

**Excursions - Math 11008-002 - Fall 2019 - Dr. Smithies
Practice Voting Theory Exam**

Section A - Voting Methods

Consider the Preference Schedule:

Number of Votes	10	6	5
1st Choice	<i>A</i>	<i>B</i>	<i>C</i>
2nd Choice	<i>C</i>	<i>D</i>	<i>B</i>
3rd Choice	<i>D</i>	<i>C</i>	<i>D</i>
4th Choice	<i>B</i>	<i>A</i>	<i>A</i>

- (1) How many voters participated?
- (2) How many candidates are in the election?
- (3) Who (if anyone) is the majority candidate?
- (4) Who (if anyone) is the Condorcet candidate?
- (5) What does this example prove about the relationship between a majority candidate and a Condorcet candidate?
- (6) Who wins in a head-to-head comparison of A and D?
- (7) How many points are available when this election is decided by pairwise comparisons?
- (8) Find the Borda total for A.
- (9) Who is first eliminated in plurality-with-elimination?
- (10) Who wins a head-to-head comparison of A and B?
- (11) Is the winner of the election by plurality-with-elimination the same as the winner of the a head-to-head comparison of A and B?
- (12) Suppose D is found to be ineligible to run for election. Give the preference schedule after D drops out of the election.
- (13) How many pairwise comparisons must be made in this election (after D was removed)?
- (14) Who (if anyone) is the Condorcet candidate after D is removed?
- (15) Who wins by the pairwise comparison voting method?
- (16) What is the total number of points available when the Borda voting method is used on the above 3 candidate election?

Section B - Fairness Criteria

- (1) Which of the following fairness criteria are satisfied by the voting method of plurality?
 - (a) The majority criterion.
 - (b) The Condorcet criterion.
 - (c) The monotonicity criterion.
 - (d) The independence of irrelevant alternatives.
- (2) Does every election have a majority candidate? (Y/N)

page 1 of 2

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Section B - Fairness Criteria (continued)

- (3) Suppose an election is held and C wins. Then a re-vote is held and all changes are favorable to only C. If C loses which of our 4 voting method was used and why?
- (4) Which voting method satisfies all 4 Fairness criterion?
- (5) Which Fairness criterion is violated by all 4 of the voting methods we studied?
- (6) If a voting method satisfies the Majority criterion, does the candidate with the most first place votes always win?

Section C - Ranking, Ties and Voting Theory

- (1) In an election with candidates A, B, C, D, and E and 77 voters, how many different preference ballots can be cast?
- (2) Can an election with an odd number of voters end in a tie in all four of our voting methods? (Y/N)
- (3) Can a head-to-head comparison be a tie when the number of voters is odd?
- (4) Can an election which has a majority candidate result in a tie by the Borda voting method?
- (5) Can an election with a majority candidate end in a tie by the plurality-with-elimination voting method?
- (6) Can an election with a majority candidate end in a tie by the pairwise comparison voting method?
- (7) In an election with N voters and 7 candidates, what is the total number of Borda points available?
- (8) In an election with N voters and 7 candidates, what is the highest Borda point total a candidate can get?
- (9) In an election with N voters and 7 candidates, what is the highest pairwise comparison point total a candidate can get?
- (10) Give the pairwise comparison ranking for the following preference schedule.

Number of Votes	3	2	2	1
1st Choice	<i>A</i>	<i>C</i>	<i>C</i>	<i>D</i>
2nd Choice	<i>B</i>	<i>A</i>	<i>B</i>	<i>C</i>
3rd Choice	<i>D</i>	<i>D</i>	<i>A</i>	<i>B</i>
4th Choice	<i>C</i>	<i>B</i>	<i>D</i>	<i>A</i>

- (11) Give the Plurality-with-Elimination ranking for the following preference schedule.

Number of Votes	3	2	2	2
1st Choice	<i>A</i>	<i>C</i>	<i>C</i>	<i>D</i>
2nd Choice	<i>B</i>	<i>A</i>	<i>B</i>	<i>A</i>
3rd Choice	<i>D</i>	<i>D</i>	<i>A</i>	<i>B</i>
4th Choice	<i>C</i>	<i>B</i>	<i>D</i>	<i>C</i>

- (12) Give the Plurality ranking for the above preference schedule.