Gerrymandering and Efficiency Gap

After completing this lesson, students should be able to:

• Calculate the number of wasted votes and the efficiency gap “toy” examples.
• Describe the range of values possible for the efficiency gap and explain why this is the range.
Before Class

- Read the article https://www.washingtonpost.com/graphics/2017/politics/courts-law/gerrymander/

- Answer the questions

1. In the Oct 4, 2017 Washington Post article “Here’s how the Supreme Court could decide whether your vote will count”, how many votes are wasted by the green party and the purple party in each of the three cracked districts?
   (a) In each of these three districts, 1 vote is wasted by green and 4 for purple.
   (b) In each of these three districts, 0 votes are wasted by green and 4 by purple.
   (c) In each of these three districts, 1 vote is wasted by green and 0 by purple.
   (d) In each of these three districts, 0 votes are wasted by green and 0 by purple.

2. In the Oct 4, 2017 Washington Post article “Here’s how the Supreme Court could decide whether your vote will count”, how many votes are wasted by the green party and the purple party in each of the two packed districts?
   (a) Green wastes 0 votes, purple wastes 4 votes.
   (b) Green wastes 1 vote, purple wastes 3 votes.
   (c) Green wastes 0 votes, purple wastes 4 votes.
(d) Green wastes 1 vote, purple wastes 9 votes.

3. In the 10/4/2017 Washington post article “Here’s how the Supreme Court could decide whether your vote will count”, how does North Carolina’s efficiency gap compare to Wisconsin’s in the last figure?

(a) Both efficiency gaps favor Democrats, but North Carolina’s is more extreme (bigger in absolute value).

(b) Both efficiency gaps favor Democrats, but Wisconsin’s is more extreme (bigger in absolute value).

(c) Both efficiency gaps favor Republicans, but North Carolina’s is more extreme (bigger in absolute value).

(d) Both efficiency gaps favor Republicans, but Wisconsin’s is more extreme (bigger in absolute value).

(e) Wisconsin’s efficiency gap favors Republicans while North Carolina’s favors Democrats, and North Carolina’s is more extreme (bigger in absolute value).

(f) Wisconsin’s efficiency gap favors Democrats while North Carolina’s favors Republicans, and Wisconsin’s is more extreme (bigger in absolute value).
How can you quantify the relative amount of gerrymandering in these three districting maps in terms of *wasted votes*?
Question. What is the efficiency gap in this districting map example? Select the closest answer. (PollEv)

A. –0.2
B. –0.1
C. –0.05
D. 0
E. 0.05
F. 0.1
G. 0.2
Efficiency gap

**Definition.** The efficiency gap is ...

What does the positive or negative sign mean for the efficiency gap?
Question. Does an efficiency gap close to zero correspond to districts that are more or less gerrymandered? (PollEv)

Question. What is the maximum possible efficiency gap? (PollEv)
A. 0.1
B. 0.5
C. 1
D. 100
E. There is no maximum.
Extra Example. Try this gerrymandering puzzle.

- Create 5 districts, with as much advantage as possible for blue.
- Create 5 districts, with as much advantage as possible for red.
- What are the efficiency gaps?
Homework

1. Examples with extreme efficiency gaps:
   (a) Draw a districting scheme in which the efficiency gap is exactly 0. You can choose how many voters to use and how to color the circles blue and red.
   (b) Draw a districting scheme in which the efficiency gap is close to 0.5.

2. For each of these three districting plans, (a), (b), and (c) find
   (i) how many districts does red win and how many does blue win?
   (ii) calculate the efficiency gap (calculate it so that it is positive if red has more wasted votes, and negative if blue has more)

(a)
Is there a relationship between the number of districts won by red vs. blue and the efficiency gap? If so, describe it.

3. Justify why efficiency gap can’t be bigger than 0.5, in the following steps.

(a) Explain why the total number of wasted votes (votes wasted by either party) is always less than half the total number of votes.

(b) Explain why the difference in wasted votes between two parties is always less
than half the total number of votes.

(c) How does this show that the efficiency gap is less than 0.5?