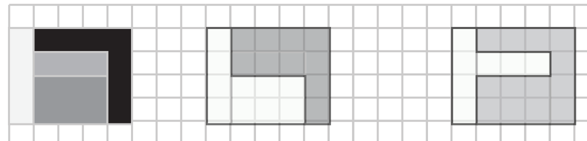
Redistricting Challenges

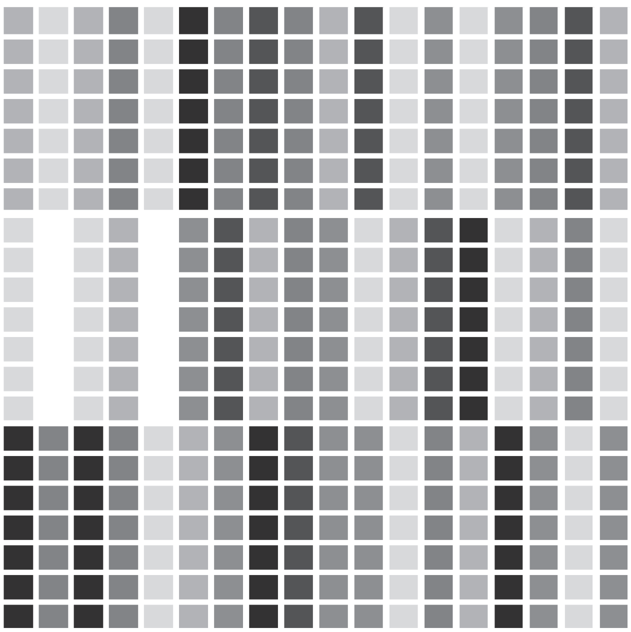
Challenge 1: Contiguity

Divide each of the following states into the assigned number of contiguous districts, without dividing blocks of the same shade. Make sure that all parts of a district are touching one another by segments *at least two squares wide*.

