Math in Modern Society
Mathematics of Voting
Extra Practice

1. There are four candidates in a local election. The preference schedule is given below.

Number of voters	**10**	**5**	**18**	**7**	**3**	**2**
First place	A	A	D	B	B	B
Second place	B	D	C	B	C	A
Third place	C	C	B	A	A	D
Fourth place	D	B	A	D	D	C

Total number of votes: _____

(a) Determine the winner of the election under each of the four methods discussed in class.

(b) In this case, which methods violate which fairness criteria?

2. Consider the election with four candidates given by the following preference schedule.

Number of voters	**7**	**4**	**2**
First choice	A	B	D
Second choice	B	D	A
Third choice	C	C	C
Fourth choice	D	A	B

(a) What is the total number of voters?

(b) How many votes are needed for the majority?

(c) Does anyone have the majority? If so, who? And under which methods does this candidate win (you should be able to answer this without applying any of the methods)?

(d) Find the Condorcet candidate in this election.

(e) Find the winner under the Borda Count method.

(f) Suppose that Candidate C drops out of the race. Who among the remaining candidates wins the election under the Borda count method?

(g) Based on your work above, which of the four fairness criteria are violated in this election? Explain. (That is, mention all four criteria and explain how there were or were not violated, under the Borda Count method.)

3. Consider the election determined by the Borda Count method, given by the following preference schedule:

Number of voters	**7**	**5**	**3**
First choice	A	B	C
Second choice	B	A	A
Third choice	C	C	B

(a) Find the winner under the Borda Count method.

(b) Does this election have a Condorcet candidate? Explain.

(c) Does this election have a majority candidate? Explain.

(d) Does this election violate the Condorcet criterion? Explain.

(e) Does this election violate the majority criterion? Explain.