

By providing my signature below I acknowledge that this is my own work, and I did not get any help from anyone else:

Name (sign): _____

Name (print): _____

Student Number: _____

Problem Number	Points Possible	Points Made
1	8	
2	6	
3	16	
4	30	
5	20	
6	20	
Total:	100	

- This test is 7 pages long. Make sure you have all 7 pages.
- If you need extra space use the last page.
- Please show your work. **An unjustified answer may receive little or no credit.**
- Your work must be **neat**. If I can't read it (or can't find it), I can't grade it.
- Please turn off your mobile phone.
- Calculators are prohibited.

1. (8 points) In the adjusted winner procedure, the Initial Winner transfers an item to the Initial Loser.

(a) (3 pts) When this transfer happens, does the total value increase, decrease, or stay the same? (Total value means the sum of Player 1's value and Player 2's value.)

(b) (5 pts) Explain your answer

2. (6 pts) In the Knaster inheritance procedure, what *specifically* would go wrong if we sold the inherited item to the lowest bidder instead?

3. (16 points) A coffee shop has 83 employees and five locations. Below is a chart containing the average number of transactions daily at each location.

Location	Daily Transactions
Location 1	1023
Location 2	456
Location 3	586
Location 4	1547
Location 5	8320

Consider the problem of apportioning employees to locations based on their average daily transactions.

- (a) (4 pts) What are the states?
- (b) (4 pts) What is the house size?
- (c) (4 pts) What is the population of each state?
- (d) (4 pts) What is the standard divisor?

4. (30 points) You are planning to buy 13 shirts. In order to make an informed decision, you have recorded how many times you wore each type of shirt over the past year.
- (a) (12 pts) Complete this table using the Jefferson method.

Year	Days Worn	SD ≈ 28.077		Divisor = 30	
		Exact	Round	Exact	Round
Crew Neck	74	2.636		2.467	
V Neck	101	3.597		3.367	
Button Down	164	5.841		5.467	
Tank Top	26	0.926		0.867	
Total	365	13.000		N/A	

- (b) (3 pts) You've found a divisor which gives a fair division under the Jefferson method. Is it...
- (a) Less than 28.077
- (b) Exactly 28.077
- (c) Between 28.077 and 30
- (d) Exactly 30
- (e) Greater than 30

(c) (12 pts) Complete this table using the Webster method.

Year	Days Worn	SD \approx 28.077		Divisor = 30	
		Exact	Round	Exact	Round
Crew Neck	74	2.636		2.467	
V Neck	101	3.597		3.367	
Button Down	164	5.841		5.467	
Tank Top	26	0.926		0.867	
Total	365	13.000		N/A	

(d) (3 pts) You've found a divisor which gives a fair division under the Webster method. Is it...

- (a) Less than 28.077
- (b) Exactly 28.077
- (c) Between 28.077 and 30
- (d) Exactly 30
- (e) Greater than 30

5. (20 points) A mathematics professor is retiring and giving away her book collection. Her two PhD students decide to use the adjusted winner procedure to divide her book collection based on subject. They make the following bids on items.

Subject	Caitlin	Bruno
Relativity	30	10
Abstract algebra	15	45
Algebraic Geometry	20	15
Differential Geometry	30	20
Algebraic topology	5	10

- (a) (5 pts) What is the initial division of items?

- (b) (15 pts) Finish applying the adjusted winner procedure. What is the final allocation?

6. (20 pts) A small startup is going out of business and needs to divide its assets equally between its three investors using the Knaster Inheritance procedure. They bid as follows.

	Investor 1	Investor 2	Investor 3
Computers	\$1500	\$1750	\$2250
Software	\$2000	\$1600	\$1800
Furniture	\$1000	\$750	\$1400

Apply the Knaster inheritance procedure to obtain a fair division.