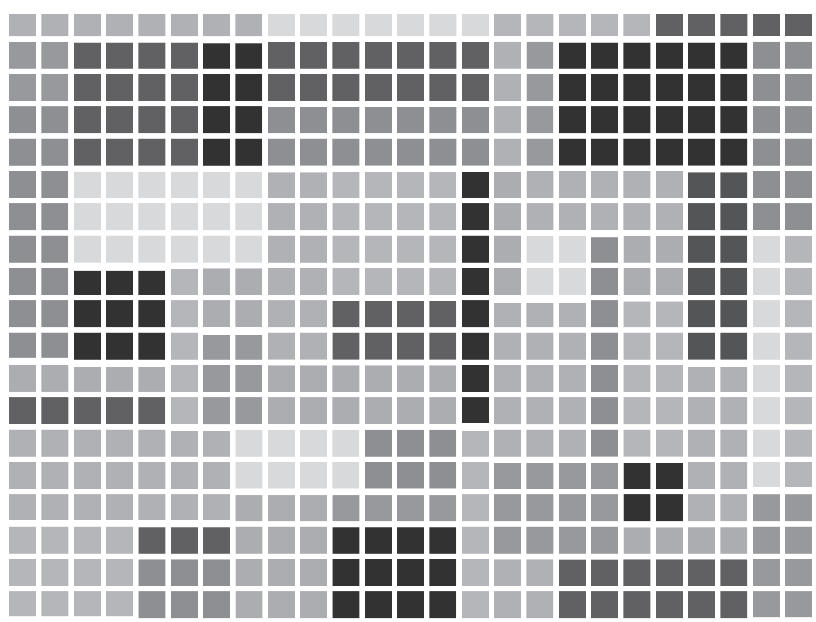
CONTIGUOUS **NOT CONTIGUOUS**



8 DISTRICTS

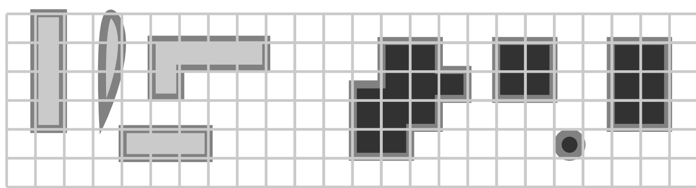


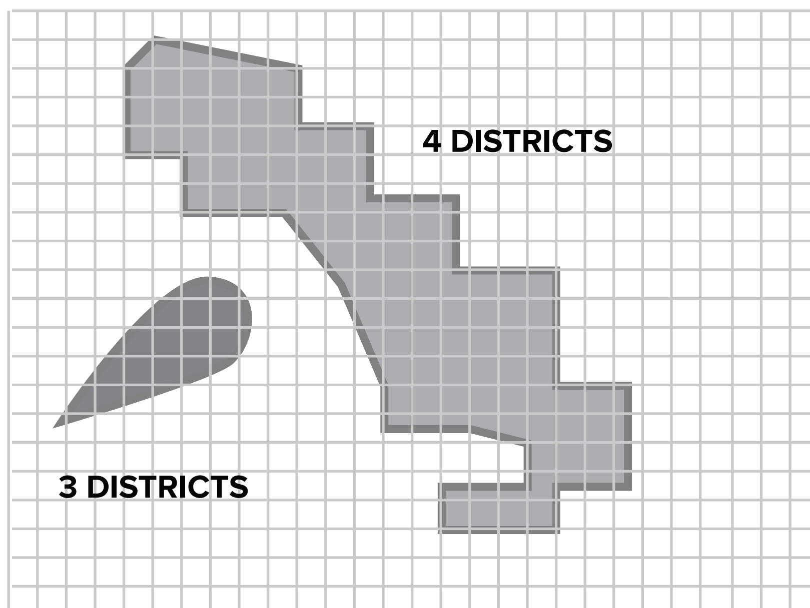
6 DISTRICTS

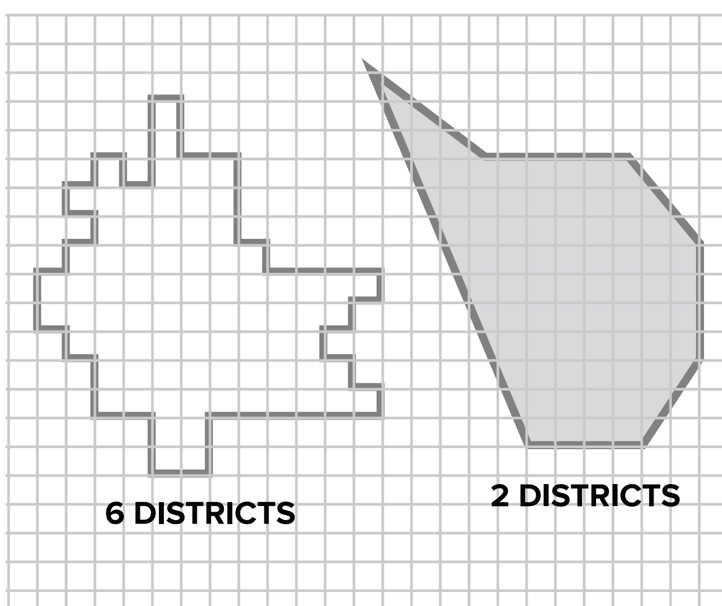


Part 1: Draw compact districts with a length/width ratio greater than 0.5. In other words, divide each of the following states into the assigned number of districts so that no district is more than two times as long (or tall) as it is wide.

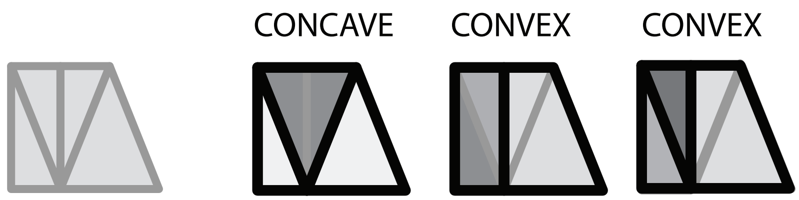
NOT COMPACT **COMPACT**

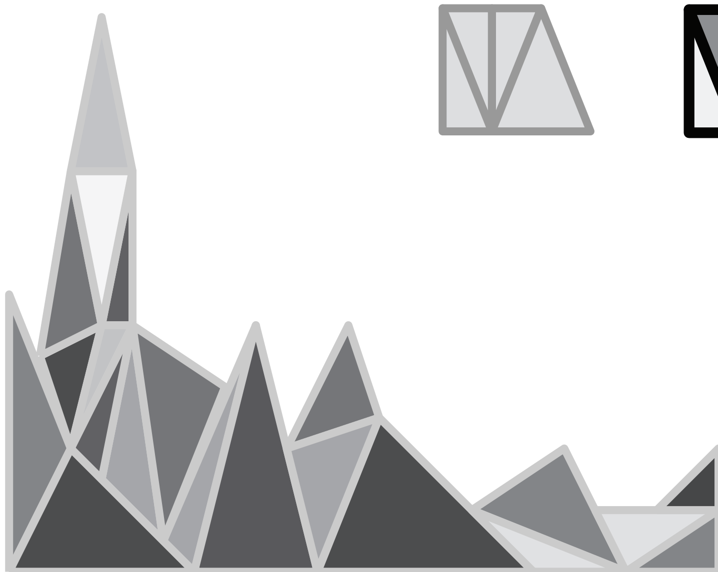




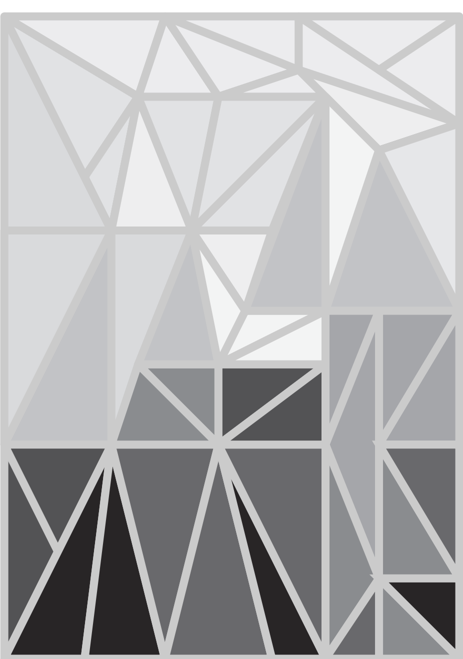


Part 2: Design districts that are convex. Compact shapes are by definition convex, meaning that they do not contain any indentations or protuberances. Following the provided lines (analogies for populations of interest, geographic features, or other pre-existing boundaries), divide the following states into the assigned number of districts, so that all states are convex and contain

