

Shapes of
voting districts

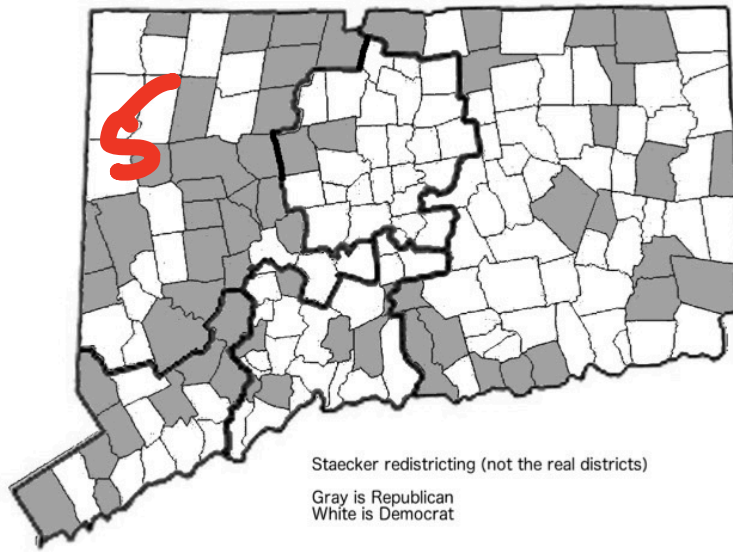
65% / 35%

D / R

All 5 districts
are D's

Proportional Representation^{PR}: In a
democracy, if $X\%$ of people
support a party, then that party
should be represented about $X\%$

USA does not have a PR system



Looks more
 "natural",
 and lets #5
 elect a republican.

Moving the lines makes
 a big difference.

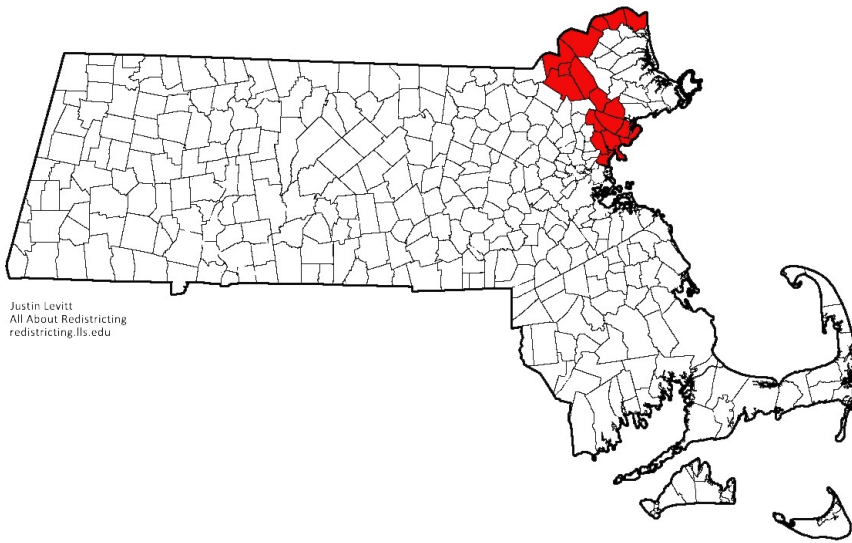
Usually, the people drawing the lines
 are not neutral

Drawing lines to achieve partisan gains
 is called Gerrymandering.

