Test 2

Math in action

Fall 2014

Friday, Oct 17th

Name (printed): Solutions

Signature: _____

Section number: _____

Directions:

The 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 this page until the professor and/or TA's say so.

Do not write below this line.

	Points		Points
1		5	
2			
3			
4		Total	

The exam is out of 100 points.

(30 points)

Problem 1

(10 points)

(a) The government is giving away 200 pounds of food based on the population of 5 major cities. Apportion the food using Hamilton's method.

City	Chicago	Binghamton	Denver	Austin	Boise	Total
Population	552	212	349	448	439	2000
No. of pounds: 200		Standard divisor: 10				
Exact Quota	55.2	21.2	34.9	44.8	43.9	XXXXX
Lower Quota	55	21	34	44	43	197
Frac Part	.2	.2	.9	.8	.9	XXXXX
Surplus			1	1	1	3
Total	55	21	35	45	44	200

Use the above table to answer (b) and (c); here, the government is apportioning the food by using Adams' method. (Use your above information to complete new table below.)

City	Chicago	Binghamton	Denver	Austin	Boise	Total
Population	552	212	349	448	439	2000
No. of pounds: 200		Standard divisor: 10				
Exact Quota	55.2	21.2	34.9	44.8	43.9	XXXXX
Upper Quota	56	22	35	45	44	202

(5 points)

(b) Does the first step of Adams' method apportion exactly 200 pounds of food? If not, should we increase the divisor, or should we decrease the divisor?

(5 points)

(c) Assume that your new divisor apportions 195 pounds. Should we increase the divisor, decrease it, or leave it the same?

(10 points)

(d) Round the exact quotas below according to each apportionment method. (For your convenience, some square roots have been written below this table).

Exact quota	3.46	2.50	7.44	5.48	4.44
Jefferson's method	3	2	7	5	4
Adams' method	4	3	8	6	5
Webster's method	3	3	7	5	4
Hungtington-Hill	3	3	7	6	4

$\sqrt{2\times 3}$	$\sqrt{3\times 4}$	$\sqrt{4\times 5}$	$\sqrt{5\times 6}$	$\sqrt{6\times 7}$	$\sqrt{7\times 8}$	$\sqrt{8\times 9}$
2.449	3.464	4.472	5.477	6.481	7.483	8.485

(20 points)
Problem 2
D.J., Stephanie, and Michelle have received some gifts from their father to be divided equally. Carry out the division of the objects using the sealed bid methods.

	D.J.	Stephanie	Michelle
Pony	$1200	$900	$900
Doll house	$200	$250	$150
Jewelry	$700	$650	$150
Total Value	2100	1800	1200
Fair Share	700	600	400
Allocated	1900	250	0
Difference	-1200	350	400
Surplus= 450			
Surplus Share	150	150	150

1200
-750
450

Summary

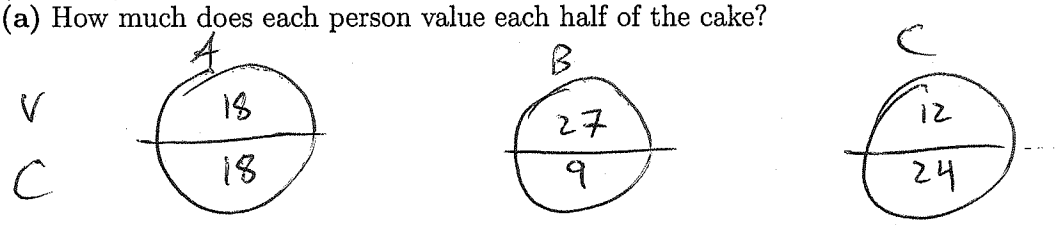
Item(s)	pony, jewelry	doll house	—
Item's Value	2100	250	0
Cash	-1050	500	550
Net Total	1050	750	550

(20 points)

Problem 3 Three friends, Angie, Beth, and Carl are trying to split a cake worth 36 dollars. One half of the cake is vanilla, the other half is chocolate. Angie likes vanilla and chocolate the same, Beth likes vanilla three times more than she likes chocolate, and Carl likes chocolate twice as much as he likes vanilla.

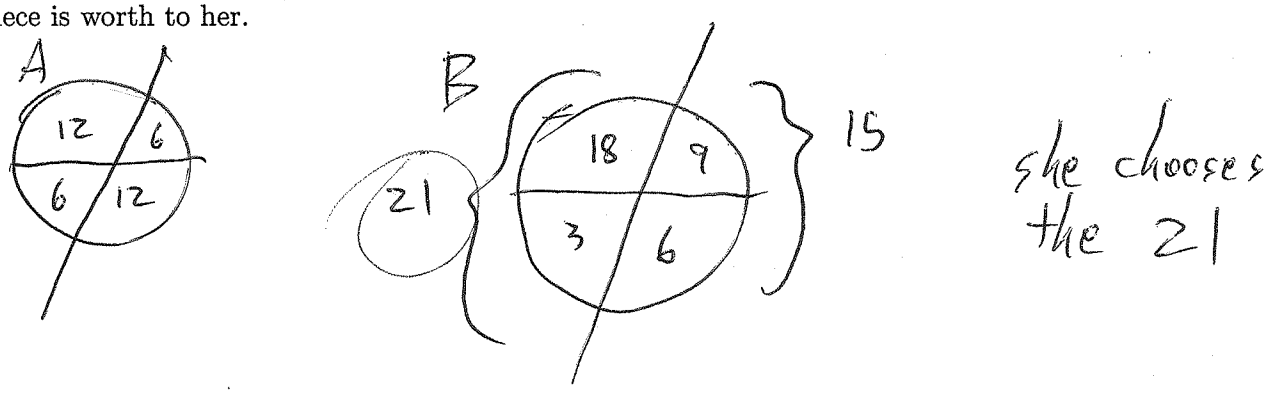
(3 points)

(a) How much does each person value each half of the cake?