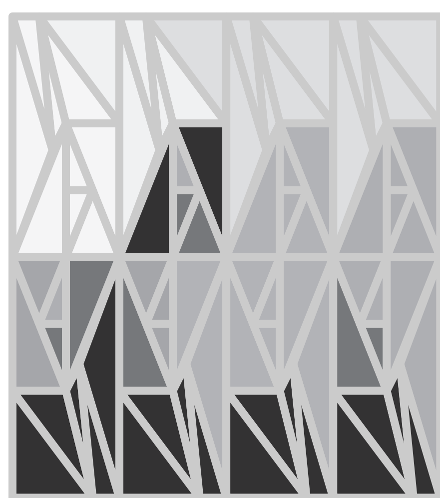




8 DISTRICTS



4 DISTRICTS

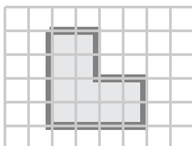


6 DISTRICTS

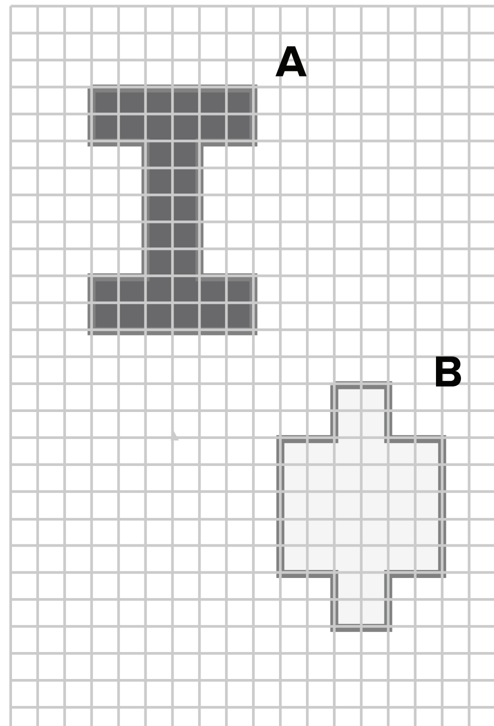
Part 3: Rank the following districts by compactness as measured by the Polsby-Popper ratio.

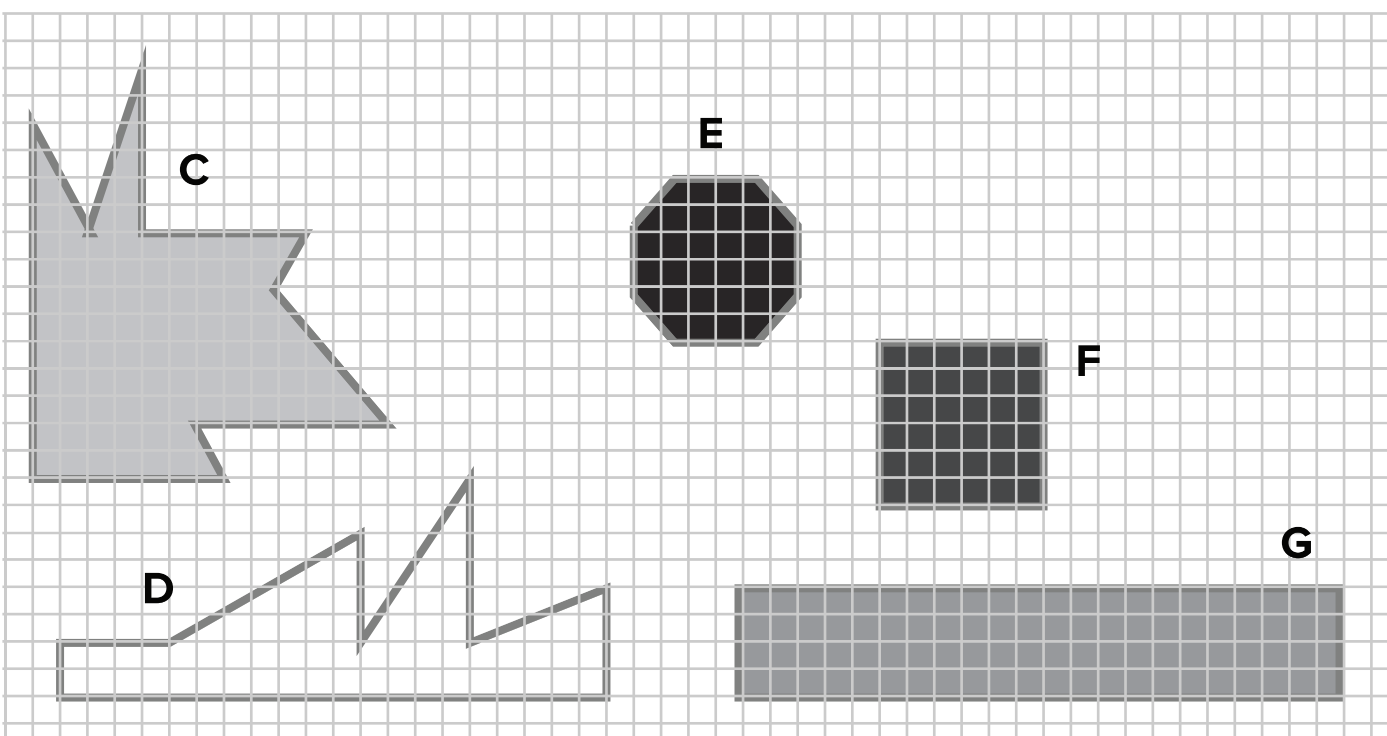
Polsby-Popper Ratio $$\frac{4\pi\,(\text{area of the district})}{(\text{perimeter of the district})^2}$$

