Supreme Court Associate Justice Anthony Kennedy gave no sign that he has abandoned his view that extreme partisan gerrymandering might violate the Constitution. | Eric Thayer/Getty Images

Supreme Court eyes partisan gerrymandering

Anthony Kennedy is seen as the swing vote that could blunt GOP's map-drawing successes.

SUPREME COURT OF THE UNITED STATES

Syllabus

VIRGINIA HOUSE OF DELEGATES ET AL. *v.*
BETHUNE-HILL ET AL.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF VIRGINIA

No. 18–281. Ar

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SUPREME COURT OF THE UNITED STATES

Syllabus

RUCHO ET AL. *v.* COMMON CAUSE ET AL.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE MIDDLE DISTRICT OF NORTH CAROLINA

No. 18–422. Argued March 26, 2019—Decided June 27, 2019*

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Next Gerrymandering Battle in North Carolina: Congress

A North Carolina court threw out the state's legislative map as an illegal gerrymander. Now the same court could force the state to redraw the state's congressional districts as well.

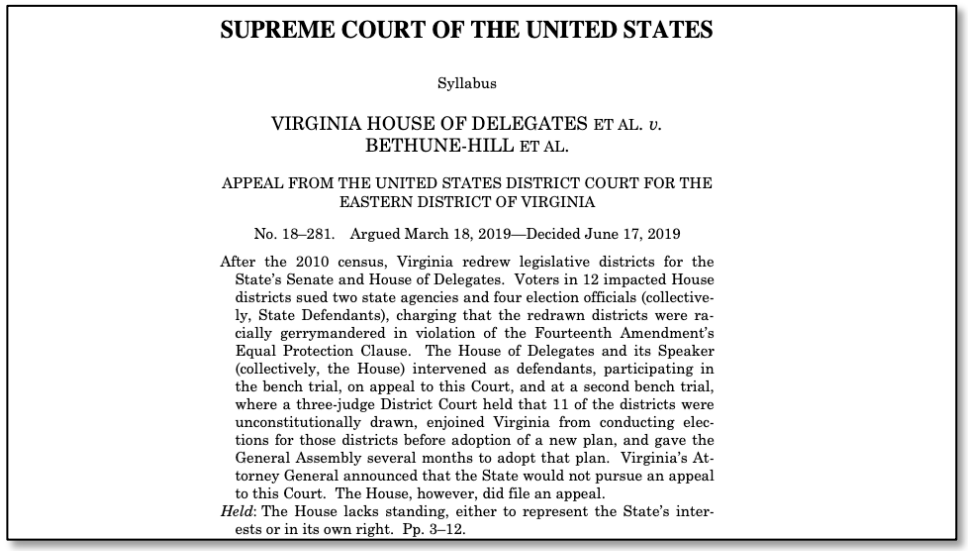
Gerrymandering

- Manipulating electoral district boundaries to favor one political party over others
- Coined in an 1812 Political cartoon
- Governor **Elbridge Gerry** signed a bill that redistricted Massachusetts to benefit his Democratic-Republican Party

The Gerrymander

According to the Supreme Court

- Gerrymandering cannot be used to:
  - Disadvantage racial/ethnic/religious groups
- It can be used to:
  - Disadvantage political parties