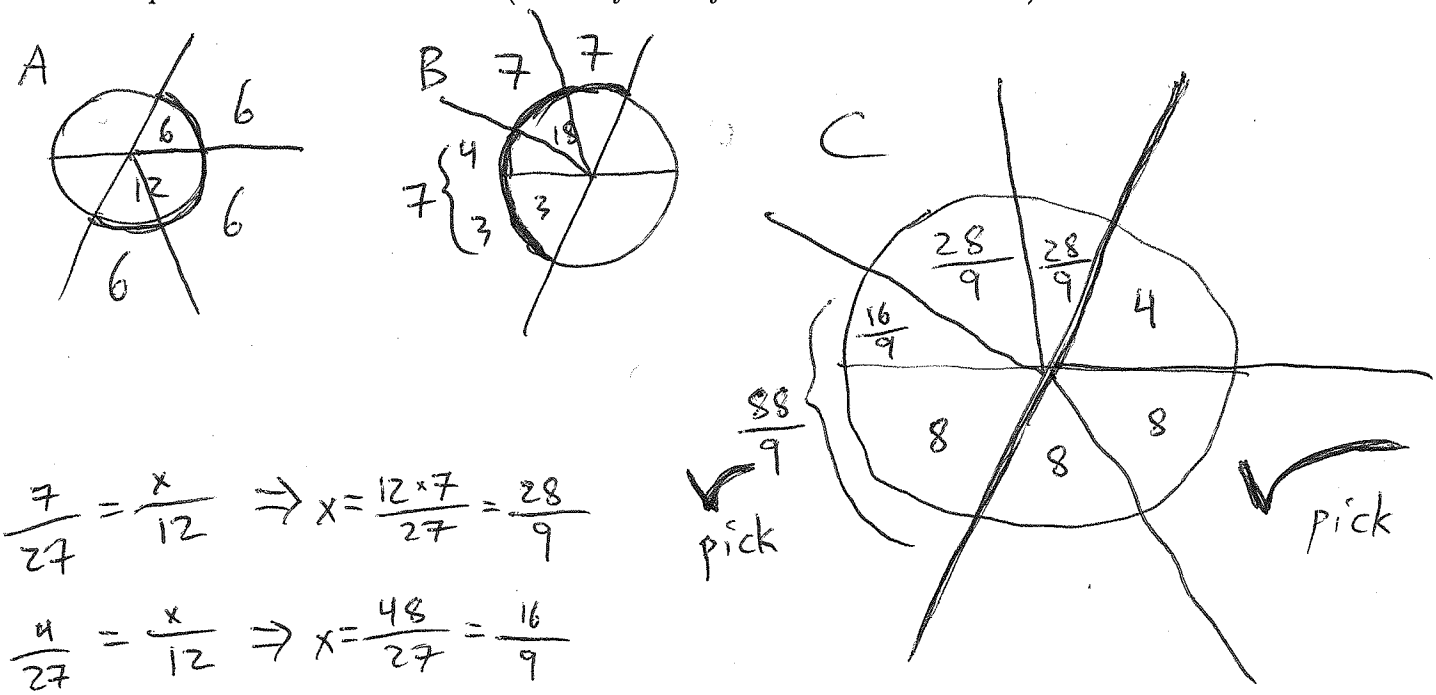
(7 points)

(b) Angie gets to cut first and she cuts the cake into two pieces. One of the pieces is 2/3 vanilla and 1/3 chocolate. The other piece is 1/3 vanilla and 2/3 chocolate. Beth now gets to choose one of the pieces. Which one will she choose? Justify this by showing what each piece is worth to her.



(10 points)

(c) Now, Carl gets to choose his cake from Angie's and Beth's pieces. Indicate how Angie and Beth would divide their pieces and which pieces Carl would select. Specify how much Carl's pieces will be worth to him (You may leave your answer as a fraction).



$\frac{7}{27} = \frac{x}{12} \Rightarrow x = \frac{12 \times 7}{27} = \frac{28}{9}$

$\frac{4}{27} = \frac{x}{12} \Rightarrow x = \frac{48}{27} = \frac{16}{9}$

A B C D E F
4 1 2
3

(20 points; 5 points each)
Problem 4
Alf, Bippity, Cahn, Doris, ET, and Fred divide a pie using the claim and challenge method. D got a piece in the 1^{st} round. After A claimed a piece in the 2^{nd} round, B, C, and F challenged. In the 4^{th} round, everyone challenged and C got the piece.

(a) Who were the only people that could have challenged in the 1^{st} round (not including A)?

B, C, D

(b) Who got a piece in the 2^{nd} round?

F

(c) Who got a piece in the 3^{rd} round?.

E

(d) Who made the claim in the 5^{th} round?

A

(10 points; 2 points each)
Problem 5
True or **False** The You Cut and I Choose method always produces an envy-free fair division.

True or **False** Hamilton's, Jefferson's, Adams', Webster's, and the Huntington-Hill method never violate the quota criterion.

True or **False** When performing the Cut and Choose method, you will always get a fair division, but never an envy-free fair division.

True or **False** Giving out iPads is an example of a discrete fair division problem.

True or **False** The Claim and Challenge method is used for continuous and discrete fair divisions.

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