Context: This activity assumes that students have some exposure to the fairly abstract settings of 'Gridlandia" and the metagraph. Today's examples are a little more closely tied to actual data, focusing on drawing districts from scratch in Districtr. The main data for redistricting analysis comes in two forms: population and demographic data provided by the census and election returns aggregated at the level of precincts by individual states. These geographies are frequently incompatible (in the sense that the smaller census units don't nest nicely into the larger precincts) and may require significant processing with the MAUP package (pronounced mop) before a usable dual graph can be created.

The decennial census population totals are treated as ground truth throughout the entire cycle. As an example, when Virginia redrew its State House boundaries in 2019, it balanced them (to within 1%) using the populations from 2010[1]. Proper use of partisan data for analyzing districts does not have such a canonical option. Individual elections always have distinguishing features, districted elections have problems with candidate popularity and uncontested races, while statewide elections can turn on very different issues than more local contests. Additionally, some analysts prefer to use probabilistic models or projections rather than the concrete prior election returns and this modeling choice can heavily impact the relevant counterfactuals supported by the analysis.

Goal(s): Explore some of the initial tradeoffs in redistricting and compare basic properties of feasible plans. Build intuition for optimization methods. Practice partisan symmetry computations.

Districtr Details

Districtr is a tool for drawing districting plans through a web browser. It provides an easy-to-use interface and lots of evaluation metrics for the maps that you design. There are plenty of other similar pieces of software out there, including other free options like Dave's Redistricting App, DistrictBuilder, and PlanScore, up to the 10k per software license Maptitude for Redistricting program that most professional plan builders use. We'll take a brief look through Districtr's interface together before turning you loose to try it out and the linked Lesson Plan and User Guide provide some additional guidance about working with Districtr.

The following exercizes are intended to get you more experience with the tradeoffs that arise as you try to construct districting plans in Districtr. Several of the prompts are (purposefully) underdefined, effectively replicating the modeling problems from which they are derived. As you go through the examples, try to consider places where you have to make decisions about definitions and metrics - what criteria are you using to evaluate success?

- **Iowa - Congressional** Iowa is always a popular starting spot because there are only 99 counties that you have to consider, rather than the thousands of smaller units in most states.
  - What is the most population balanced Congressional plan you can find?
  - What is the maximum number of districts you can create that don't touch the boundary of the state?
  - If you make a districting plan balanced to within 2%, what is the maximum number of Democratic districts you can expect? How does this vary depending on the election you use? Does this change if the population target is 1% instead?
  - What is the largest difference you can find between two election years? That is, if you compare your plan's expected number of seats under each election, what is the largest deviation between the expected number of Democratic majority districts?
  - If you measure compactness by the number of adjacent counties that are not placed into the same district what is the most compact plan you can make that is population balanced within 2%? What about 1%?

[1] They also measured how many precincts were split by appealing to a map from early in the census cycle, even though many of those boundaries had changed over the course of the decade.

- **Michigan and/or Wisconsin - Congressional** Fairly recent battleground states are good places to experiment with the concepts of packing and cracking.
  - Can you create a plan with at least two cracked and at least two packed districts?
  - Try to create a plan with as many competitive districts as possible. What is the largest difference between the number of expected Democratic seats as you vary across all of the included elections?
  - Can you draw a plan where all boundary corners are right angles? Alternatively, what is the nicest looking plan you can make?
- **North Carolina, Pennsylvania, Virginia - Congressional** Each of these states had at least one map ruled unconstitutional in the last cycle.
  - Look at the election results from the year before the map was ruled unconstitutional. Can you make a map that is at least as extreme as the actual results? For example, a 10-3 North Carolina map.
  - Can you draw a map that is within one seat of statewide proportional representation?
  - Can you draw a map that reverses the gerrymandering in the same election? That is, given that a 10-3 map exists in North Carolina, can you find a 3-10 map? How close can you get?
- **Massachusetts - Congressional** One of the archetypal redistricting examples. The overall partisan balance is in the neighborhood of 35%-65% Democratic leaning but there hasn't been a Republican Representative in 37 years (and counting!).
  - Can you construct a district within 2% of the population balance that would be expected to elect a Republican under all elections? If not, what is the largest number of elections that seems to work?
  - How does the previous answer change if you build out of towns rather than precincts?
  - Draw a city council plan for the town of Lowell. How well does your map do in reflecting the overall demographic balance of the city? How does this answer change if you consider various types of coalition districts?
- **Chicago - City Council** The history of segregation in Chicago means that districted election systems must take geography into account in order to understand the potential for effective representation.
  - What is the most population balanced plan you can construct out of community areas?
  - How does the segregation of the districts change as you move from 50 individual districts to multi-member districts?
  - Compare the VAP balance to the total population balance in your districting plan. How significant is the difference for potential minority representation? Can you construct a plan that is balanced both for population and VAP?
- **Choose your own adventure!** Pick a favorite state and find its official legislation that governs redistricting.
  - What criteria are specified? How might you measure them?
  - Can you construct a plan that satisfies all of the criteria you identified?
  - Build a plan that tries to create boundaries that are as close to straight lines as possible. Using the evaluation tabs, determine whether you think the plan is reasonable. What changes might you want to make to create a fairer plan? Can you perform these while also keeping the straight boundaries?