

# Test 2 - Math 130

## Spring 2014

Make-up Version

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

Do not write below this line.

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	Points		Points
1		5	
2			
3			
4		Total	

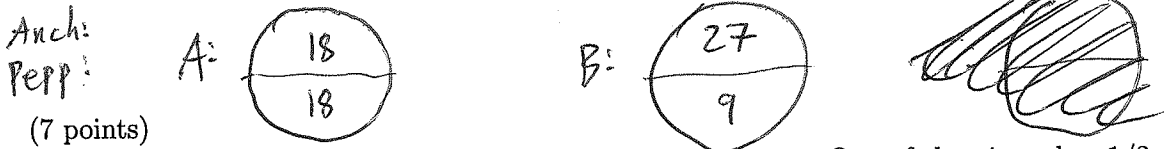
The exam is out of 100 points.

(20 points)

**Problem 1** Two pals, Abe and Beauford are trying to split a pizza worth 36 dollars. One half of the pizza has anchovies, the other half has pepperoni. Abe likes anchovies and pepperoni the same, and Beauford likes anchovies three times as much as he likes pepperoni.

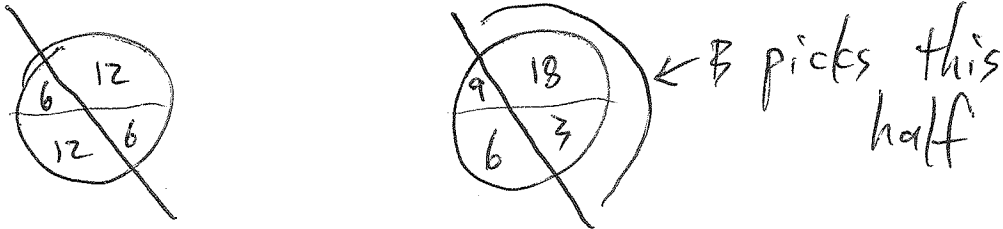
(3 points)

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



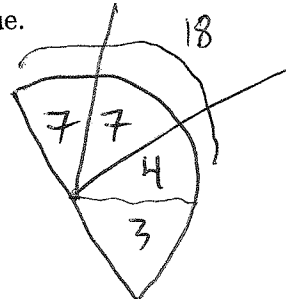
(7 points)

(b) Abe gets to go first and he cuts the pizza into two pieces. One of the pieces has  $\frac{1}{3}$  of the anchovies half and  $\frac{2}{3}$  of the pepperoni half. The other piece has  $\frac{2}{3}$  of the anchovies half and  $\frac{1}{3}$  of the pepperoni half. Beauford now gets to choose one of the pieces. Which one will he choose? Justify this by showing what each piece is worth to him.



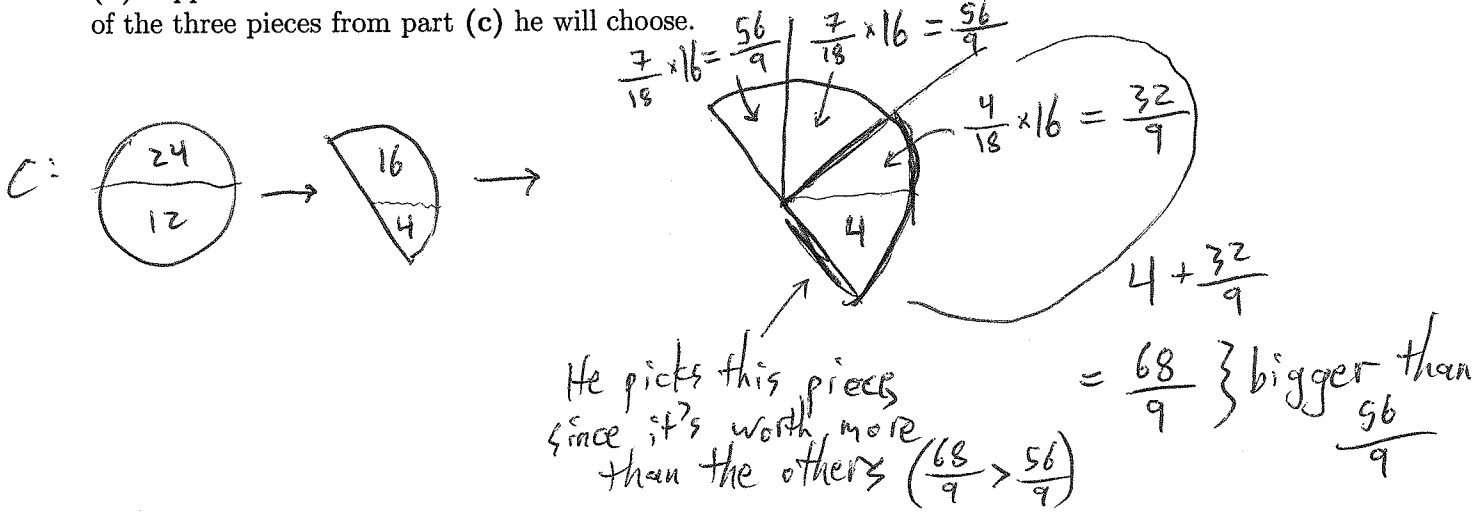
(5 points)

(c) Suppose a third pal, Carl comes in and decides he wants to have some pizza too. Abe, Beauford and Carl decide to use the cut and choose method using their cut from part (b) to give Carl a share of the pizza. Indicate with a clear diagram one way in which Beauford may divide his slice into three pieces of equal value.



