

Math in Action (MAT 130)

Fall 2015

Exam 1

10/7/2015

Time Limit: 60 Minutes

Name (printed): _____

Signature: _____

Section number: _____

Directions:

This test is one hour long. No phone, calculator, electronics, notes, talking to friends, etc. You may use only a pen or pencil. Absolutely no cheating!

No scrap paper! If you need some you may use the back side of this exam or ask someone who is proctoring the exam.

Read carefully. Show your work. Check your work.

Do not turn to the next page or begin the test until the professor and/or TA's say so.

Do not write below this line.

Grade Table (for teacher use only)

Question	Points	Score
1	15	
2	15	
3	20	
4	20	
5	20	
6	10	
Total:	100	

The exam is out of 100 points.

1. (15 points) Binghamton University is surveying a random group of students to determine which campus sport has the biggest following. The choices are Volleyball, Soccer and Golf.

Choice	Num Ballots			
	4	5	3	6
1st	S	V	V	G
2nd	G	G	S	S
3rd	V	S	G	V

- (a) (5 points) Determine the winner using the plurality method. Did the winner have a majority?
- (b) (5 points) Use the borda count method to rank the candidates.
- (c) (5 points) Do your results from parts (a) and (b) violate the majority criterion? Explain.

2. (15 points) The fifty states of America are voting on their favorite holiday. The choices are Independence Day, Flag Day and Thanksgiving.

Choice	Num Ballots			
	15	10	9	16
1st	F	I	T	F
2nd	T	T	I	I
3rd	I	F	F	T

- (a) (5 points) Use the pairwise comparison method to rank the candidates.
- (b) (5 points) Does the pairwise comparison method ever violate the condorcet criterion? Does your result in part (a) violate the condorcet criterion?
- (c) (5 points) Will removing any of non-winning candidates from the election in part (a) cause the independence of irrelevant alternatives criterion to be violated? Explain.

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3. (20 points) Consider the weighted voting system $[q : 10, 6, 6, 5, 4, 2, 1]$. Calculate the following:
- (a) (5 points) The total weight of the system.
- (b) (5 points) The q -values satisfying the quota restriction.
- (c) (5 points) A q -value that would be nonfunctional.
- (d) (5 points) A q -value satisfying the quota restriction that would make a voter a dictator (if none exists, write "no").

4. (20 points) Sheldon, Leonard, Howard and Raj use a voting system when deciding which movie to watch on movie night. Their weighted voting system is $[13 : 6, 5, 4, 2]$. (Sheldon has weight 6, Leonard has weight 5, Howard has weight 4 and Raj has weight 2.)

(a) (15 points) List all the coalitions and their weights; circle the winning coalitions, and underline every critical voter.

(b) (5 points) Find the power index of each person. (Leave the numbers as fractions.)

5. (20 points) The Board of Trustees of Binghamton University is trying to decide whether or not to change the school colors from green to either blue, red or purple, or if they should leave it the same. They poll a random group of students to help with their decision.

Choice	Num Ballots			
	5	2	4	4
1st	G	B	G	G
2nd	B	G	P	R
3rd	R	P	B	P
4th	P	R	R	B

- (a) (15 points) Use the plurality with elimination method to rank the candidates. Show all work.

- (b) (5 points) Assume Purple was the winning color (this may or may not have happened in part (a)). Now, several voters change their preference by ranking Purple 4th instead of 1st. As a result, several people claim the monotonicity criterion has been violated. Are they correct? Explain.

6. (10 points) True or False (Circle one, no need to explain.)

(2 points each.)

True or **False** In the weighted voting system $[8 : 7, 4, 1, 1]$, the voter with 7 votes has veto power.

True or **False** The pairwise comparison method does not violate any of the fairness criteria.

True or **False** In the weighted voting system $[7 : 7, 4, 1, 1]$, the voter with 7 votes is a dictator.

True or **False** The majority criterion is the only criterion that is satisfied by all four voting methods.

True or **False** In the weighted voting system $[q : 7, 5, 4, 1, 1]$, 9 could be a possible value of q calculated by the quota restriction.

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