

Decennial apportionment and the US House of Representatives

Now that the Census of 2010 is complete there will be changes in the number of State Representatives in the House.

In 1787 the US Constitution declared that “all of the states should be represented by population” and that “the number of representatives shall not exceed one for every thirty thousand.” This is the part of the Constitution that refers to the members of the House of Representatives. As the population in the states rose the number of members of the House of Representatives rose. In 1911 it was decided that the House size should be limited to 435. It was originally thought that each representative should stand for about 30,000 voters. But as the population of the United States grew, the number of people represented by each congressman also rose. At present, one House Representative represents almost 700,000 voters. This is called the ratio of constituents per House member.

Every ten years after the Decennial Census (1990, 2000, 2010, etc) each state’s number of allocated representatives is recalculated. Now that the 2010 Census is almost complete, it will be time for the Clerk of the House of Representatives to recalculate the number of seats that each state has in the House. This will be completed by January 25th, 2011.

The calculation of each state’s number of representatives is an interesting mathematical task. By the Constitution each state has at least one representative. After that the math begins.

- States are arranged in descending order by the size of their population. We don’t yet have the 2010 data. So, we will calculate the number of representatives that was evaluated from the 2000 Census.
- The states and their population are listed. Each state is given one representative as required by the Constitution.
- The most populous state is given one more representative first and then its priority for another representative is calculated using the following formula; $A_n = \frac{P}{\sqrt{n(n+1)}}$

where P is the population of the state (as just arrived at from the recent Census), and n is the number of seats in the House it currently holds before the next possible allocation.

Showing the 7 most populous states, this is what my data looks like. I’ve given every state the one seat that is guaranteed by the Constitution.

State	Apportionment Population	Initial number of representatives	$\frac{P}{\sqrt{n(n+1)}}$ Priority
California	33,930,798	1	23,992,697.36
Texas	20,903,994	1	14,781,355.91
New York	19,004,973	1	13,438,545.28
Florida	16,028,890	1	11,334,136.81
Illinois	12,439,042	1	8,795,730.95
Pennsylvania	12,300,670	1	8,697,887.17
Ohio	11,374,540	1	8,043,014.37

So, since California has the highest number, California gets one more seat in the House of Representatives.

I've now recalculated my priorities. These are the new 7 highest priorities states, again arranged in descending order of priority.

State	Population	Representatives	Priority
Texas	20,903,994	1	14,781,355.91
California	33,930,798	2	13,852,190.28
New York	19,004,973	1	13,438,545.28
Florida	16,028,890	1	11,334,136.81
Illinois	12,439,042	1	8,795,730.95
Pennsylvania	12,300,670	1	8,697,887.17
Ohio	11,374,540	1	8,043,014.37

So now Texas gets the next seat and I recalculate.

State	Population	Representatives	Priority
California	33,930,798	2	13,852,190.28
New York	19,004,973	1	13,438,545.28
Florida	16,028,890	1	11,334,136.81
Illinois	12,439,042	1	8,795,730.95
Pennsylvania	12,300,670	1	8,697,887.17
Texas	20,903,994	2	8,534,019.81
Ohio	11,374,540	1	8,043,014.37

- Notice that only Texas' priority changed when I gave it another House seat.

1. Which state should now get the next seat?
2. Change the number of Representatives for that state and recalculate that seat's new priority. Show your formula and work but you should use a calculator.

California	33,930,798	2	
New York	19,004,973	1	
Florida	16,028,890	1	
Illinois	12,439,042	1	
Pennsylvania	12,300,670	1	
Texas	20,903,994	2	
Ohio	11,374,540	1	

Since my chart doesn't have the most recent data for the population of each state, my calculations will not be correct for 2010 but I hope the idea of how it works will be evident.

Source: http://en.wikipedia.org/wiki/United_States_congressional_apportionment

3. These are the first 11 states in the U.S. listed alphabetically with the number of Representatives they were allocated due to the 2000 Census. Calculate the ratio of constituents to Representatives for these 11 states.

2000 reapportionment population, representatives, and change

State	Apportionment Population	Number of apportioned Representatives based on Census 2000	Ratio of to Representative
Alabama	4,461,130	7	
Alaska	628,933	1	
Arizona	5,140,683	8	
Arkansas	2,679,733	4	
California	33,930,798	53	
Colorado	4,311,882	7	
Connecticut	3,409,535	5	
Delaware	785,068	1	
Florida	16,028,890	25	
Georgia	8,206,975	13	
Hawaii	1,216,642	2	

Source: <http://usgovinfo.about.com/library/weekly/aa122800b.htm>

4. These are the states that presently have only one Representative. Calculate their ratio of constituents to Representatives

State	Apportionment Population	Number of apportioned Representatives based on Census 2000	Ratio of to Representative
Alaska	628,933	1	
Delaware	785,068	1	
Montana	905,316	1	
North Dakota	643,756	1	
South Dakota	756,874	1	
Vermont	609,890	1	
Wyoming	495,304	1	

5. Louisiana is expected to lose 2 Representatives. Why do you suppose that is?
6. If Louisiana loses 2 Representatives, about how much smaller is its 2010 population than its 2000 population?
7. Arizona, Florida, Georgia, Nevada, South Carolina, Utah, and Washington are expected to gain one Representative each. Can you describe any trends?