Area = 12 units^2
Perimeter = 16



$$\frac{4\pi\,(12\text{units}^2)}{(16)^2} = \frac{48\pi}{256} = 0.59$$

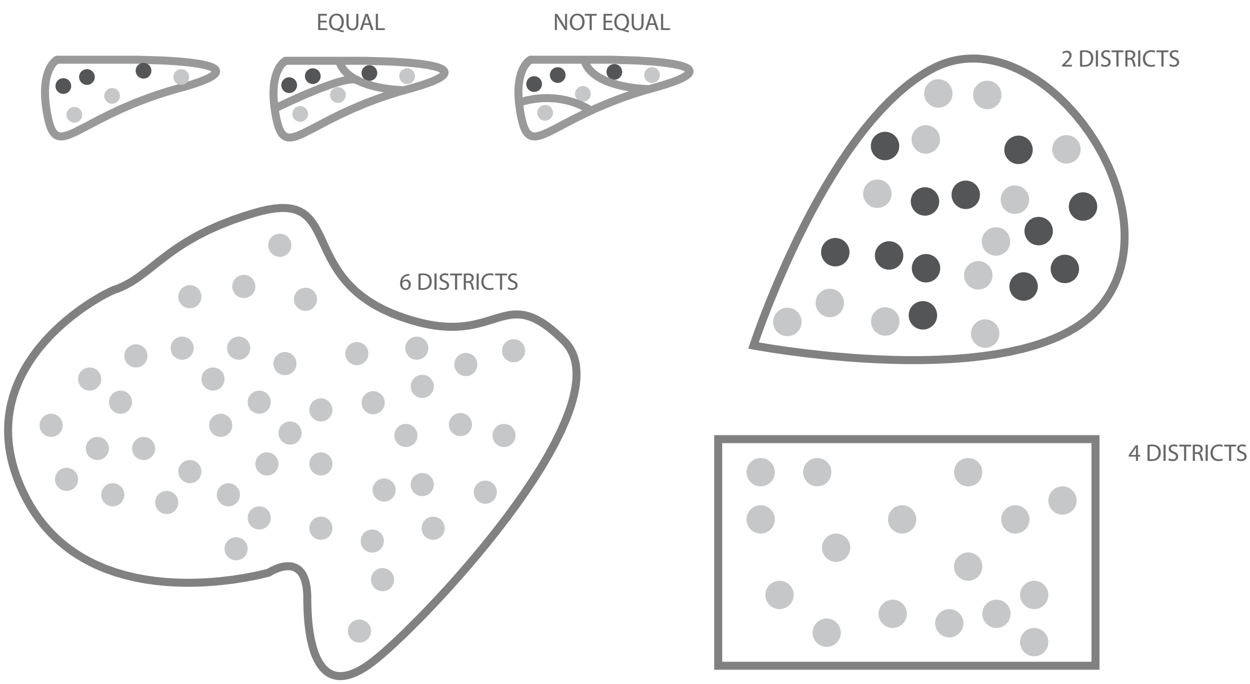




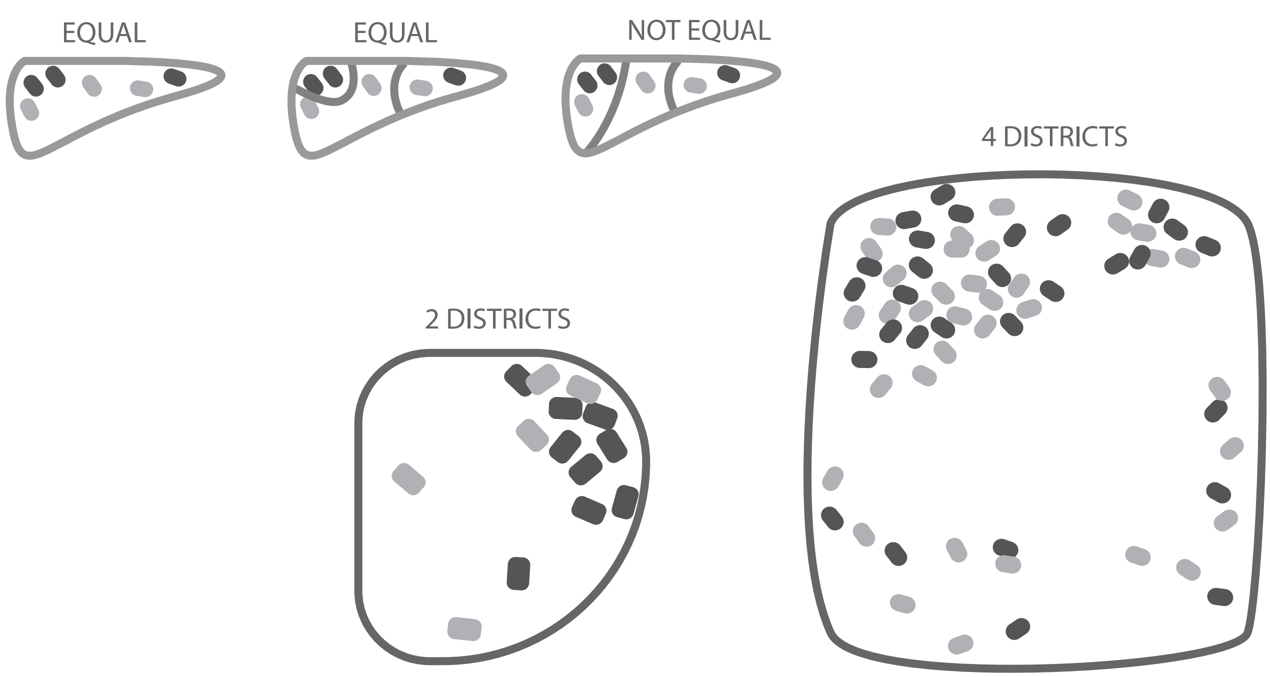
Challenge 3: Population Equality

Divide each of the following states into the assigned number of districts so that each district has an equal population size.

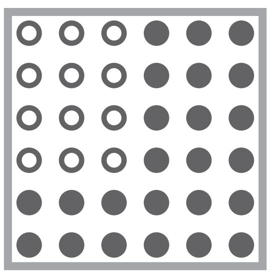
Part 1: In this scenario voters live in equal, if low, density throughout the state.



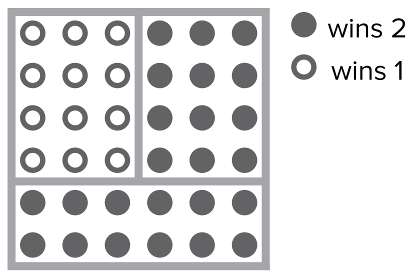
Part 2: This scenario is more realistic; voters live in different population densities throughout



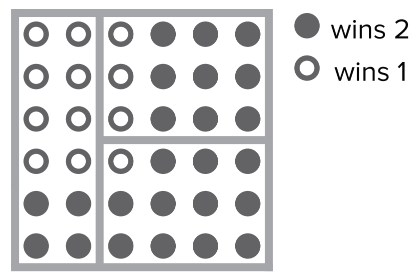
In the imaginary state below, there are 36 voters that must be divided into three districts with 12 voters in each district. This state, like all states, contains voters who tend to vote a certain way on key issues or political party candidates. In this imaginary state, 12 of the voters are open circle voters (1/3 of the population), and the other 24 are filled-circle voters (2/3 of the population). In order to win a district, voters of one type must make up the majority (7 or more) of the voters in a district. With fair redistricting, the outcome of an election in this state should reflect the ratio of dashed to solid voters. Dashed voters should win one of the three districts, and solid voters should win the other two.