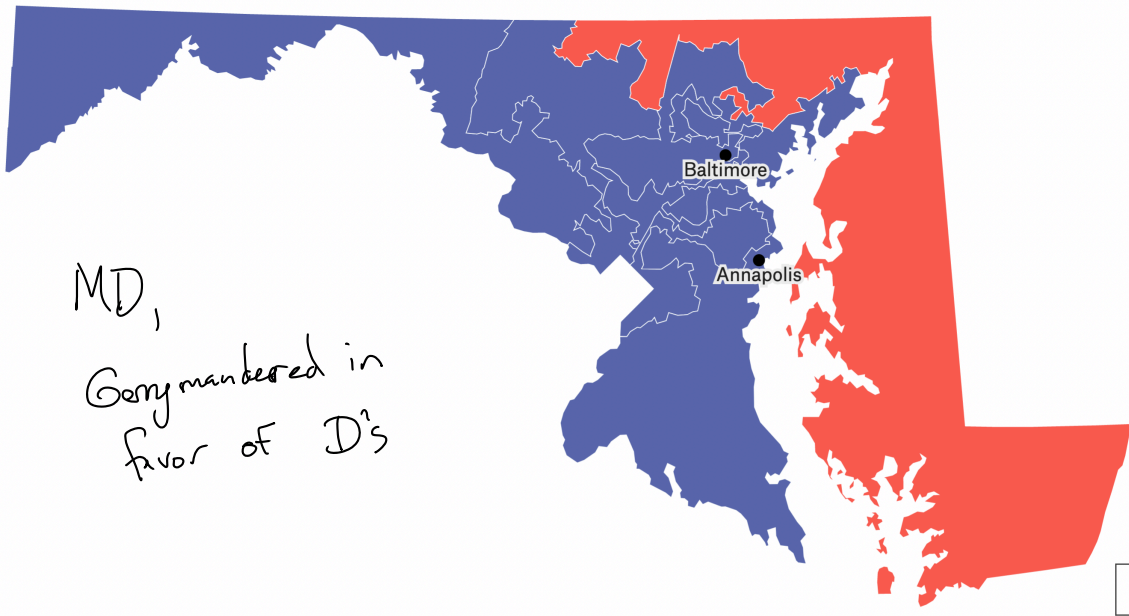


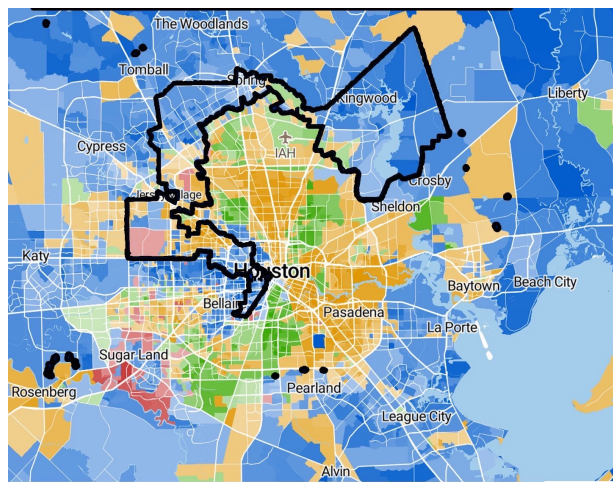
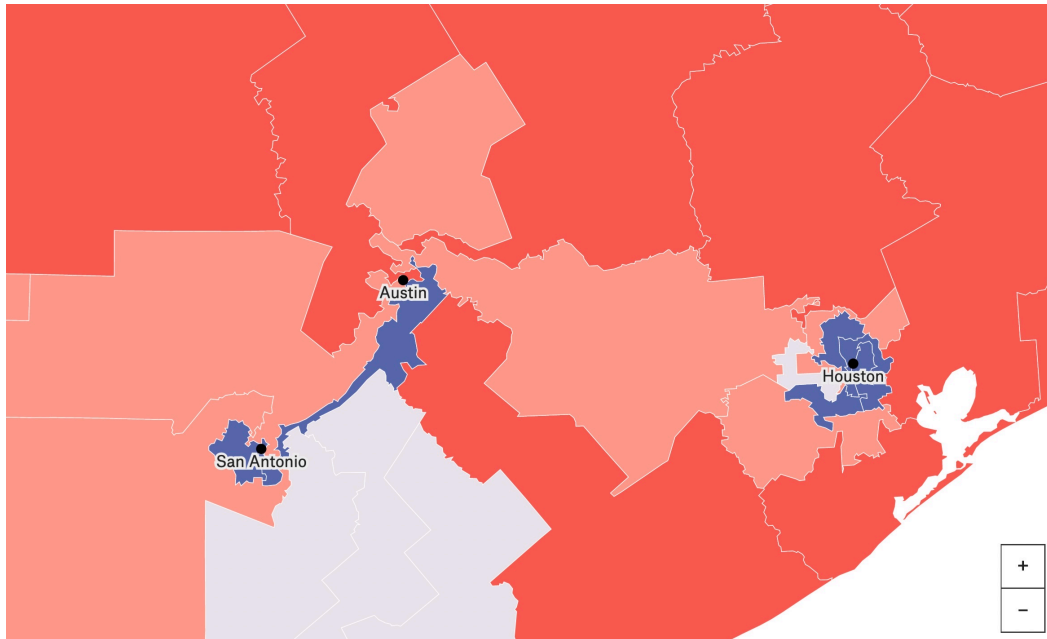
Elbridge Gerry
 MA 1812

