

Problem set 2, due Tuesday, March 4th, 2014

<u>Example 1</u>	<u>Example 2</u>	<u>Example 3</u>	<u>Example 4</u>
20: A>B>C	20: A>B>C	25: A>B>C	49: A>B>C
25: A>C>B	35: A>C>B	10: B>A>C	48: B>A>C
35: B>C>A	25: B>C>A	25: B>C>A	3: C>B>A
20: C>B>A	20: C>B>A	40: C>A>B	

For all examples, assume sincere voting unless otherwise stated.

1-1. Positional rules. Find the plurality, Borda, and anti-plurality winners in example 1.

1-2. Elimination rules. Find the Hare, Baldwin, and Coombs winners in example 1.

1-3. Condorcet analysis. Construct a tournament diagram and pairwise matrix from example 1. Use this to find the Smith set, and the minimax, ranked pairs, beatpath, Condorcet-Hare, and Black winners.

1-4. Strategy in plurality. Given example 1 and the plurality rule, is there a group of voters who can gain through strategy? Explain.

2-1. Positional rules. Find the plurality, Borda, and anti-plurality winners in example 2.

2-2. Elimination rules. Find the Hare, Baldwin, and Coombs winners in example 2.

2-3. Condorcet analysis. Construct a tournament diagram and pairwise matrix from example 2. Use this to find the Smith set, and the minimax, ranked pairs, beatpath, Condorcet-Hare, and Black winners.

3-1. Positional rules. Find the plurality, Borda, and anti-plurality winners in example 3.

3-2. Elimination rules. Find the Hare, Baldwin, and Coombs winners in example 3.

3-3. Condorcet analysis. Construct a tournament diagram and pairwise matrix from example 3. Use this to find the Smith set, and the minimax, ranked pairs, beatpath, Condorcet-Hare, and Black winners.

3-4. Strategy. Explain why most voting rules will be vulnerable to strategy in example 3.

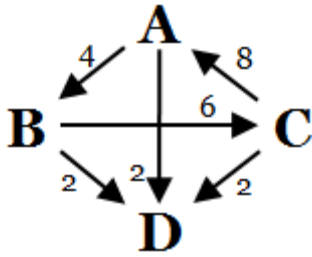
4-1. Positional rules. Find the plurality, Borda, and anti-plurality winners in example 4.

4-2. Elimination rules. Find the Hare, Baldwin, and Coombs winners in example 4.

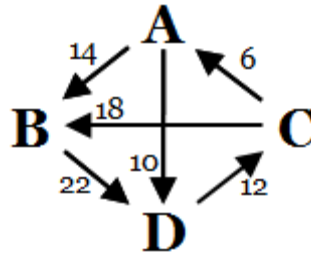
4-3. Condorcet analysis. Construct a tournament diagram and pairwise matrix from example 4. Use this to find the Smith set, and the minimax, ranked pairs, beatpath, Condorcet-Hare, and Black winners.

4-4. Strategy in Borda, minimax, Hare. Given example 4 and the Borda rule, is there a group of voters who can gain through strategy? How about minimax? How about Hare? Explain.

Example 5



Example 6



In examples 5 and 6, each arrow in the tournament diagrams points from the winner to the loser of each pairwise comparison. The attendant number represents the margin of each pairwise victory.

5. Condorcet rule comparison. Find the Smith set and the minimax, beatpath, and ranked pairs winners in example 5.

6. Condorcet rule comparison. Find the Smith set and the minimax, beatpath, and ranked pairs winners in example 6.

Example 7

#	A	B	C
40	100	60	0
30	40	100	0
30	20	0	100

Example 8

#	A	B	C
45	100	0	0
30	0	100	80
25	0	80	100

For examples 7 and 8, let the entries in the # column represent a number of voters, let the entries in the A column represent the utilities of these voters for candidate A, and so on. Assume that a utility of 50 or more implies that a voter sincerely ‘approves of’ a candidate.

7. Approval vs range. Find the approval voting and range voting winners in example 7.

8. Strategy in approval and range. Find the approval voting and range voting winners given sincere voting in example 8, and explain why the outcome is hard to predict if voters behave strategically.

9. Majority criterion. Give an example in which Borda fails the majority criterion.

10. Majority and mutual majority criteria. Name two voting rules that pass the majority criterion but not the mutual majority criterion. Explain why each passes the majority criterion, and give an example in which each fails the mutual majority criterion.

11. Condorcet and Condorcet loser criteria. Name two voting rules that pass the Condorcet loser criterion but not the Condorcet criterion. Explain why each passes the Condorcet loser criterion, and give an example in which each fails the Condorcet criterion.

12. Monotonicity criterion. Give an example in which Hare fails the monotonicity criterion. Explain why Borda and minimax both pass the monotonicity criterion.

13. Arrow theorem. What does the Arrow theorem demonstrate? Give as much intuition for the result as you can.

14. Gibbard-Satterthwaite theorem. What does the Gibbard-Satterthwaite theorem demonstrate? Give as much intuition for the result as you can.

Example 15: 120 voters. 2 seats to be filled. 81 voters for party A, and 39 voters for party B

15-1. Hare quota. Find the outcome of example 15 in a party list system with the Hare quota.

15-2. Droop quota. Find the outcome of example 15 in a party list system with the Droop quota.

15-3. STV. If we have an STV system instead of a party list system, is the outcome different?

15-4. D'Hondt. Find the outcome of example 15 in a party list system using the D'Hondt method.

15-5. Sainte-Laguë. Find the outcome of example 15 in a party list system using the Sainte-Laguë method.

15-6. Block voting. Discuss the outcome of example 15 if block voting is used.

15-7. SNTV or cumulative voting. Discuss the outcome of example 15 if SNTV or cumulative voting is used.

Example 16: 1100 voters. 10 seats to be filled. 501 voters for party A, 400 for B, and 199 for C.

16-1. Hare quota. Find the outcome of example 16 in a party list system with the Hare quota.

16-2. Droop quota. Find the outcome of example 16 in a party list system with the Droop quota.

16-3. STV. If we have an STV system instead of a party list system, is the outcome different?

16-4. D'Hondt. Find the outcome of example 16 in a party list system using the D'Hondt method.

16-5. Sainte-Laguë. Find the outcome of example 16 in a party list system using the Sainte-Laguë method.

16-6. Block voting. Discuss the outcome of example 16 if block voting is used.

16-7. SNTV or cumulative voting. Discuss the outcome of example 15 if SNTV or cumulative voting is used.

Example 17

31: $A_1 > A_2 > A_3 > B_1 > B_2 > B_3$

20: $A_2 > A_1 > A_3 > B_1 > B_2 > B_3$

10: $A_3 > A_1 > A_2 > B_1 > B_2 > B_3$

20: $B_1 > B_2 > B_3 > A_1 > A_2 > A_3$

15: $B_2 > B_1 > B_3 > A_1 > A_2 > A_3$

4: $B_3 > B_1 > B_2 > A_1 > A_2 > A_3$

17. STV. Find the outcome of example 17 in an STV system with the Droop quota.

18. Party list. Explain the difference between an open party list system and a closed party list system

19. MMP and parallel. Explain the difference between a regular party list system, a mixed member proportional system, and a parallel system.

20. Proxy systems. Explain how proxy systems differ from traditional proportional representation systems.