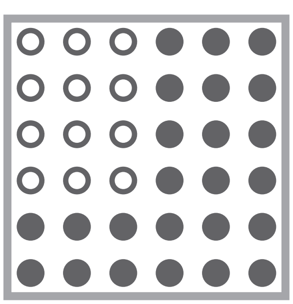
FAIR



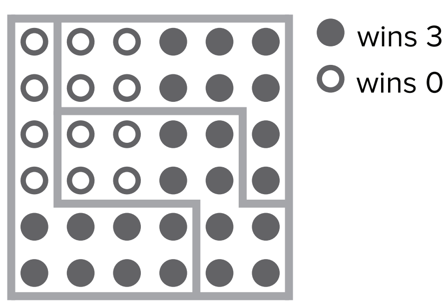
FAIR



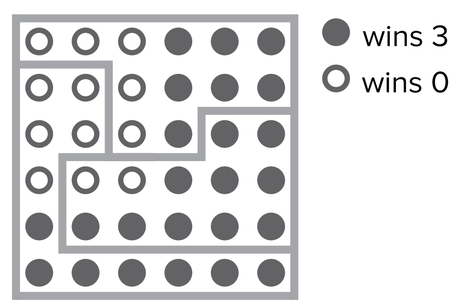
It’s possible to draw districts so that open-circle voters could never achieve a majority, thus ensuring that they are not represented in the outcome of district voting. This is an example of **gerrymandering**. Here’s what that could look like:



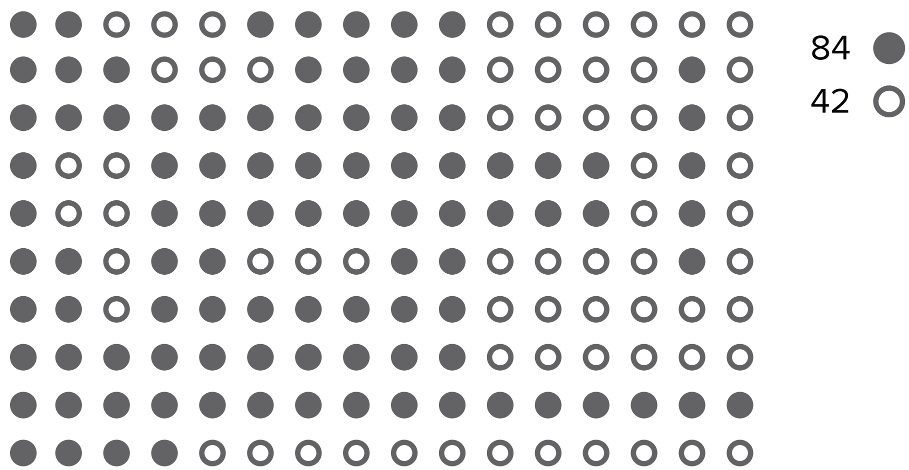
UNFAIR



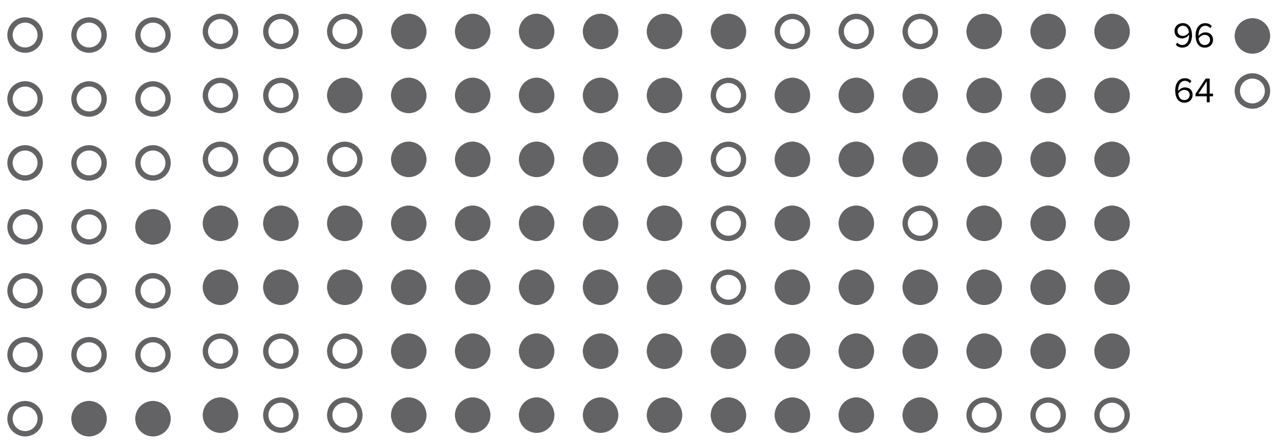
UNFAIR



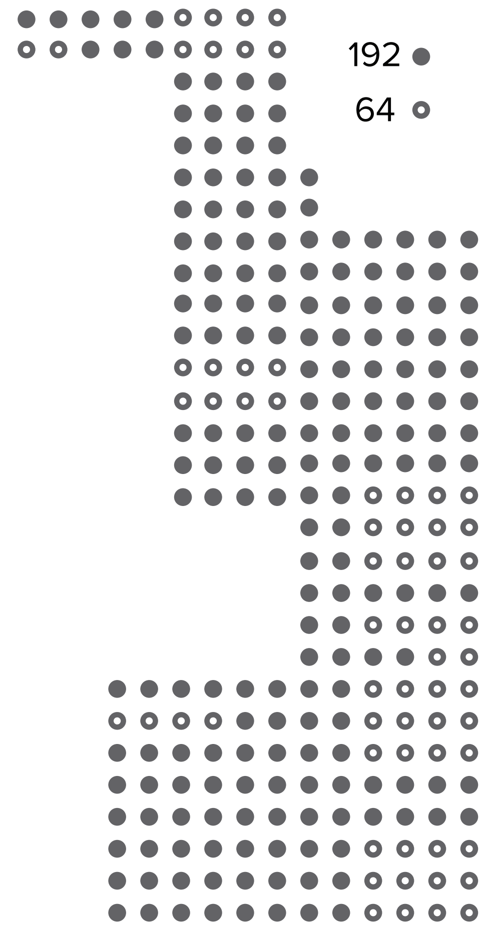
Your challenge is to draw fair districts for each of the following imaginary states, where each dot represents a block of 10,000 voters. For each state, the number of districts and the ideal voting outcome is indicated. Dashed voters are in the minority in each state. As you draw your districts, make sure that you follow the principles of population **equality**, **compactness**, and **contiguity**.



6 DISTRICTS: 4 ● 2 ○

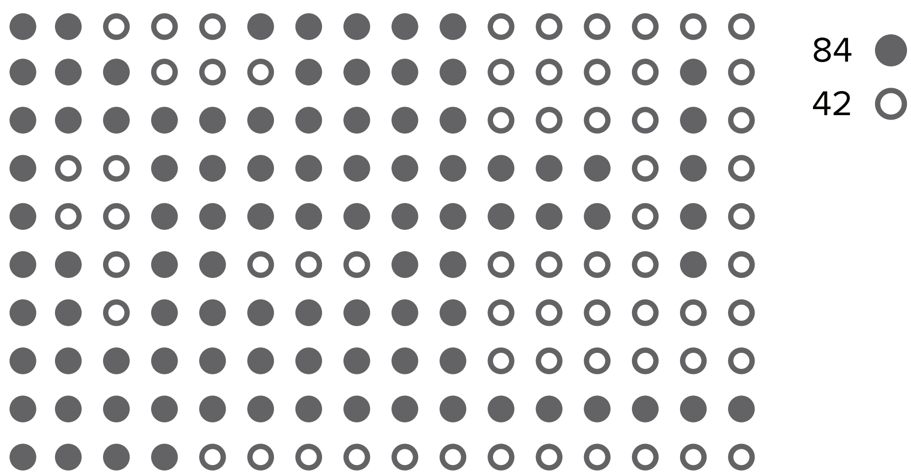


5 DISTRICTS: 3 ● 2 ○

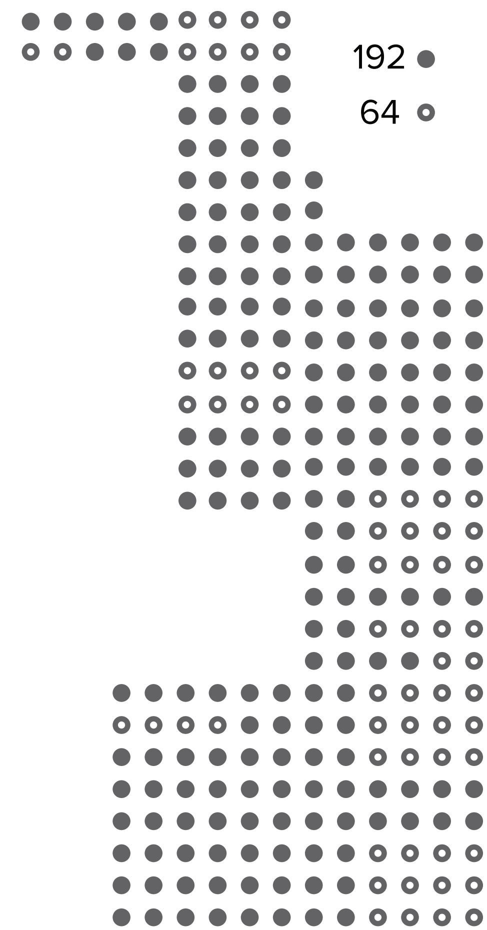


4 DISTRICTS: 3 ● 1 ○

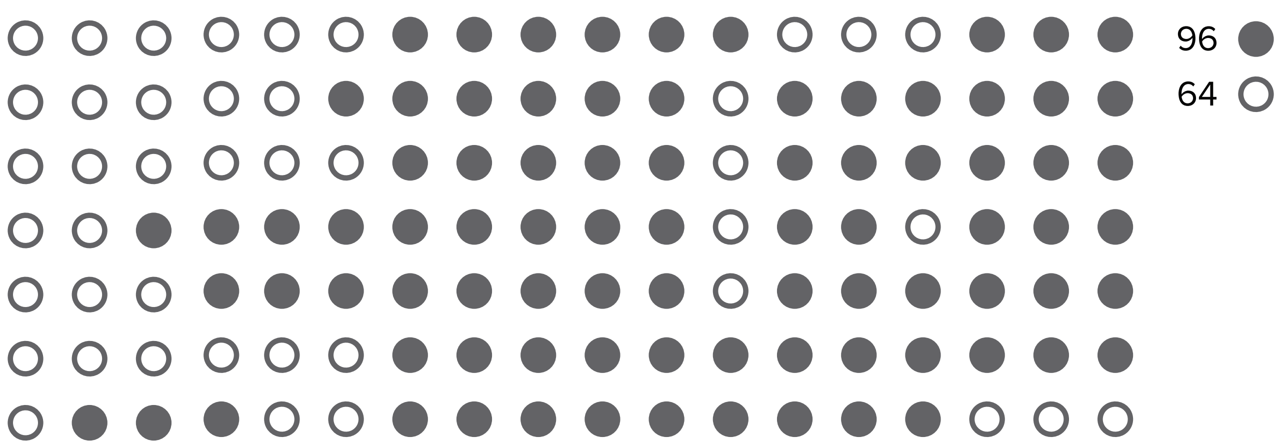
Split the clusters of voters into different districts so that the solid voters have a majority in every district.