SUPREME COURT OF THE UNITED STATES

Syllabus

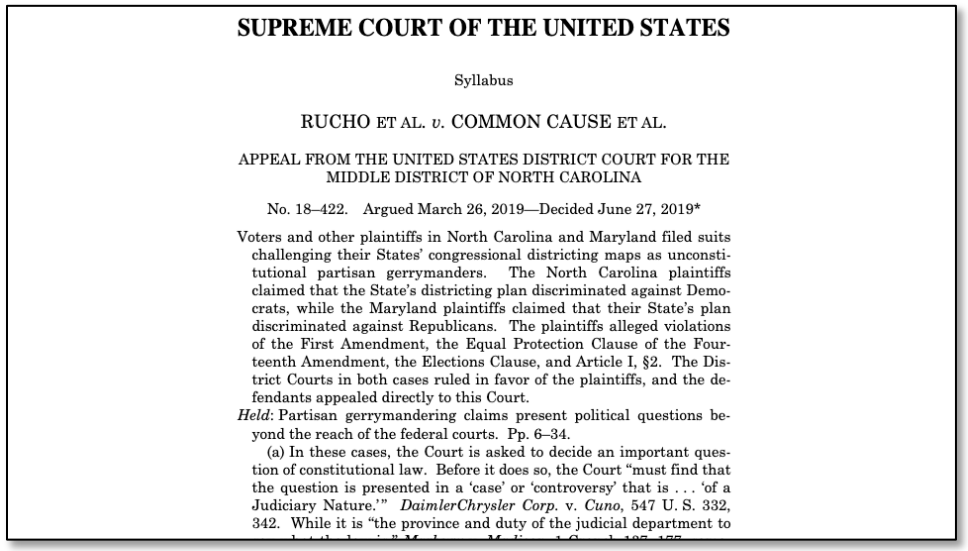
VIRGINIA HOUSE OF DELEGATES ET AL. *v.*
BETHUNE-HILL ET AL.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF VIRGINIA

No. 18–281. Argued March 18, 2019—Decided June 17, 2019

After the 2010 census, Virginia redrew legislative districts for the State's Senate and House of Delegates. Voters in 12 impacted House districts sued two state agencies and four election officials (collectively, State Defendants), charging that the redrawn districts were racially gerrymandered in violation of the Fourteenth Amendment's Equal Protection Clause. The House of Delegates and its Speaker (collectively, the House) intervened as defendants, participating in the bench trial, on appeal to this Court, and at a second bench trial, where a three-judge District Court held that 11 of the districts were unconstitutionally drawn, enjoined Virginia from conducting elections for those districts before adoption of a new plan, and gave the General Assembly several months to adopt that plan. Virginia's Attorney General announced that the State would not pursue an appeal to this Court. The House, however, did file an appeal.

Held: The House lacks standing, either to represent the State's interests or in its own right. Pp. 3–12.



SUPREME COURT OF THE UNITED STATES

Syllabus

RUCHO ET AL. *v.* COMMON CAUSE ET AL.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE MIDDLE DISTRICT OF NORTH CAROLINA

No. 18–422. Argued March 26, 2019—Decided June 27, 2019*

Voters and other plaintiffs in North Carolina and Maryland filed suits challenging their States' congressional districting maps as unconstitutional partisan gerrymanders. The North Carolina plaintiffs claimed that the State's districting plan discriminated against Democrats, while the Maryland plaintiffs claimed that their State's plan discriminated against Republicans. The plaintiffs alleged violations of the First Amendment, the Equal Protection Clause of the Fourteenth Amendment, the Elections Clause, and Article I, §2. The District Courts in both cases ruled in favor of the plaintiffs, and the defendants appealed directly to this Court.

Held: Partisan gerrymandering claims present political questions beyond the reach of the federal courts. Pp. 6–34.

