Q's

- Can we create voting methods which make sense as much as possible?

- How can we judge if a voting method is working sensibly?

The Plurality System

In a plurality election, the one with the most 1st place rankings is the winner.

| | | | |
|-----------|-----------|-----------|-----------|
| <u>Ex</u> | <u>25</u> | <u>37</u> | <u>12</u> |
| | A | A | B |
| | B | C | C |
| | C | B | A |

Find the winner using plurality.

$$A : 25 + 37 = 62$$

$$B : 12$$

$$C : 0$$

A wins!

Plurality is how most political elections work.

"plurality" means more votes than anybody else.

"majority" means more than 50%.

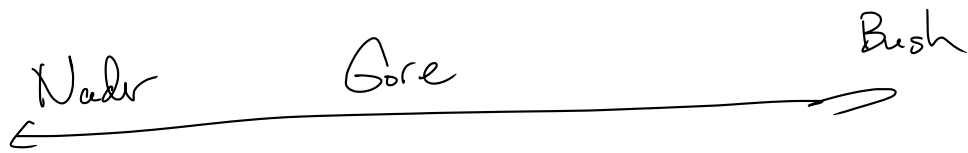
Not every plurality winner actually gets a majority.

Plurality often achieves weird results.

Bush vs Gore (2000)

↑ ↑
R D

Another candidate: Ralph Nader Green Party



votes in FL would decide it

votes in FL:

B: 2,912,790

G: 2,912,253

N: 97,421

N's were blamed for making Gore lose.

If these voters ranked their choices:

it probably would look like:

| | | |
|------------------|------------------|---------------|
| <u>2,912,790</u> | <u>2,912,253</u> | <u>97,421</u> |
| B | G | N |
| G | B | G |
| N | N | B |

↑
very generous to B.

Using plurality, B wins.

B: 2,912,790
G: 2,912,253
N: 97,421

If we compare B vs G

B is preferred by 2,912,790
G is preferred by 2,912,253 + 97,421
= 3,009,674

A majority of voters preferred G over B.
(but B won)

We should blame the system!
plurality is to blame.

Ranked Choice Voting (RCV)

aka "instant runoff"
or "transferable vote"

Used in Australia & Ireland,
and for congress in ME & AK.

Do rounds, in each round you count 1st place rankings, eliminate the one with fewest votes.

| <u>Ex</u> | <u>38</u> | <u>15</u> | <u>15</u> | <u>7</u> | <u>10</u> | <u>15</u> |
|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| A | B | B | D | C | C | |
| B | C | C | C | B | B | |
| C | A | D | B | A | D | |
| D | D | A | A | D | A | |

RCV:

Round 1

A: 38

B: 30

C: 25

D: 7

eliminate D.

(A wins plurality)

Round 2

38

15

15

7

10

15

A

B

B

C

C

C

B

C

C

B

B

B

C

A

A

A

A

A

A: 38

B: 30

C: 32

eliminate B

Round 3

| | | | | | |
|----------------|----------------|----------------|---------------|----------------|----------------|
| $\frac{38}{A}$ | $\frac{15}{C}$ | $\frac{15}{C}$ | $\frac{7}{C}$ | $\frac{10}{C}$ | $\frac{15}{C}$ |
| C | A | A | A | A | A |

A: 38

C wins!

C: 62

In AK,

Sarah Palin