(5 points)

(d) Suppose Carl likes Anchovies twice as much as he likes Pepperoni. Indicate clearly which of the three pieces from part (c) he will choose.



1038  
 662  
 ---  
 1700  
 311  
 ---  
 2011  
 679  
 ---  
 2690  
 310  
 ---  
 3000

(30 points)

**Problem 2**

(10 points)

(a) The Alliance is sending 30 soldiers to 5 of its main cities. Apportion the soldiers using Hamilton's method.

City	Dalaran	Darnassus	Exodar	Ironforge	Stormwind	Total
Population	1038	662	311	679	310	3000
No. of soldiers: 30		Standard divisor: 100				
Exact Quota	10.38	6.62	3.11	6.79	3.10	XXXXX
Lower Quota	10	6	3	6	3	28
Frac Part	.38	.62	.11	.79	.10	XXXXX
Surplus		1		1		2
Total	10	7	3	7	3	30

Use the above table to answer (b) and (c); here, the Alliance is apportioning the soldiers by using Jefferson's method instead. (If you would like to, you may copy your above information into the new table below.)

City	Dalaran	Darnassus	Exodar	Ironforge	Stormwind	Total
Population	1038	662	311	679	310	3000
No. of soldiers: 30		Standard divisor: 100				
Exact Quota	10.38	6.62	3.11	6.79	3.10	XXXXX
Lower Quota	10	6	3	6	3	28

(5 points)

(b) Does the first step of Jefferson's method apportion exactly 30 soldiers? If not, should we increase the divisor, or should we decrease the divisor? no

(5 points)

(c) Assume that your new divisor apportions 31 soldiers. 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	7.999	2.448	5.000	6.480	3.477
Jefferson's method	7	2	5	6	3
Adams' method	8	3	5	7	4
Webster's method	8	2	5	6	3
Hungtington-Hill	8	2	5	6	4

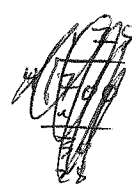
$\sqrt{2 \times 3}$	$\sqrt{3 \times 4}$	$\sqrt{4 \times 5}$	$\sqrt{5 \times 6}$	$\sqrt{6 \times 7}$	$\sqrt{7 \times 8}$	$\sqrt{8 \times 9}$
2.449	3.464	4.472	5.477	6.481	7.483	8.485

(20 points)

**Problem 3**

Tony, Kurt, Kevin, and Danica have inherited some car parts from an unknown source. Carry out the division of these objects between them using the sealed bids method.

	Tony	Kurt	Kevin	Danica
Clutch	\$1200	\$500	\$400	\$1100
Flywheel	\$400	\$500	\$1000	\$900
Tires	\$600	\$400	\$200	\$700
Engine	\$600	\$1000	\$400	\$900
Total Value	<del>2800</del> 2800	<del>2400</del> 2400	<del>2000</del> 2000	<del>3600</del> 3600
Fair Share	<del>700</del> 700	<del>600</del> 600	<del>500</del> 500	<del>900</del> 900
Allocated	1200	1000	1000	700
Difference	-500	-400	-500	200
Surplus= 1200				
Surplus Share	300	300	300	300



Summary

Item(s)	clutch	engine	flywheel	tires
Item's Value	1200	1000	1000	700
Cash	-200	-100	-200	500
Net Total	1000	900	800	1200

A B C D E F G  
 1 2 3 4 5  
 1 2 3

(20 points; 5 points each)

**Problem 4**

Aberforth, Bobby, Ceres, Domino, Evanda, Fernando, and Glinda decide to split a piece of land using the claim and challenge method. They proceed in alphabetical order. Suppose Domino starts the fourth round, and also claims his piece in the fourth round. Also suppose that Fernando wins in the fifth round.

(a) How many rounds are needed to complete the allocation?

6

(b) Who got their pieces in the first three rounds?

A, B, C

(c) Describe the fifth round in terms of claims, challenges, and passes by each player.

E claims, F challenges, G passes

(d) Who will go first in the sixth round?

E

(10 points; 2 points each)

**Problem 5**

True or  False In a claim-and-challenge involving 55 people, there must be 54 rounds.

True or  False Hamilton's method respects the quota criterion.

True or  False Hamilton's method does not have the Alabama paradox.

True or  False The cut-and-choose (cake cutting with 3 people) method never produces an envy-free division.

True or  False Dividing up a gallon of water between a group of friends is an example of a discrete division problem.