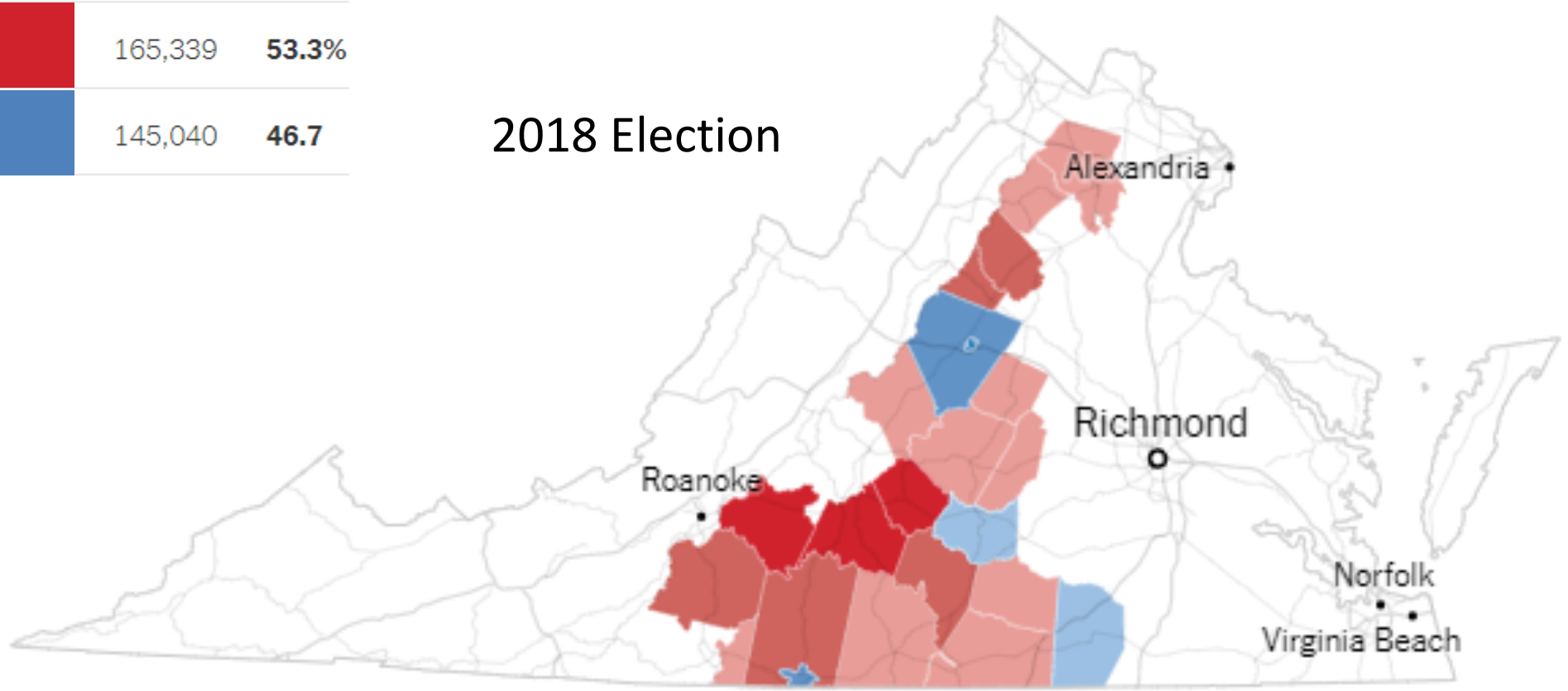
(a) In these cases, the Court is asked to decide an important question of constitutional law. Before it does so, the Court "must find that the question is presented in a 'case' or 'controversy' that is . . . 'of a Judiciary Nature.'" *DaimlerChrysler Corp.* v. *Cuno*, 547 U. S. 332, 342. While it is "the province and duty of the judicial department to

