

Quiz 5, Math of Democracy

Fall 2019, Dr. Adam Graham-Squire

7:16

Name: Key

give 25 min

1. (5 points) Bob is attempting to use Webster's method¹ to apportion a country that has 6 states in it, and 34 seats in its House of Representatives. When he does his initial apportionment with a divisor of 835, he gets 33 seats. Explain to Bob:

- (a) Whether he should *increase* or *decrease* his divisor (and by how much, approximately).
- (b) *Why* he should do the increase or decrease.

(a) Bob needs to decrease his ^{modified} divisor. Since he only needs one more seat, I could recommend a small change, like only down to 800.

(b) He needs to do a decrease b/c he needs the rounded quotas to increase (at least, one of them). To do that, he needs to divide the populations by a smaller divisor than 835, b/c dividing by a smaller # makes your result larger.

$$\text{Mod. quota} = \frac{\text{State Pop}}{\text{mod. divisor}} \leftarrow \begin{array}{l} \text{make that smaller} \\ \text{to make} \\ \text{this larger.} \end{array}$$

¹Webster's method can be described as "Find each state's modified quota, rounded. Find a modified divisor so that the total number of seats adds up to the correct number needed for the House of Representatives."

2. (5 points) (a) Below is a table for calculating an apportionment using Jefferson's method for a country with five states. Assuming that the country will apportion 12 seats, use the table below to do the apportionment (you may need to fill in additional columns, which you should do as needed).

State	P_i	$P_i/2$	$P_i/3$	$P_i/4$	$P_i/5$	
A	3000	1500				
B	5000	2500	1666.7 1666.7	1250		
C	7000	3500	2333.3	1750	1400	
D	2800	1400				
E	6100	3050	2033.3 2033.3	1525		

State A → 1

B → 3

C → 4

D → 1

E → 3

Total = 12.



- (b) Use the table technique to explain why Jefferson's method will never have the Alabama paradox. (If you can't do that, then just explain it using *any* technique).

For the Alabama paradox, you would need to add a seat to the House, and somehow cause a state to lose a seat in the resulting apportionment. In the table method, though, adding a seat to the house means you just circle the next largest #, so no state would ever lose a seat when you added a seat to the House.