6 DISTRICTS: 6 0



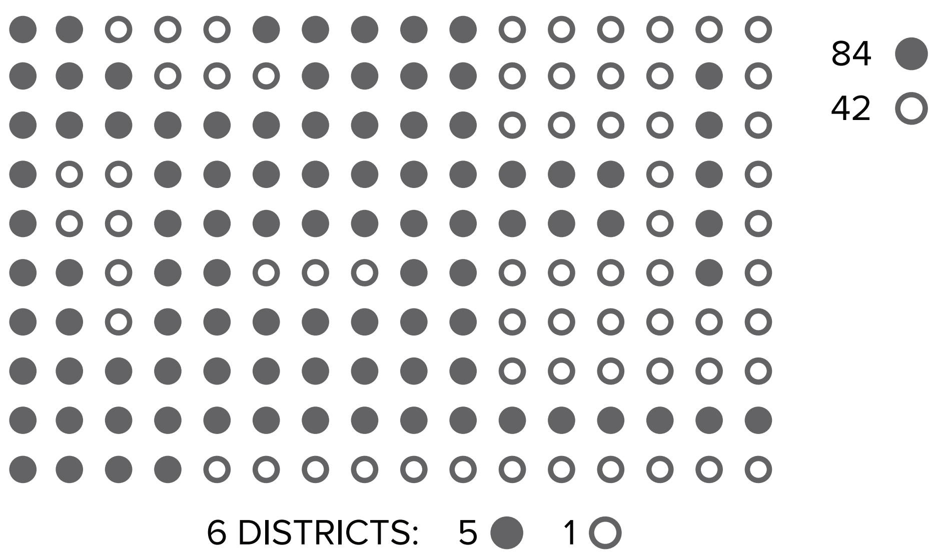
4 DISTRICTS: 4 0

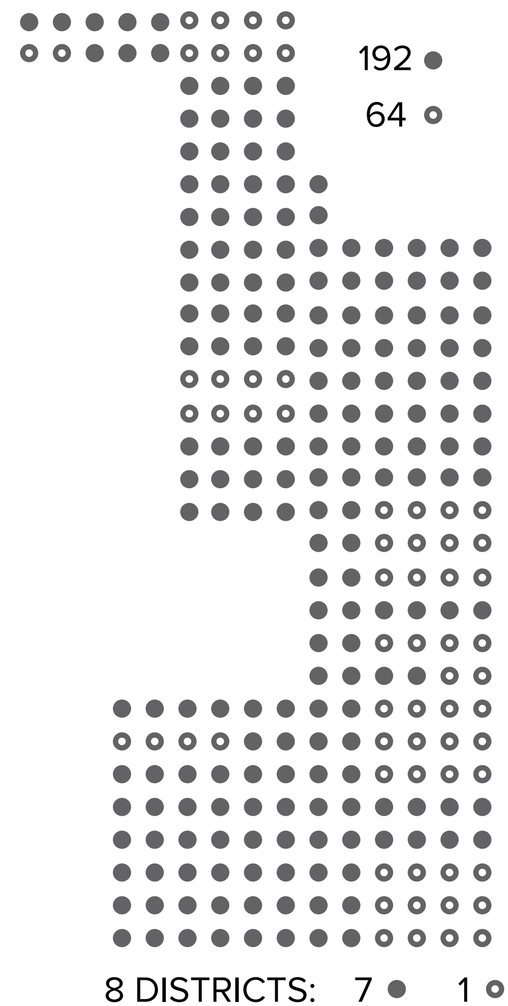


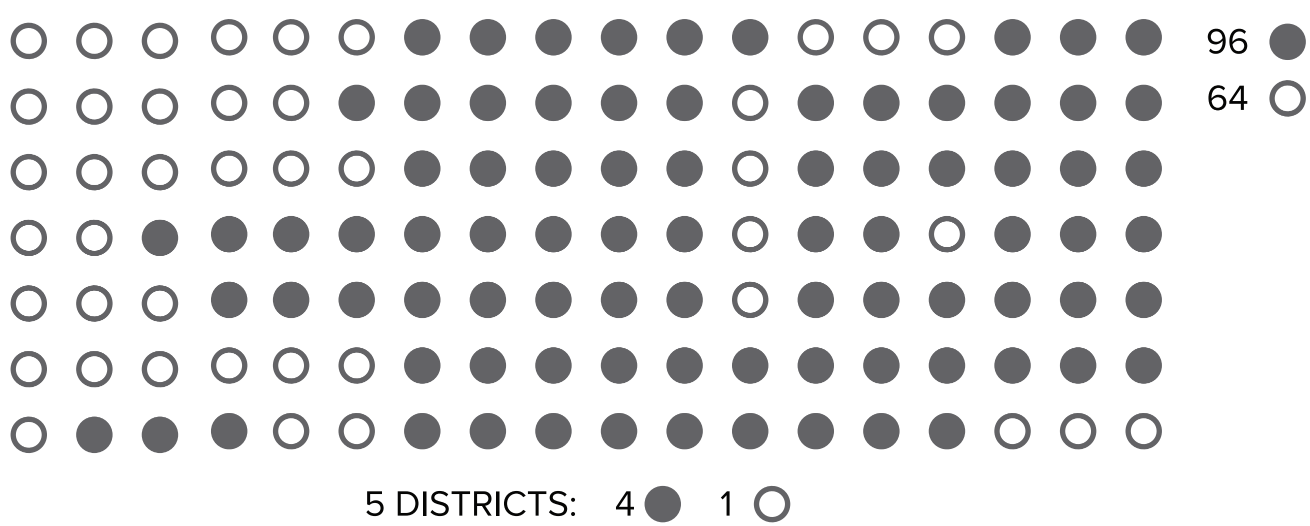
5 DISTRICTS: 5 0

Part 3. Packing Districts

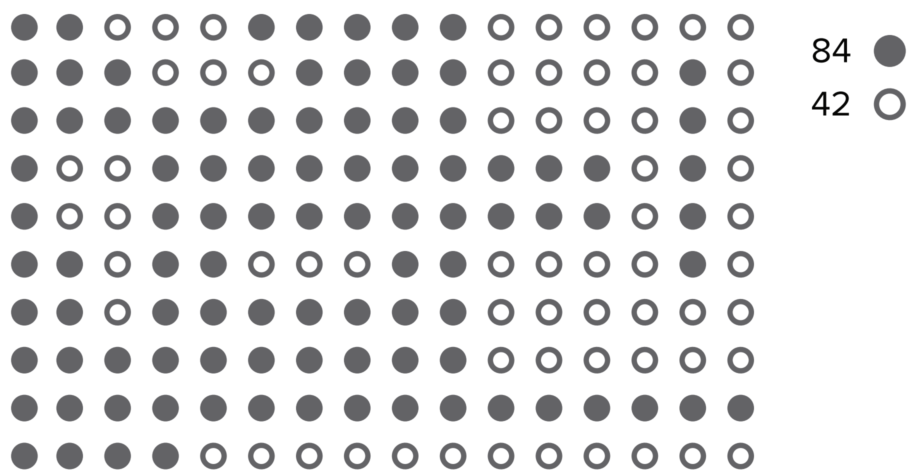
Try to pack the groups of open-circle voters into one or two districts, so that solid voters win more districts than they should under a fair redistricting plan.



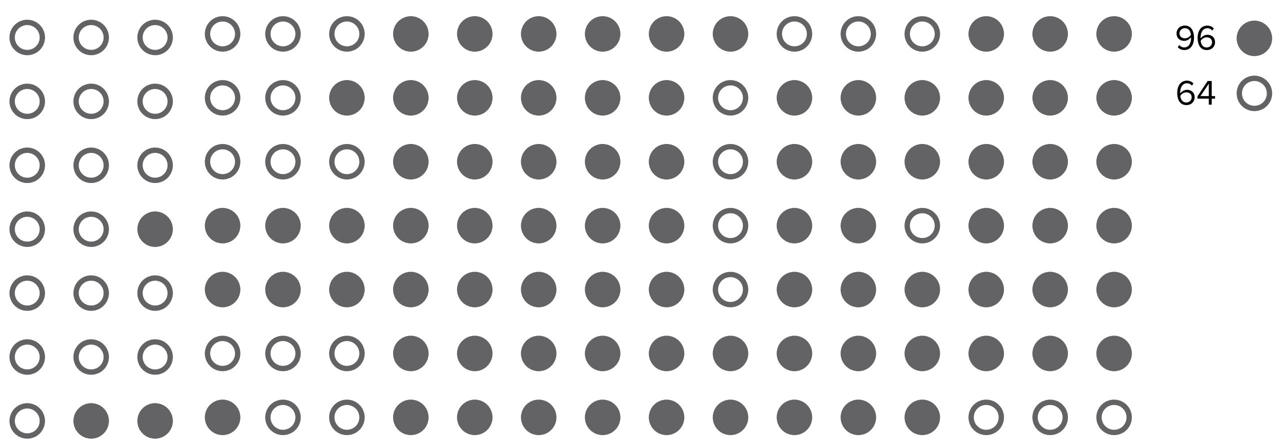




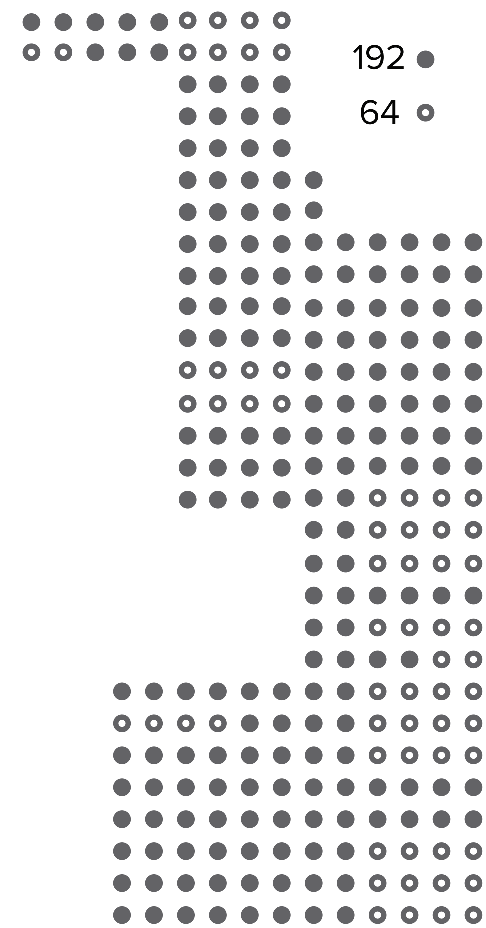
Try to “stack the deck” in favor of the minority open-circlevoters. Create districts that ensure that open-circlevoters, who are in the minority, win more districts than they would if the lines were drawn fairly.



6 DISTRICTS: 3 ● 3 ○



5 DISTRICTS: 2 ● 3 ○



8 DISTRICTS: 5 ● 3 ○

Real Congressional Distrcits

Gerrymandered districts tend to look weird because they are often neither compact nor contiguous. Take a look at the following series of 8 districts taken from real states from the 115th congressional district map. Experts in the fields of political science, statistics, and sociology have deemed four of these districts as some of “the most gerrymandered” districts in the United States, in part because they are the least compact. Can you guess which ones may have been gerrymandered?