## Test 1A, Math of Democracy

Dr. Adam Graham-Squire, Fall 2018

Name: _		Kly		<u></u>			
I pledge t	hat I have ne	ither given no	or received	any una	uthorized as	ssistance on	this exam
\(\frac{1}{2}\)			(signatu	(re)	<u> </u>		

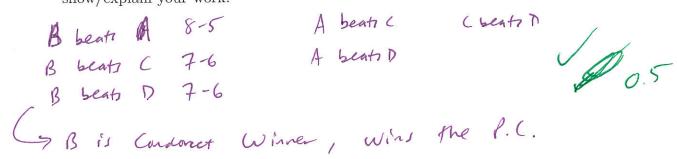
## **DIRECTIONS**

- 1. Don't panic.
- 2. Show/explain all of your work. A correct answer with insufficient work will lose points.
- 3. Read each question carefully, and make sure you answer the the question that is asked. If the question asks for an explanation, make sure you give one.
- 4. Clearly indicate your answer.
- 5. Calculators are allowed on this test, but any other technology (cell phones, computers, etc) is NOT allowed.
- 6. Make sure you sign the pledge.
- 7. Number of questions = 4. Total Points = 20.

1. (5 points) Consider the following preference schedule:

Number of voters	3	1	1	4	4
1st choice	A	Α	Α	В	D
2nd choice	В	С	D	Α	С
3rd choice	С	D	С	С	В
4th choice	D	В	В	D	A

(a) Use the Pairwise Comparison method to find the winner of the election (if two candidates are tied in a head-to-head, give each of them a half-point). Briefly show/explain your work.



(b) Now suppose the the first column of voters decided to NOT show up for the election. The preference schedule now looks like:

Number of voters	1	1	4	4
1st choice .	A	A	В	D
2nd choice	С	D	A	С
3rd choice	D	С	С	В
4th choice	В	В	D	A

Run the Pairwise Comparison election on the new preference schedule. What, if anything, does your result tell you about Pairwise Comparison and a Fairness Criterion? Explain your answer.

2. (5 points) Will the following election, under the Instant Runoff method, demonstrate a monotonicity anomaly?

Number of voters	22	8	15	17
1st choice	Α	В	В	С
2nd choice	В	A	С	A
3rd choice	С	С	A	В

to A and A why

- If so, explain what ballots would need to change, and in what way, to cause the monotonicity anomaly.
- If *not*, explain how changing votes in *any* of the columns could never cause a monotonicity anomaly.

Note: It is fine to reference the criteria for the presence of a monotonicity anomaly in a three-candidate IRV election, but for a complete answer you should actually modify the preference schedule in some way to support your conclusions.

Move 7 BAK votes to ABC, get

A got 7 more votes and lost theelector

two of the pairs and explain why the violates that particular criteria. Opposed/explanation for how the method	of voting methods and fairness criteria. Chat particular voting method either satisfic Of the two you choose, one of them must od satisfies, and the other must be a proof/expl do more than 2, I will score all of them and scores.	be a anation give
<ul> <li>Range voting and Independence</li> <li>Sequential Pairwise voting and</li> <li>Coombs Method and Monotoni</li> <li>Top-two runoff and No-show cr</li> </ul>	ce of Irrelevant Alternatives criterion  Condorcet Winner criterion  ieity criterion  will with  riterion	we seaft everyor the east-to-beard, 50 the east-to-beard, 50 the east-to-beard, and work as well, and with a well and
is soved Superately.	Removing a losing of	h candidate candidate
b/c each voter give	the sures of other coes separate points to ear adidate will still has of lose) b/c no ones	on candidate
change.  Coombs and Gono: +		
24 25 <u>B</u> 16  A B B  C C C  C C  A	D  B  C  B  C  B  C  B  C  C  C  C  C  C	with Cana
Top Lus and No-show:	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	D gove, A wins Top-tun runoff. Remon  Z B CDA though, rakes most by

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4. (5 points) (a) Of all of the voting methods we have looked at so far, which one do you think is the best? Briefly explain why it is better than the other methods.

(b) Of all of the fairness criteria we have seen so far, which one do you think is *most* important for an election to have? Explain (briefly) why that particular criteria is so

important for a fair election.

Scoring: Need to include Many different answer! Something begand just what something begand just what is on Description of Methods Best is comparison to other Methods, (a) I think Pairwise Comparison is the best by Cirkin it ancowages people to fully rank candidates, and Sit a candidate beats a 10+ of other, then They should win the effection. If it ends in a tie, reed a backup method like Boda. Boda count fails Majority, which I pulk is very important. Instant 50, (. is Runoff fails a lot of criteria (Monotoncity, etc) ble of ore the changes in depost order. Top-two and plurality don't Prost ... take enough , Horna toon into consider at too.

(5) The Condocet where criteria is my most important, b/L I think most people acknowledge that important, b/L I think most people acknowledge that it some one can beat everyone else, they schould be it some one can beat everyone else, they schould be if some one can beat everyone else, they schould be in a head-head.

The winner. Majority is also important, but if you have condocet then Mojority is guaranteed. So many methods fail IIA that it doesn't seem as worth it.

Monotonicity and No-show seem to be more estenic Monotonicity and No-show seem to be more estenic because they only seem to begin fail in strange because they only seem to begin fail in strange situations in which the election is very contested.

Extra Credit(1 point) Under any of the voting methods we have seen, is it possible to have a candidate who is not ranked first in *any* ballots, but still wins the election? If so, explain what the method is and give an example of how it could happen. If not, explain why it is NOT possible for at least 3 of the voting methods.