

Instructions: Counting the following preference ballots according the plurality method and the method of pairwise comparisons. Note any fairness criteria that have been violated.

| | | | | | | |
|------------------|---|---|---|---|---|---|
| Number of voters | 5 | 3 | 3 | 5 | 3 | 2 |
| 1st choice | N | H | B | H | F | F |
| 2nd choice | S | F | S | B | N | N |
| 3rd choice | F | B | H | N | B | B |
| 4th choice | H | N | N | F | S | H |
| 5th choice | B | S | F | S | H | S |

1.

| | | | | | |
|------------------|----|----|---|----|---|
| Number of voters | 27 | 19 | 8 | 15 | 2 |
| 1st choice | B | A | D | C | A |
| 2nd choice | D | D | C | A | C |
| 3rd choice | A | C | A | D | D |
| 4th choice | C | B | B | B | B |

2.

| | A | B | C | D | E | F |
|---------------|---|---|----|----|----|---|
| 1 # of Voters | | | 45 | 40 | 15 | |
| 2 | | | | | | |
| 3 1st choice | B | A | C | | | |
| 4 2nd choice | D | C | D | | | |
| 5 3rd choice | E | D | E | | | |
| 6 4th choice | C | E | A | | | |
| 7 5th choice | A | B | B | | | |
| 8 | | | | | | |

3.

| | | | | | |
|------------------|----|----|----|----|----|
| Number of voters | 25 | 20 | 10 | 30 | 10 |
| 1st choice | F | B | H | S | S |
| 2nd choice | S | H | F | F | H |
| 3rd choice | H | F | S | B | B |
| 4th choice | B | S | B | H | F |

4.

| | | | | | | |
|------------------|----|---|----|---|---|---|
| Number of voters | 10 | 8 | 10 | 8 | 7 | 8 |
| 1st choice | A | A | C | D | D | B |
| 2nd choice | B | D | E | C | C | E |
| 3rd choice | C | B | D | B | B | A |
| 4th choice | D | C | A | E | A | C |
| 5th choice | E | E | B | A | E | D |

5.

Math 1116 Voting Activity I Key.

1. Plurality $N=5, H=8, B=3, F=5$ H wins

Pairwise Comparisons

| | | | | | |
|-----|-----------------|---|-------|----------------|----------------------|
| N-H | 5+3+2 vs 3+3+5 | H | B-F | 3+5 vs 5+3+3+2 | F |
| N-B | 5+3+2 vs. 3+3+5 | B | B-S | 3+3+5+3+2 vs 5 | B |
| N-F | 5+3+5 vs 3+3+2 | N | F-S | 3+5+3+2 vs 5+3 | F |
| N-S | 5+3+5+3+2 vs. 3 | N | | | |
| H-B | 5+3+5 vs 3+3+2 | H | N-II | S-I | |
| H-F | 3+3+5 vs 5+3+2 | H | H-III | ← H wins | |
| H-S | 3+5+2 vs. 5+3+3 | S | B-II | | |
| | | | F-II | | <u>no violations</u> |

2. Plurality $A = 19+2=21, B=27, C=15, D=8$

B wins

Pairwise Comparisons

| | | | | | | | |
|-----|------------------|---|-----|------------------|---|-------|----------|
| A-B | 19+8+15 vs. 27 | A | B-C | 27 vs. 19+8+15+2 | C | A-III | ← A wins |
| A-C | 27+19+2 vs. 8+15 | A | B-D | 27 vs. 19+8+15+2 | D | B-I | |
| A-D | 19+15+2 vs. 27+8 | A | C-D | 15+2 vs. 27+19+8 | D | C-I | |
| | | | | | | D-II | |

Plurality Method has a Condorcet criterion violation

3. Plurality $A = 40, B = 45, C = 15, D = 0, E = 0$ B wins

Pairwise Comparisons

| | | | | | | | |
|-----|--------------|---|-----|--------------|---|-------|----------|
| A-B | 40+15 vs. 45 | A | B-D | 45 vs. 40+15 | D | A-I | |
| A-C | 40 vs. 45+15 | C | B-E | 45 vs. 40+15 | E | B- | |
| A-D | 40 vs 45+15 | D | C-D | 40+15 vs. 45 | C | C-III | ← C wins |
| A-E | 40 vs 45+15 | E | C-E | 40+15 vs. 45 | C | D-II | |
| B-C | 45 vs. 40+15 | C | D-E | 40+15 vs. 45 | D | E-II | |

Condorcet criterion violation in plurality method.

4. Plurality $F=25, B=20, H=10, S=40$ S wins

Pairwise

| | | | | | | | |
|-----|--------------------|---|-----|--------------------|---|-------|----------------------------------|
| F-B | 25+10+30 vs. 20+10 | F | B-H | 20+30 vs. 25+10+10 | B | F-III | ← F wins |
| F-H | 25+30 vs. 20+10+10 | F | B-S | 20 vs. 25+10+30+10 | S | B-I | Condorcet violation in plurality |
| F-S | 25+20+10 vs. 30+10 | F | H-S | 20+10 vs. 25+30+10 | S | H- | |
| | | | | | | S-II | |

S. Plurality

$$A = 10 + 8 = 18$$

$$B = 8$$

$$C = 10$$

$$D = 8 + 7 = 15$$

(2)

A wins

Pairwise Comparison

A-B $10 + 8 + 10$ vs. $8 + 7 + 8$ A

A-C $10 + 8 + 8$ vs. $10 + 8 + 7$ A

A-D $10 + 8 + 8$ vs. $10 + 8 + 7$ A

A-E $10 + 8 + 7$ vs. $10 + 8 + 8$ E

B-C $10 + 8 + 8$ vs. $10 + 8 + 7$ B

B-D $10 + 8$ vs. $8 + 10 + 8 + 7$ D A-III ← wins

B-E $10 + 8 + 8 + 7 + 8$ vs. 10 B B-II

C-D $10 + 10 + 8$ vs. $8 + 8 + 7$ C C-II

C-E $10 + 8 + 10 + 8 + 7$ vs. 8 C D-III

D-E $10 + 8 + 8 + 7$ vs. $10 + 8$ D E-I

no violation