VA 5th District

VA 5th District

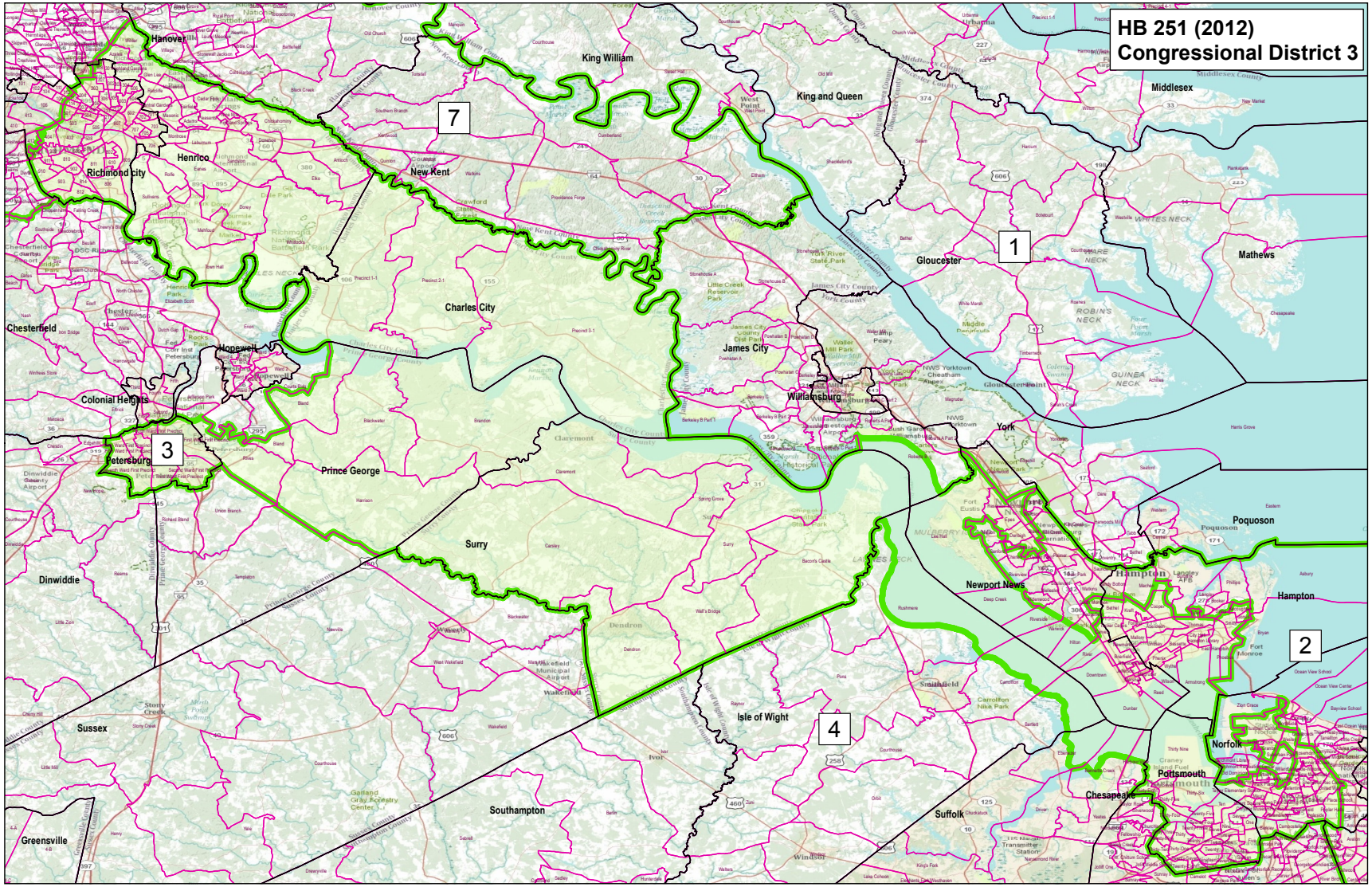
	Votes	Pct.
	165,339	**53.3%**
	145,040	**46.7**

