Gerrymandering and Compactness in NC and MD

After completing this section, students should be able to;

- Calculate measures of compactness for actual districts
- Compare measures of compactness and their advantages and disadvantages
- Use compactness to argue that districts are or are not gerrymandered
Compactness of real regions

- Consider congressional districts for a chosen year. Each group should work with a different year.
- Census data on area and perimeter is available via https://tinyurl.com/uncMath115StudentSpreadsheets
- Compute compactness for all districts in the state you chose, using the Polsby-Popper and the Schwarzberg methods.
- If time permits, you can compute the Reock score of one district at a time as follows: to www.geogebra.com, upload a map, draw a circle that just encloses a district, calculate the area of the circle in geogebra units, and use the map scale to convert to meters, then compare to the area of the district itself on the spreadsheet.
Evaluate measures

**Question.** What are advantages and disadvantages of these measures of compactness? Which of the measures do you think is the best? Why?
**Question.** If you were tasked to develop a mathematical criteria for detecting gerrymandering using compactness, what would you propose? Is there a compactness method and a threshold score beyond which you would argue a district is gerrymandered?
Argue in court

**Question.** Imagine that there is a court case involving the congressional districts for a certain state (e.g. NC or MD) for the current congress (116th congress, elected 2018). You are called as a subject matter expert to argue that the districts for that state are gerrymandered, or that they are not. Make your argument using data from class to support it. You can decide if you which state to choose and if you want to argue that the districts are gerrymandered or that they are not.
Homework

1. On the spreadsheet for the efficiency gaps for all 50 states, wherever there is an uncontested vote, there is a note that “the calculation assumes that in a contested race, 25% of votes would go to opponent”. Why do you think these numbers are chosen (75% to 25%) rather calculating wasted votes as usual (with 100% to 0%)? (Hint: what would the efficiency gap be for that district if it were calculated as usual, and is that a fair reflection of what is going on in that district? What would be the difference in wasted votes for a 75% to 25% split?)

   - You will need to make a copy of the data file before editing it.
   - The columns ShapeLength meters and ShapeArea sq meters give the perimeter and area of each district.
   - Please submit a screenshot of the computed P-P and Schwartzberg numbers, clearly labeled by district number and state, or you can copy the numbers and submit.
   - Please order by district number.
• Suggestion: Use spreadsheet formulas to avoid tedious repetitive work.

3. Which of these four measures of compactness do you think is best? (Polsby-Popper, Schwarzberg, Reock, or Convex Hull, or you can suggest another measure or a modified version of one of these). Give at least one reason why you prefer it.

4. Compactness criteria: We have come up with ways to give a compactness score for a district.
   (a) For one of the compactness measures (e.g. Polsby-Popper or Schwartzberg), find a threshold or criteria at which you would suspect that a district’s compactness score is suspicious. Your answer should specify a number for the threshold and which compactness measure, e.g. ”My threshold for Polsby-Popper is 0.45 - below this number is suspicious for gerrymandering”.

   (b) Explain how you arrived at this threshold and argue why it is reasonable. You can pretend that someone else is challenging your threshold in a court case.

5. Write up an argument to support ONE of the following statements.
   • NC congressional districts for the 116 Congress are gerrymandered (2018 elections 2019-2020 Congress)
   • NC congressional districts for the 116 Congress are not gerrymandered (2018 elections 2019-2020 congress)
   • Maryland congressional districts for the 116 Congress are gerrymandered (2018
Homework

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elections 2019-2020 congress)

• Maryland congressional districts for the 116 Congress are not gerrymandered (2018 elections 2019-2020 congress)

A good argument will include quantitative evidence, preferably more than one type (e.g. both efficiency gap and compactness), and will directly address the objections or arguments that someone with an opposing view might raise. A strong answer will compare numerical scores for the situation you are considering to established thresholds and / or other years or states. You may find support for your position (or a way to argue against an opponent’s objection) by considering other factors such as racial make-up of districts. You may want to cite other sources not used in class (informal citations are fine).