

# Quiz 4, Math of Democracy

Fall 2018, Dr. Adam Graham-Squire

Name: \_\_\_\_\_

Key

9 min

⇒ 30 min.

Consider the following state with five districts, with these results in an election in 2012:

District	% Democrat	% Republican
1	55	45
2	54	46
3	53	47
4	52	48
5	51	49

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1. Calculate the efficiency gap for the election above. Briefly explain who it favors and whether or not it is indicative of gerrymandering.

$$W_D = 5 + 4 + 3 + 2 + 1 = 15$$

$$W_R = 45 + 46 + 47 + 48 + 49 = 235$$

$$E.G. = \frac{235 - 15}{500} = \frac{220}{500} = 44\%$$

This is a large E.G., very close to 50%, and likely indicates gerrymandering in favor of Republicans. Democrats b/c they win every district and have few wasted votes (Dems have 53% of overall votes but win 100% of seats).

2. Now suppose that between 2012 and 2014, there was a 10% uniform partisan shift from Democrats to Republicans. Calculate the new percentage votes for Democrats and Republicans in each district in the 2014 election.

District (2012)	% Dem	% Rep
1	55	45
2	54	46
3	53	47
4	52	48
5	51	49

District (2014)	% Dem	% Rep
1	49.5	50.5
2	48.6	51.4
3	47.7	52.3
4	46.8	53.2
5	45.9	54.1

②

$$D1: 55 - 55(0.1) = 49.5 \text{ for D, } 45 + 5.5 = 50.5 \text{ for R}$$

$$D2: 54 - 54(0.1) = 48.6 \text{ for D, } 46 + 5.4 = 51.4 \text{ for R}$$

$$D3: 53 - 53(0.1) = 47.7 \text{ for D, } 47 + 5.3 = 52.3 \text{ for R}$$

etc

$\Rightarrow$  R wins all!

R % overall is 52.3

3. Calculate the efficiency gap for the 2014 election. Briefly explain who it favors and whether or not it is indicative of gerrymandering.

$$E.G. W_R = 0.5 + 1.4 + 2.3 + 3.2 + 4.1 = 11.5$$

$$W_D = 49.5 + 48.6 + 47.7 + 46.8 + 45.9 = 238.5$$

②

$$E.G. = \frac{238.5 - 11.5}{500} = \frac{227}{500} = 45.4\%$$

Also really gerrymandered (close to 50%) now in favor of Republicans, who win every seat.



4. In general, what do you believe is more important for an electoral map, a good efficiency gap score or good partisan symmetry? Use your answers from the previous question to support your reasoning, if possible.

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There are many answers. Here is one:

I think symmetry is more important. In the problems we just did, the efficiency gap indicated gerrymandering both times, in favor of different parties, even though the maps did not change just a slight change in party loyalty. On the other hand, the results were symmetric. When Dems win a little over 50% of the vote, they get all the seats, and when Reps win <sup>a little</sup> over 50% then they win all the seats. This is fair (symmetric) b/c it treats parties the same. It shows competitiveness in each district, not necessarily gerrymandering.