2018 Election



Gerrymandering Today

- Computers make it really effective



Gerrymandering Today

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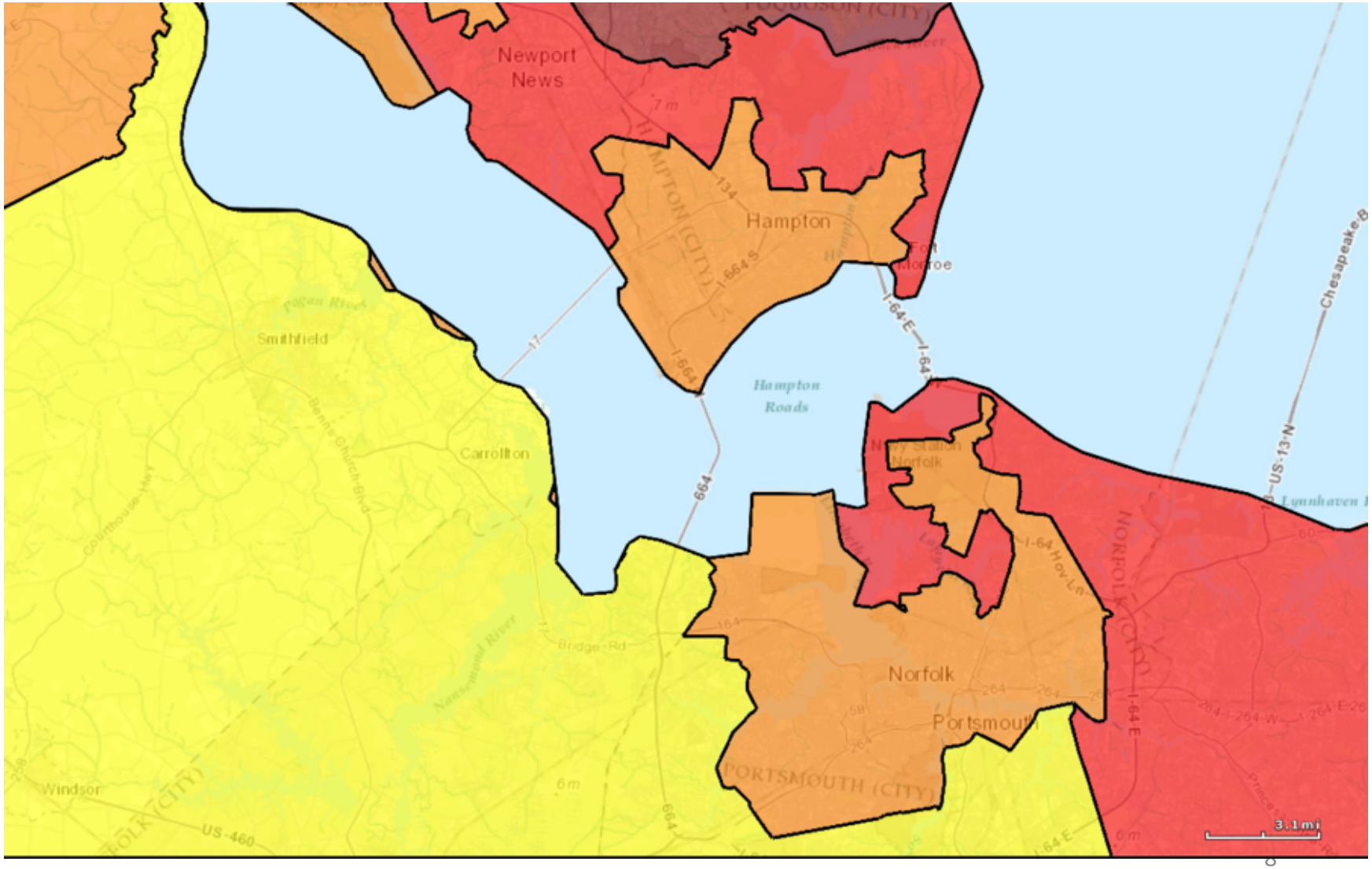
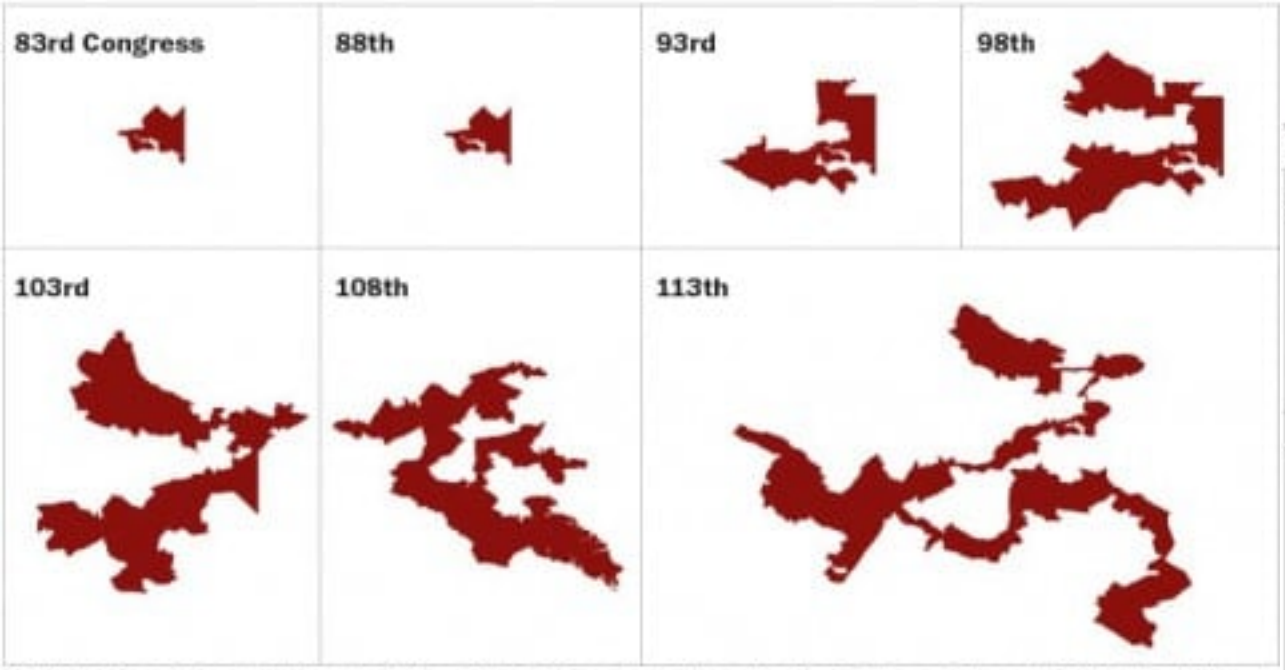


