Exploring the World of Math

Name: _____ Date: _____

Test 7: Voting, Power Index, Sharing and Apportionment

1. Five people named Tyrone, Mammoth, Cindi, Brenda and Thomas will divide a cake that is divided into five slices, s1, s2, s3, s4 and s5. The table gives us the value of each slice in the eyes of the individuals.

	S1	S2	S3	S4	S5
Tyrone	$1.90	$2.15	$2.40	$2.90	$3.40
Mammoth	$2.50	$2.50	$2.50	$2.50	$2.50
Cindi	$3.50	$3.00	$2.50	$2.25	$2.00
Brenda	$3.75	$2.75	$3.25	$2.85	$3.35
Thomas	$3.00	$2.70	$1.90	$3.01	$3.10

   a. What items are fair shares to Tyrone?

   b. What items are fair shares to Mammoth?

   c. What items are fair shares to Cindi?

   d. What items are fair shares to Brenda?

   e. What items are fair shares to Thomas?

   f. What is the only fair division of the cake?

2. Tina likes sausage pizza 4 times more than veggie pizza. We have a single pizza, one half sausage and one half veggie. The extra-large pizza costs $18.

   a. How much is the sausage pizza worth to Tina?

   b. How much is the veggie pizza worth to Tina?

   c. How much is ¼ of the veggie pizza worth to Tina?

   d. How much is ½ of the veggie pizza and ½ of the sausage pizza worth to Tina?

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3. Four regions of our country are called Oneland, Twoland, and Threeland. The population of Oneland is 87,125. The population of Twoland is 101,082. The population of Threeland is 165,231. In our government, we have 80 seats in the House of Representatives.

   a. What is the standard divisor for our population?

   b. How many seats will Oneland receive based upon their population?

   c. How many seats will Twoland receive based upon their population?

   d. How many seats will Threeland receive based upon their population?

4. Milk is distributed to elementary schools based upon population. The total district population is 7,345 elementary school students. The following table shows the amount of milk sent to five schools.

	School A	School B	School C	School D	School E
Gal of milk	53 gal	68 gal	42 gal	77 gal	82 gal

   a. What is the population of school A?

   b. What is the population of school B?

   c. What is the population of school C?

   d. What is the population of school D?

   e. What is the population of school E?

5. Who would have the advantage in the chooser or divider scenario where the divider has the second choice?

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6. Determine the Banzhaf Power Index for the four players. Player one gets 7 votes, player two gets 5 votes, player three gets 3 votes, and player four gets 2 votes. Determine all the possible sets. Add their weighted number to get the total weight. Identify winning sets of 9 and above. Then underline all critical players that will allow the total weight to fall below 9 if that player was removed from the team.

2 person coalition	Wt	3 person coalition	Wt	4 person coalition	Wt

7. How many times are all critical players underlined?

8. How many times is P critical? Divide by the total underlined critical to get its Banzhaf power index.

$P_1 =$ _____ $P_2 =$ _____ $P_3 =$ _____ $P_4 =$ _____

9. The company of four employees has a payroll of $500,000. Based upon the above Banzhaf power index, what should each employee be paid?

10. Determine the Shapley Shubik Power Index for three players. Player one gets 6 votes, player two gets 5 votes, and player three gets 3 votes. Determine all the possible sets. Identify the pivotal player when adding that causes the weight to equal or exceed 8 and underline all the pivotal player in that set.

11. How many times are all players pivotal?

P1 = _____   P2 = _____   P3 = _____

12. Calculate the Shapley Shubik Power Index for each player (pivotal divided by 3!)

P1 = _____   P2 = _____   P3 = _____

13. The group of lawyers at the company has a payroll of $300,000. Based upon the above Shapley Shubik Power Index, what should each lawyer be paid?

Using the Borda Count Method. We vote for the city council. Our choices are A, B, C, D, and E for the letter in their last name.

1	2	3	4	5	6	7	8	9	10
B	C	A	B	B	B	C	B	C	C
A	A	B	A	A	A	B	A	D	A
C	D	C	E	C	E	A	C	B	D
E	E	D	C	E	C	E	E	A	E
D	B	E	D	D	D	D	D	E	B
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
C	B	C	B	B	A	C	C	C	C
B	A	B	A	A	B	D	B	D	A
A	C	A	E	C	C	B	A	B	D
E	E	E	C	E	D	A	E	A	E
D	D	D	D	D	E	E	D	E	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
B	A	B	C	C	C	B	B	C	C
A	B	A	B	A	D	A	A	A	B
C	C	E	A	D	B	C	E	D	A
E	D	C	E	E	A	E	C	E	E
D	E	D	D	B	E	D	D	B	D

14. Organize the different ballots and do a points tally

1st (5)									
2nd (4)									
3rd (3)									
4th (2)									
5th (1)									

15. Total each choice:

   A =

   B=

   C =

   D =

   E=

16. Who would win if the election was determined by first place ballots?

17. Using the letters A, B, C and D diagram or explain how the elimination election would work if the person with the lowest votes is removed during each ballot.