

Lecture Notes: Instant Runoff Voting (a.k.a. Ranked Choice Voting)

Math F113X

Problems with plurality voting?

Plurality voting = First Past the Post Voting
The person who gets the most votes, wins!

Example : 4 candidates

Equal distribution of votes: $\frac{100\%}{4} = 25\%$

Someone could win with $25\% + 1$ vote

$\Rightarrow$ about 75% of the voters wanted someone else!

① Winner might have significantly less than a majority.

② Pressure to vote strategically * dilutes the power of 3rd party candidates

Instant Runoff Voting (IRV)

Also known as Ranked Choice Voting  winner is preferred by a majority of votes!

Method:

→ Requires a preference schedule.

① Look at all the 1st choice votes

Does someone have a majority? If yes, they win!

② Eliminate the candidate with the least # of 1st choice votes and shift those votes to those voters' 2nd choice candidates

* break ties somehow ("by lot" = coin flip in AK)

Is there a majority winner? If yes, they win!

* There's always a majority winner in a 2-candidate race!

Instant Runoff Voting (IRV)

With four candidates, how many rounds of IRV? (Max? Min?)

Min # of rounds = 1 ← Someone gets a majority in round 1

Max # of rounds = 3

(With n candidates, the max # of rounds is $n-1$)

Find the winner using IRV

# votes	3	4	2	1	1
→ 1st choice	A	B	C	C	D
2nd choice	C	C	D	B	C
3rd choice	B	D	B	A	B
4th choice	D	A	A	D	A

voters = $3 + 4 + 2 + 1 + 1 = 11$

majority $> \frac{11}{2} = 5.5$

majority means at least 6 votes

Round 3

3	4	2	1	1
C	B	C	C	C
B	C	B	B	B

B	C
4	7

← C has a majority!

C wins!

Round 1

1st choice votes

A	B	C	D
3	4	3	1

B is plurality winner!

but $4 < 6$ no majority winner!

D is eliminated.

Round 2

3	4	2	1	1
A	B	C	C	C
C	C	B	B	B
B	A	A	A	A
3	4	4		

A is eliminated

Find the winner using IRV

(Example 7)

# votes	37	22	12	29
1st choice	<u>Adams</u>	<u>Brown</u>	<u>Brown</u>	Carter
2nd choice	Brown	Carter	Adams	<u>Adams</u>
3rd choice	Carter	Adams	Carter	Brown

$$\# \text{ voters} = 37 + 22 + 12 + 29 = 100$$

$$\text{need } 51 = \frac{100}{2} + 1 \text{ for a majority}$$

$$\text{Round 1: } A = 37, B = 22 + 12 = 34, \boxed{C = 29}$$

no majority. C is eliminated

$$\text{Round 2: } A = 37 + 29 = 66 \quad B = 22 + 12 = 34$$

↑ a majority! A wins!

What can go wrong with IRV?

- Can fail to pick the Condorcet Winner (Example 6 in your text.)
- Can fail the **Monotonicity Criterion**

If voters switch their vote (if you imagine re-running the election where voters made different choices) to support the eventual winner of the election this shouldn't change the outcome of the election!

(Example 7 again)

# votes	37	22	12	29
1st choice	Adams	Brown	Brown	Carter
2nd choice	Brown	Carter	Adams	Adams
3rd choice	Carter	Adams	Carter	Brown

# votes	37	22	10	2	29
1st choice	Adams	Brown	Adams	Brown	Carter
2nd choice	Brown	Carter	Brown	Adams	Adams
3rd choice	Carter	Adams	Carter	Carter	Brown

Round 1: $A = 37 + 10 = 47$

$B = 22 + 2 = 24$

$C = 29$

B was eliminated

Round 2:

$A = 37 + 10 + 2 = 49$

$C = 22 + 29 = 51$

C wins!