

**12A: Voting Methods**

Class Prep Assignment

Due at the beginning of next class

**Personal Reflection:** Do you think the U.S. presidential election system is fair? Explain why or why not.

**Voting Methods**

**Ranked Choice Voting and the Preference Schedule**

**Example 1.** Students are voting for their class president and the candidates are Omar (O), Ann (A), and Helen (H). They have ranked the candidates according to their preference.

	Vien	Ann	Marv	Tasha	Eve	Omar	Lupe	Dave	Helena	Jimmy
1 <sup>st</sup> choice	A	A	O	H	A	O	H	O	H	A
2 <sup>nd</sup> choice	O	H	H	A	H	H	A	H	A	H
3 <sup>rd</sup> choice	H	O	A	O	O	A	O	A	O	O

Make a **Preference Schedule:**

1 <sup>st</sup> choice				
2 <sup>nd</sup> choice				
3 <sup>rd</sup> choice				

**Plurality Method** (only first choice counts)

	1	3	3	3
1 <sup>st</sup> choice	A	A	O	H
2 <sup>nd</sup> choice	O	H	H	A
3 <sup>rd</sup> choice	H	O	A	O

**Example 2.** Five candidates are running for office and labeled A, B, C, D and E for simplicity. Which candidate wins under each method?

**Plurality Method**

	3	4	4	6	2	1
1 <sup>st</sup> choice	B	C	B	D	B	E
2 <sup>nd</sup> choice	C	A	D	C	E	A
3 <sup>rd</sup> choice	A	D	C	A	A	D
4 <sup>th</sup> choice	D	B	A	E	C	B
5 <sup>th</sup> choice	E	E	E	B	D	C

How many people voted?

How many votes are needed for a majority win?

How many votes are needed for a plurality win?

**Instant Runoff Method** (Sometimes Called Sequential Runoff or Single Transferrable Vote)

	3	4	4	6	2	1
1 <sup>st</sup> choice	B	C	B	D	B	E
2 <sup>nd</sup> choice	C	A	D	C	E	A
3 <sup>rd</sup> choice	A	D	C	A	A	D
4 <sup>th</sup> choice	D	B	A	E	C	B
5 <sup>th</sup> choice	E	E	E	B	D	C

**Point System** (Borda Count)

	3	4	4	6	2	1
1 <sup>st</sup> choice	B	C	B	D	B	E
2 <sup>nd</sup> choice	C	A	D	C	E	A
3 <sup>rd</sup> choice	A	D	C	A	A	D
4 <sup>th</sup> choice	D	B	A	E	C	B
5 <sup>th</sup> choice	E	E	E	B	D	C

**Condorcet Method** (Pairwise Comparisons)

	3	4	4	6	2	1
1 <sup>st</sup> choice	B	C	B	D	B	E
2 <sup>nd</sup> choice	C	A	D	C	E	A
3 <sup>rd</sup> choice	A	D	C	A	A	D
4 <sup>th</sup> choice	D	B	A	E	C	B
5 <sup>th</sup> choice	E	E	E	B	D	C

Class Prep AssignmentDue at the beginning of next class**12C: Apportionment**

**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. Find the divisor: The number of people each person should represent (decimal)
2. Divide the population by the divisor to get the standard quota.

**Hamilton's Method (vetoed in 1792, used from 1850-1900):** Cut off decimal to find initial or minimum 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 or minimum number. Lower the divisor so that there are no leftover seats

**Webster's Method (used in 1840):** Instead of cutting off the decimal, round it to find the initial or minimum number. Then 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 or minimum number.

Part of U.S. history is the 3/5 compromise between the North and the South in 1787, in which slaves were counted as 3/5 of a person for representation. When the slaves were freed in 1863 they were counted as whole people. Black men were given the right to vote in 1870, and all women in 1920. [http://www.aaregistry.org/historic\\_events/view/three-fifths-compromise](http://www.aaregistry.org/historic_events/view/three-fifths-compromise)

**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:**

**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	

**Total 23,231**

**Divisor:**

### 12D: Gerrymandering and Solutions

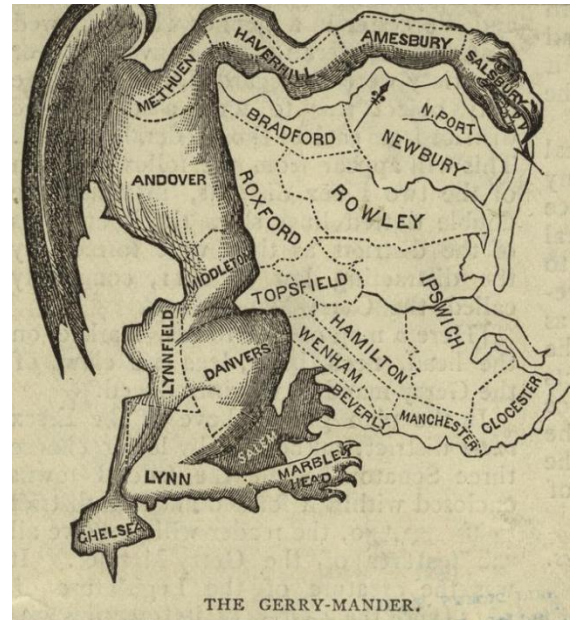
#### Class Prep Assignment

Due at the beginning of next class

Apportionment determines how many representatives are given to each state. Then each state draws the districts that elect one representative each.

Watch the videos and look for the following information.

1. How often does redistricting happen?
2. What are the two rules for drawing district lines?
  - 1.
  - 2.
3. Who determines where the district lines are drawn?



4. There are two types of gerrymandering.

What is cracking?

What is packing?

5. What is gerrymandering?



**How to Measure Gerrymandering: The Efficiency Gap**

Example 1. The votes are shown for five districts in a hypothetical state. Determine the number of seats won and calculate the efficiency gap.

**Election Results:**

	District	D Votes	R Votes	D Wasted Votes	R Wasted Votes
Democrats win	1	75	25		
_____ seats	2	60	40		
	3	43	57		
Republicans win	4	48	52		
_____ seats	5	49	51		
	<b>Total</b>				

**Efficiency Gap** = 
$$\frac{\text{Party A Wasted Votes} - \text{Party B Wasted Votes}}{\text{Total Votes}} =$$

**A maximum efficiency gap of \_\_\_\_\_% is currently being proposed.**

Adapted from: [https://www.brennancenter.org/sites/default/files/legal-work/How the Efficiency Gap Standard Works.pdf](https://www.brennancenter.org/sites/default/files/legal-work/How%20the%20Efficiency%20Gap%20Standard%20Works.pdf)

**Another Solution to Gerrymandering** – Fair Representation (with Ranked Choice Voting)

Instead of   3   districts that elect   1   representatives each, we

would have \_\_\_\_\_ district that elects \_\_\_\_\_ representatives.

The representation would be more \_\_\_\_\_ to the population.

**More information**

Democracy vs. Math: <https://www.nytimes.com/2017/08/29/magazine/the-new-front-in-the-gerrymandering-wars-democracy-vs-math.html>

Efficiency Gap Infographics for each state: <https://www.azavea.com/blog/2017/07/19/gerrymandered-states-ranked-efficiency-gap-seat-advantage/>

Article about project REDMAP (REDstricting Majority Project): <https://qz.com/1009713/gerrymandering-definition-guide-to-understanding-gill-v-whitford-supreme-court-case/>