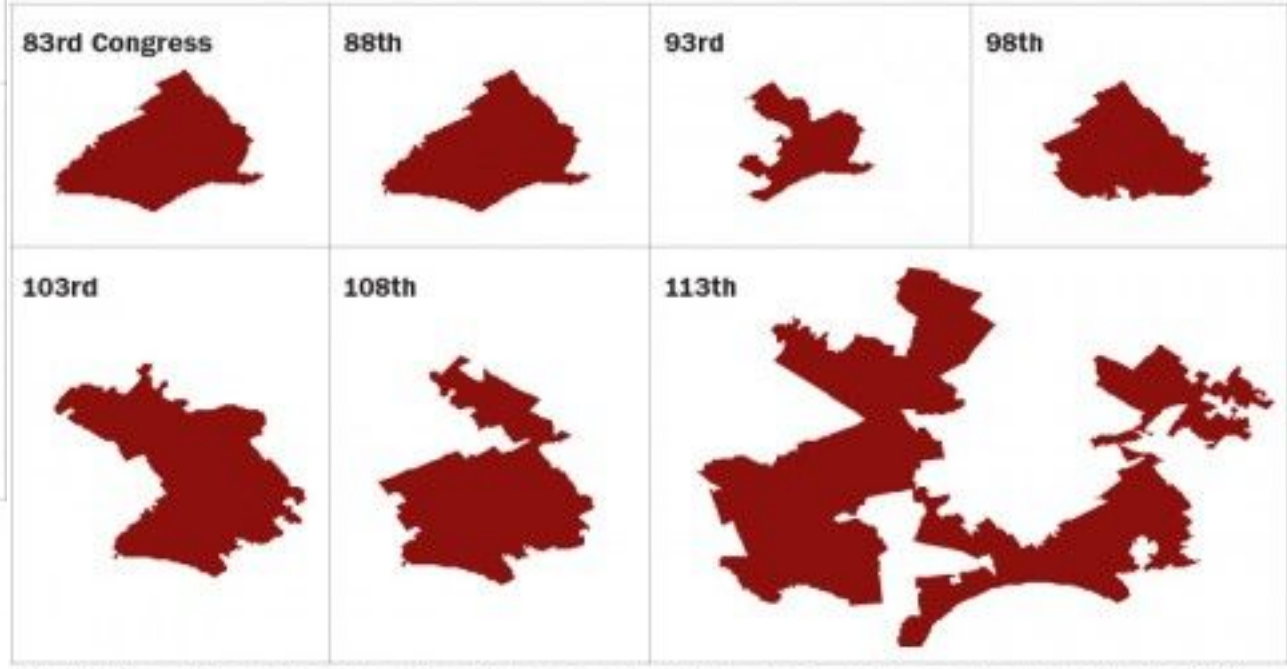
Gerrymandering Today

THE EVOLUTION OF MARYLAND'S THIRD DISTRICT



SOURCE: Shapefiles maintained by Jeffrey B. Lewis, Brandon DeVine, Lincoln Pritcher and Kenneth C. Martis, UCLA.
Drawn to scale.
GRAPHIC: The Washington Post. Published May 20, 2014