MA, 1812



Maps are ^{often} decided by courts

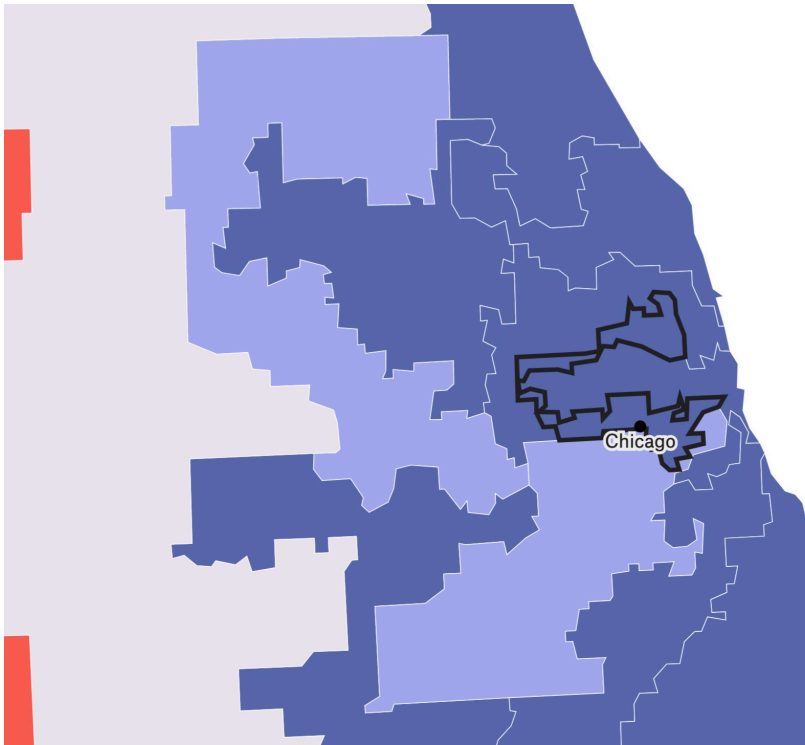




Majority Race Key



2



2 historically latino nbhds.

Court ordered to empower this group.

2 big topics

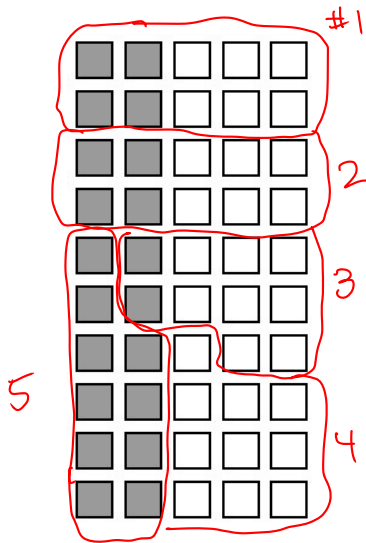
- How to do it
- How to detect it.
(different ways)

50 boxes,

20 Dark, 30 light

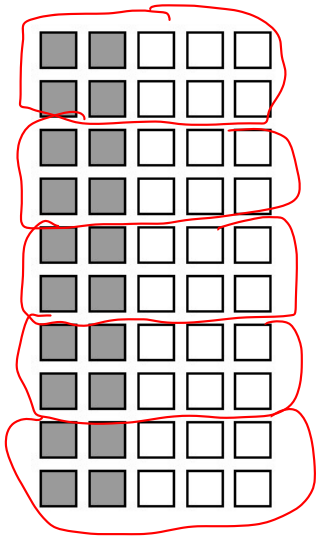
20 D's 30 L's

Let's make 5 districts of
10 each



Results:

#1:	4D/6L	L's win	L: 4
#2:	4D/6L	L's win	D: 1
#3:	2D/8L	L's win	
#4:	0D/10L	L's win	
#5:	10D/0L	D's win	

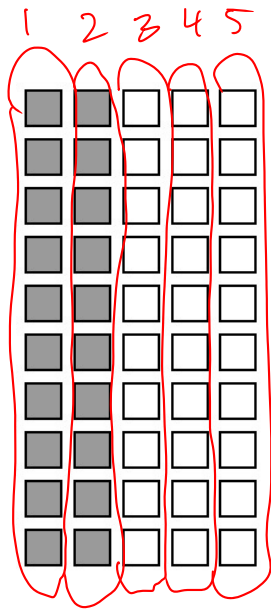


This time, L wins all of them.

