

**5.1: Apportionment**Class Prep AssignmentDue at the beginning of next class

**Apportionment** is the problem of dividing up a fixed number of people or items among groups of different sizes. For example, we use apportionment to determine the number of representatives for each state in the US House of Representatives, or to divide school busses among districts.

**Rules of Apportionment**

1. The people/items can only be divided into \_\_\_\_\_.
2. We must use the \_\_\_\_\_ of people/items being divided.
3. Each group must get \_\_\_\_\_ of the people/items being divided up.
4. The number of people/items assigned to each group should be \_\_\_\_\_ to the size of the group. (Exact is rarely possible so get as close as possible).

**Apportionment Methods and Steps**

1. Divide the total population by the number of items to find the divisor: The number of people each person should represent (decimal).
2. Divide the population of each group by the divisor to get the standard quota.

**Hamilton's Method (vetoed in 1792, used from 1850-1900):** Cut off decimal to find the initial number. Then give any extra seats in order of the highest decimal remainders.

**Jefferson's Method (used from 1792-1830):** Cut off the decimal to find the initial number. Lower the divisor if needed so that there are no leftover seats. Uses trial and error.

**Webster's Method (used in 1840):** Instead of cutting off the decimal, round it to find the initial number. Then raise or lower the divisor if needed so there are no leftover seats.

**Hill-Huntington Method (used 1941-present):** Instead of rounding using 0.5 or higher, use the geometric mean  $\sqrt{x(x+1)}$  to round the initial number. Then raise or lower the divisor if needed so there are no leftover seats.

It is important to acknowledge slavery in the U. S. when these methods were formed. In the textbook I encourage you to read about the 3/5 Compromise and Hamilton, Jefferson and Webster's relationship to slavery. In the 3/5 compromise, only 3/5 of the slave population was counted for representation. When the slaves were freed in 1863, they were counted as whole people. Black men were given the right to vote in 1869 and all women in 1920, however, there are still voter suppression measures for black people and other minoritized groups.

**Example 1.** PCC has four campuses and 45 full-time math instructors. The number of students at each campus is given in terms of full-time equivalency (FTE). How can we divide up the math instructors fairly?

2016-17 Academic Year Data: <https://www.pcc.edu/ir/factsheet/Factbook/201617/swr5yrt2012-2016.pdf>

**a. Use Hamilton's method to apportion the math instructors.**

<u>Campus</u>	<u>Students (FTE)</u>	<u>Standard Quota</u>	<u>Initial or Minimum</u>	<u>Final</u>
Sylvania	8871			
Cascade	4841			
Rock Creek	6797			
Southeast	2722			

**Total**

**Divisor:**

**b. Use Jefferson's method to apportion the math instructors.**

<u>Campus</u>	<u>Students (FTE)</u>	<u>Standard Quota</u>
Sylvania	8871	
Cascade	4841	
Rock Creek	6797	
Southeast	2722	

**Total 23,231**

**Divisor:**

**c. Use Webster's method to apportion the math instructors.**

<u>Campus</u>	<u>Students (FTE)</u>	<u>Standard Quota</u>
Sylvania	8871	
Cascade	4841	
Rock Creek	6797	
Southeast	2722	

**Total 23,231**

**Divisor:**

**d. Use Hill-Huntington's method to apportion the math instructors.**

<u>Campus</u>	<u>Students (FTE)</u>	<u>Standard Quota</u>
Sylvania	8871	
Cascade	4841	
Rock Creek	6797	
Southeast	2722	
<b>Total</b>	<b>23,231</b>	

**Divisor:**