THE EVOLUTION OF PENNSYLVANIA'S SEVENTH DISTRICT



SOURCE: Shapefiles maintained by Jeffrey B. Lewis, Brandon DeVine, Lincoln Pritcher and Kenneth C. Martis, UCLA.
Drawn to scale.
GRAPHIC: The Washington Post. Published May 20, 2014

How does it work?

- States are broken into precincts
- All precincts have the same size
- We know voting preferences of each precinct
- Group precincts into districts to maximize the number of districts won by my party

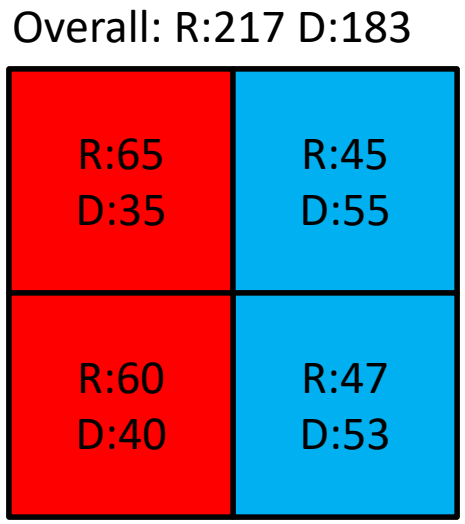
Overall: R:217 D:183

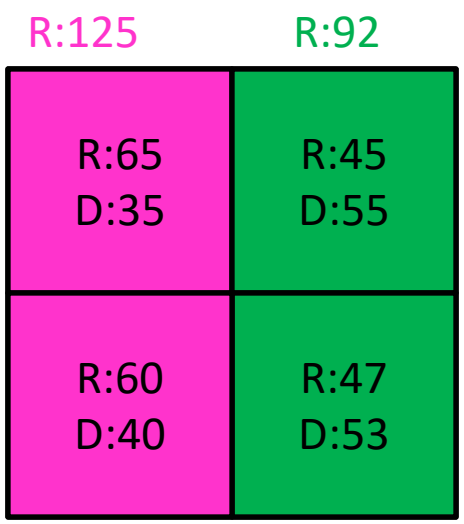
R:65 D:35	R:45 D:55
R:60 D:40	R:47 D:53

vs

How does it work?

- States are broken into precincts
- All precincts have the same size
- We know voting preferences of each precinct
- Group precincts into districts to maximize the number of districts won by my party





Gerrymandering Problem Statement

- Given:
  - A list of precincts: $p_1, p_2, \ldots, p_n$
  - Each containing m voters
- Output:
  - Districts $D_1, D_2 \subset \{p_1, p_2, \ldots, p_n\}$
  - Where $|D_1| = |D_2|$
  - $R(D_1) > \frac{mn}{4}$ and $R(D_2) > \frac{mn}{4}$
    - $R(D_i)$ gives number of "Regular Party" voters in D_i
    - $R(D_i) > \frac{mn}{4}$ means D_i is majority "Regular Party"
  - "failure" if no such solution is possible

Valid Gerrymandering!

$$m \cdot \frac{n}{2} \cdot \frac{1}{2}$$

Dynamic Programming

- Requires Optimal Substructure
  - Solution to larger problem contains the solutions to smaller ones
- Idea:
  1. Identify the recursive structure of the problem
     - What is the "last thing" done?
  2. Save the solution to each subproblem in memory
  3. Select a good order for solving subproblems
     - "Top Down": Solve each recursively
     - "Bottom Up": Iteratively solve smallest to largest

