

1. # voters

	7	5	4	3	2
1 <sup>st</sup> (4pt)	A	B	B	<del>C</del>	<del>D</del>
2 <sup>nd</sup> (3pt)	B	<del>D</del>	<del>C</del>	<del>D</del>	A
3 <sup>rd</sup> (2pt)	<del>C</del>	<del>C</del>	A	B	<del>C</del>
4 <sup>th</sup> (1pt)	<del>D</del>	A	<del>D</del>	A	B

a) A has 7, B has 9, C ~~has~~ has 3, D has 2  
 $\Rightarrow$  Ranking is B, A, C, D

b) A gets  $7(4) + 5(1) + 4(2) + 3(1) + 2(3) = 50 \text{ pt}$   
 B gets  $7(3) + 5(4) + 4(4) + 3(2) + 2(1) = \underline{65 \text{ pt}}$   
 C gets  $7(2) + 5(2) + 4(3) + 3(4) + 2(2) = 52 \text{ pt}$   
 D gets  $7(1) + 5(3) + 4(1) + 3(3) + 2(4) = 43 \text{ pt}$

$\Rightarrow$  Ranking is B, C, A, D

c) There are  $7+5+4+3+2 = 21$  votes. Need 11 to win.

	Round 0		Round 1		Round 2
A	<u>7</u>	+2 =	<u>9</u>	+3 =	<u>12</u>
B	<u>9</u>		<u>3</u>		<u>X</u>
C	<u>3</u>		<u>X</u>		<u>X</u>
D	<u>2</u>				
	$\xrightarrow{\text{Elim D}}$		$\xrightarrow{\text{Elim C}}$		

$\Rightarrow$  Ranking is B, A, C, D

d) A vs B : 9 vs 12  
 A vs C : 9 vs 12  
A vs D : 11 vs 10

B vs C : 16 vs 5  
B vs D : 16 vs 5  
C vs D : 14 vs 7

wins	A	B	C	D
	I	III	II	

$\Rightarrow$  Ranking: B, C, A, D

2. a) B, A, D, C  
 b) B, A, C, D  
 c) B, A, D, C  
 d) B, A, C, D

3.

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

11 total votes  
 → need 6 to win

	Round 0		Round 1
	1st votes	last votes	
A	4	4	X
B	3	4	3
C	2	1	6
D	2	0	2

2+4 = 6

Elim A!

C wins

4. a) Every voter prefers X to Y so X gets more points than Y from every individual voter, and thus more total points.
- b) Every pairwise comparison that Y wins, X will also win (i.e. Y wins vs Z implies X also wins vs Z). Also, X beats Y in a pairwise comparison. Therefore X has at least 1 more win than Y and is ranked higher in the outcome.