

Math of Social Choice 19-2
December 1, 2017

Poll Question: What social issue most informs your vote in political elections?

Results: There were 28 voters, including five voters' ballots that had ties. Therefore, N=23 by excluding the ties and there were 20 unique ballots types.

Candidates: n=5

- L = LGBTQ+ Rights
- S = Socio-Economic Equality
- R = Race Relations
- I = Immigration
- W = Women's Rights

Ballot Report:

	LGBTQ+ Rights	Women's Rights	Race Relations	Immigration	Socio-economic Equality
1.	3	4	5	2	1
2.	5	3	1	2	4
3.	1	4	3	5	2
4.	1	5	3	2	4
5.	3	1	5	4	2
6.	5	1	2	3	4
7.	3	5	4	1	2
8.	4	2	3	5	1
9.	5	3	4	1	2
10.	2	4	3	1	5
11.	4	5	3	1	2
12.	4	2	3	5	1
13.	4	2	5	3	1
14.	4	3	2	5	1
15.	4	5	2	3	1
16.	5	5	1	2	5
17.	4	2	3	5	1
18.	2	4	3	1	5
19.	2	1	4	5	3
20.	3	5	1	2	4
21.	5	3	2	4	1
22.	1	1	1	1	1
23.	2	2	1	2	1
24.	1	1	1	1	1
25.	3	5	1	2	4
26.	5	3	1	5	2
27.	3	3	4	2	1
28.	3	1	2	4	5

Website Generated 1:1 Comparisons:

(Includes ties – refer below to official 1:1 comparisons)

	1	2	3	4	5
1. Socio-economic Equality	-	15	14	18	17
2. Race Relations	10	-	16	15	17
3. Immigration	12	10	-	13	16
4. Women's Rights	7	11	12	-	15
5. LGBTQ+ Rights	8	9	9	10	-

Website Generated Beatpath Results:

	1.	2.	3.	4.	5.
1. Socio-economic Equality	-	15	15	18	17
2. Race Relations	10	-	16	15	17
3. Immigration	12	10	-	13	16
4. Women's Rights	7	11	12	-	15
5. LGBTQ+ Rights	8	9	9	10	-

Ties:

Ballot numbers 16, 22, 23, 24, and 26 have been eliminated due to the ties that were reported.

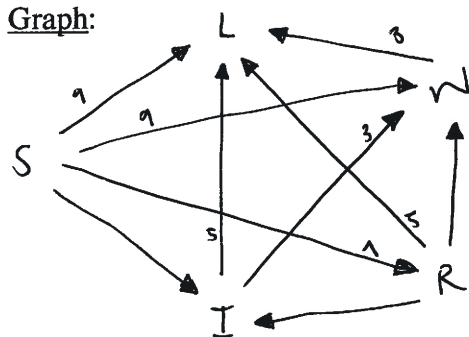
Preference Schedule:

1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
S	S	R	I	S	S	W	S	L	W	L	I	W	R	S	I	I	I	S	W	R
I	W	I	S	I	R	S	I	I	R	S	L	L	I	R	S	S	L	W	R	I
R	R	L	R	W	W	L	L	R	L	R	R	S	W	I	L	W	R	I	I	L
W	L	S	L	R	L	I	W	S	I	W	W	R	S	L	R	R	W	L	S	S
L	I	W	W	L	I	R	R	W	S	I	S	I	L	W	W	L	S	R	L	W

1:1 Comparisons:

L:W 10:13	L:S 7:16	W:S 7:16
L:R 9:14	W:R 11:12	R:I 12:11
L:I 9:14	W:I 10:13	R:S 8:15
		I:S 11:12

Graph:



Majority Candidate?: There is no majority candidate. The candidate with the most 1st place votes is S with 9 (of 23), which is not $\geq N/2$.

Smith Set:

L W R I S using sequential comparison
↑ ↑ ↑ to know that $S \in \text{Smith set}$

because S is the Condorcet candidate, beating all other candidates, then it makes up the entirety of the Smith set
 $S = \{S\}$

Runoff:

1st place votes:

L=2
W=4
R=3
I=5
S=9

23

runoff I and S
I:S 11:12
so $N = \{S\}$

Coombs Method:

last place votes:

L=5
W=6
R=3
I=6
S=3

23

eliminate W and I
L=11
R=6
S=6

23

eliminate L and runoff R and S
R:S 8:15
so $N = \{S\}$

Pairwise Comparison:

L:W	10:13	L:S	7:16	W:S	7:16
L:R	9:14	W:R	11:12	R:I	12:11
L:I	9:14	W:I	10:13	R:S	8:15
				I:S	11:12

$$\frac{N(N-1)}{2} = \frac{5(4)}{2} = 10 \text{ PW Points}$$

Condorcet Candidate?: S is the Condorcet candidate because S beat every other candidate in 1:1 comparisons.
L:S 7:16
W:S 7:16
R:S 8:15
I:S 11:12

Plurality:

1st place votes:

L=2
W=4
R=3
I=5
S=9

23

so $N = \{S\}$

Elimination: eliminate L first, then...

W=4
R=3
I=6
S=10

23

eliminate R

W=4
I=9
S=10

23

runoff I and S
I:S 11:12
so $N = \{S\}$

Beatpath:

Beatpath satisfies the Smith Criterion. Because there is only one candidate in the Smith set, it must win, so $N = \{S\} = S$. — evidence

$S \triangleright L (9 > 0)$
 $S \triangleright W (9 > 0)$
 $S \triangleright R (7 > 0)$
 $S \triangleright I (11 > 0)$

Pairwise Points:

L=0
W=1
R=3
I=2
S=4

10 PW points

so $N = \{S\}$