Dynamic Programming

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Consider the last precinct

After assigning the first $n-1$ precincts $p_1, p_2, \dots, p_{n-1}$

D_1
k precincts
x voters for R

D_2
$n-k-1$ precincts
y voters for R

If we assign p_n to D_1

p_n

If we assign p_n to D_2

D_1
$k+1$ precincts
$x + R(p_n)$ voters for R

Valid gerrymandering if:
$k+1 = \frac{n}{2}$,
$x + R(p_n), y > \frac{mn}{4}$

D_2
$n-k$ precincts
$y + R(p_n)$ voters for R

Valid gerrymandering if:
$\mathrm{n} - k = \frac{n}{2}$,
$x, y + R(p_n) > \frac{mn}{4}$

World One
D_1
$k+1$ precincts
$x + R(p_n)$ voters for R

D_2
$n-k-1$ precincts
y voters for R

World Two
D_1
k precincts
x voters for R

D_2
$n-k$ precincts
$y + R(p_n)$ voters for R

Define Recursive Structure

$S(j, k, x, y) =$ True if from among the first $\boldsymbol{j}$ precincts:

$\boldsymbol{k}$ are assigned to D_1

$n \times n \times mn \times mn$

exactly $\boldsymbol{x}$ vote for R in D_1

exactly $\boldsymbol{y}$ vote for R in D_2

4D Dynamic Programming!!!

Two ways to satisfy $S(j,k,x,y)$:

$S(j,k,x,y)$ = True if:

from among the first j precincts

k are assigned to D_1

exactly x vote for R in D_1

exactly y vote for R in D_2

D_1
$k-1$ precincts
$x - R(p_j)$ voters for R

D_2
$j-k$ precincts
y voters for R

p_j

Then assign p_j to D_1

OR

D_1
k precincts
x voters for R

D_2
$j-1-k$ precincts
$y - R(p_j)$ voters for R

p_j

Then assign p_j to D_2

D_1
k precincts
x voters for R

D_2
$j-k$ precincts
y voters for R

$$S(j,k,x,y) = S(j-1,k-1,x-R(p_j),y) \vee S\left(j-1,k,x,y-R(p_j)\right)$$

Final Algorithm

$$S(j,k,x,y) = S(j-1,k-1,x-R(p_j),y) \vee S\left(j-1,k,x,y-R(p_j)\right)$$

Initialize $S(0,0,0,0) = \text{True}$

for $j = 1, \dots, n$:

  for $k = 1, \dots, \min(j, \frac{n}{2})$:

    for $x = 0, \dots, jm$:

      for $y = 0, \dots, jm$:

        $S(j,k,x,y) =$

$$S(j-1,k-1,x-R(p_j),y) \vee S\left(j-1,k,x,y-R(p_j)\right)$$

Search for True entry at $S(n, \frac{n}{2}, > \frac{mn}{4}, > \frac{mn}{4})$

$S(j,k,x,y) = \text{True}$ if:

from among the first j precincts

k are assigned to D_1

exactly x vote for R in D_1

exactly y vote for R in D_2

Run Time

$$S(j,k,x,y) = S\big(j-1,k-1,x-R(p_j),y\big) \vee S\Big(j-1,k,x,y-R\big(p_j\big)\Big)$$

Initialize $S(0,0,0,0) = \text{True}$

n for $j = 1, \dots, n$:

$\frac{n}{2}$ for $k = 1, \dots, \min(j, \frac{n}{2})$:

nm for $x = 0, \dots, jm$:

nm for $y = 0, \dots, jm$:

$S(j,k,x,y) =$

$$S\big(j-1,k-1,x-R(p_j),y\big) \vee S\Big(j-1,k,x,y-R\big(p_j\big)\Big)$$

$\Theta(n^4m^2)$

Search for True entry at $S(n, \frac{n}{2}, > \frac{mn}{4}, > \frac{mn}{4})$

$\Theta(n^4 m^2)$

- Input: list of precincts (size n), number of voters (integer m)
- Runtime depends on the *value* of m, not *size* of m
  - Run time is exponential in *size* of input
  - Input size is $n + |m| = n + \log m$
- Note: Gerrymandering is NP-Complete