

**Instructions:** Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each problem.

1. Convert the following preference ballots into a preference schedule (table). (8 points)

<b>Ballot</b> 1st C 2nd A 3rd D 4th B <b>①</b>	<b>Ballot</b> 1st B 2nd C 3rd D 4th A <b>②</b>	<b>Ballot</b> 1st A 2nd D 3rd B 4th C <b>③</b>	<b>Ballot</b> 1st C 2nd A 3rd D 4th B <b>①</b>	<b>Ballot</b> 1st B 2nd C 3rd D 4th A <b>②</b>
<b>Ballot</b> 1st A 2nd D 3rd B 4th C <b>③</b>	<b>Ballot</b> 1st A 2nd C 3rd D 4th B <b>④</b>	<b>Ballot</b> 1st B 2nd C 3rd D 4th A <b>②</b>	<b>Ballot</b> 1st B 2nd C 3rd D 4th A <b>②</b>	<b>Ballot</b> 1st C 2nd A 3rd D 4th B <b>①</b>
<b>Ballot</b> 1st A 2nd D 3rd D 4th B <b>④</b>	<b>Ballot</b> 1st A 2nd D 3rd B 4th C <b>③</b>	<b>Ballot</b> 1st C 2nd A 3rd D 4th B <b>①</b>	<b>Ballot</b> 1st B 2nd C 3rd D 4th A <b>②</b>	<b>Ballot</b> 1st A 2nd D 3rd B 4th C <b>③</b>
				<b>Ballot</b> 1st C 2nd A 3rd D 4th B <b>①</b>

Voters	6	5	4	2
1st	C	B	A	A
2nd	A	C	D	C
3rd	D	D	B	D
4th	B	A	C	B

2. Use the following preference schedule to find the winner of the election using the indicated method.

<b>Number of voters</b>	<b>14</b>	<b>10</b>	<b>8</b>	<b>7</b>	<b>4</b>
Andersson	2	3	1	5	3
Broderick	1	1	2	3	2
Clapton	4	5	5	2	4
Dutkiewicz	5	2	4	1	5
Eklundh	3	4	3	4	1

a. Plurality Method (6 points)

A: 8      C: 0      E: 4      B wins  
 B: 24      D: 7

b. Borda Count Method (10 points)

$A: 14 \times 4 + 10 \times 3 + 8 \times 5 + 7 \times 1 + 4 \times 3 = 145$   
 $B: 14 \times 5 + 10 \times 5 + 8 \times 4 + 7 \times 3 + 4 \times 3 = 185 \leftarrow \text{winner}$   
 $C: 14 \times 2 + 10 \times 1 + 8 \times 1 + 7 \times 4 + 4 \times 1 = 78$   
 $D: 14 \times 1 + 10 \times 4 + 8 \times 2 + 7 \times 5 + 4 \times 1 = 79$   
 $E: 14 \times 3 + 10 \times 2 + 8 \times 3 + 7 \times 2 + 4 \times 5 = 120$

c. Plurality with Elimination Method (8 points)

Rnd 1  
 A: 8  
 B: 24  
 C: 0  
 E: 4  
 D: 7

B wins  
 no need for additional  
 rounds since B already  
 has a majority  
 $48/2 = 24 \rightarrow 22$  majority  
 24 > 22

d. Method of Pairwise Comparisons (9 points)

$A \vee B$  14+10  
 $A \vee C$  14+10  
 $A \vee D$  14+8 10  
 $A \vee E$  14+10  
 $B \vee C$  24  
 $B \vee D$  24  
 $B \vee E$  24  
 $C \vee D$  14 10+8+7  
 $C \vee E$  14+10  
 $D \vee E$  10 14+8

A B C D E  
 III III 1 II

B wins

e. Is there a majority criterion violation? Why or why not? (5 points)

no. B has a majority, but B won all elections

f. Is there a Condorcet criterion violation? Why or why not? (5 points)

no, since B wins pairwise comparison and all other methods

3. What is the difference between a majority and a plurality? (4 points)

a majority is 50% + 1 vote

a plurality is the most votes obtained.

they are only the same when there are 2 candidates

4. Explain Arrow's Impossibility Theorem. How is it similar to Young's Impossibility Theorem? (7 points)

This theorem says that no voting system is always completely fair. All methods will violate some fairness criterion at least some of the time

5. A County Elections Board needs to allocate 50 "floating" pollworkers to various communities during an election to troubleshoot problems that arise. The communities and their registered voting populations are noted in the table below. Use the tables to apportion the pollworkers to the various communities.

Town	Population	Standard Quota	Lower Quota	Upper Quota	Extra Seat?	Final Apportionment
Oakcastle	3182	9.084	9	10		9
Southaven	2509	7.163	7	8		7
Whitefaire	4011	11.451	11	12		11
Easthill	3703	10.572	10	11	+1	11
Eriden	4109	11.731	11	12	+1	12
Standard Divisor =		350.28	48			50

17514  
total  
pop

a. By Hamilton's Method (10 points)