L: 5

D: 0

The D's are "cracked"



1 & 2 goes to D

3, 4, 5 goes to L

L: 3

D: 2.

We've seen:

4L/1D
5L/0D
3L/2D

Can we do

2L/3D?

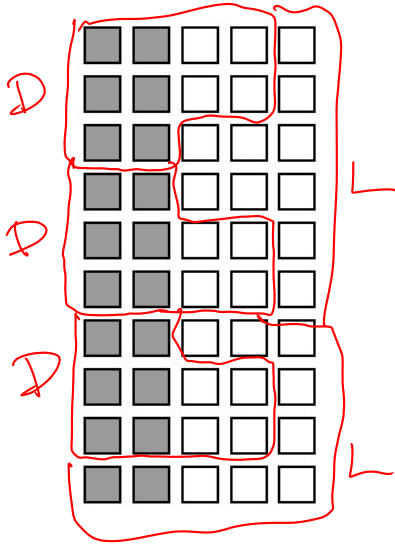
How to tell if this is possible?

How many D voters are required to win 3D districts?

Each district is 10, so the threshold to win is 6.

For D to win 3 districts, we'll need
at least $3 \times 6 = 18$ D voters.

So 3D/2L should be possible,
since D's have 20 voters.



Make D's win 3, L's get 2.

Build 3 districts where D's just barely win.

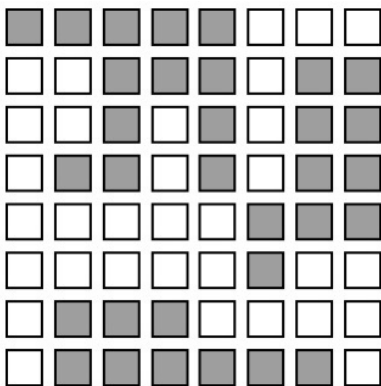
we get 3D/2L districts.

Can we get 4D/1L? NO
each district needs 6 to win.

To win 4D's, we need $6 \times 4 = 24$ D votes.
there's only 20.

4D/1L is impossible.

5D/0L also impossible.



64 squares,

32D, 32L.

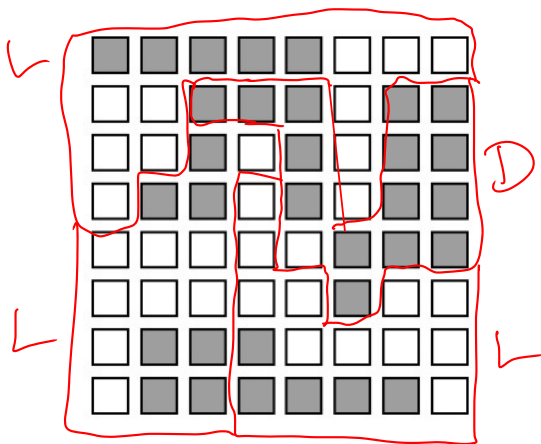
I want 4 districts of
16 each.

possible { ~~0D/4L~~
 1D/3L
 2D/2L
 3D/1L
~~4D/0L~~

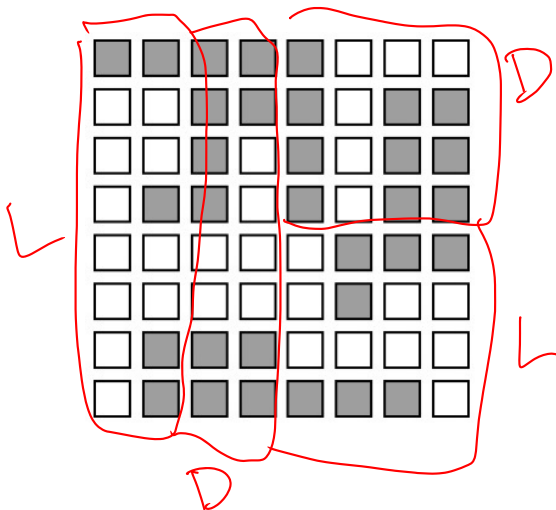
- Which are possible?
- draw districts for the possible ones.

The threshold to win is 9 per district.

0D/4L requires at least $9 \times 4 = 36$ L voters.
 impossible.



3L / 1D
 ↑
 pack as many D's as possible
 into 1 district



2L / 2D