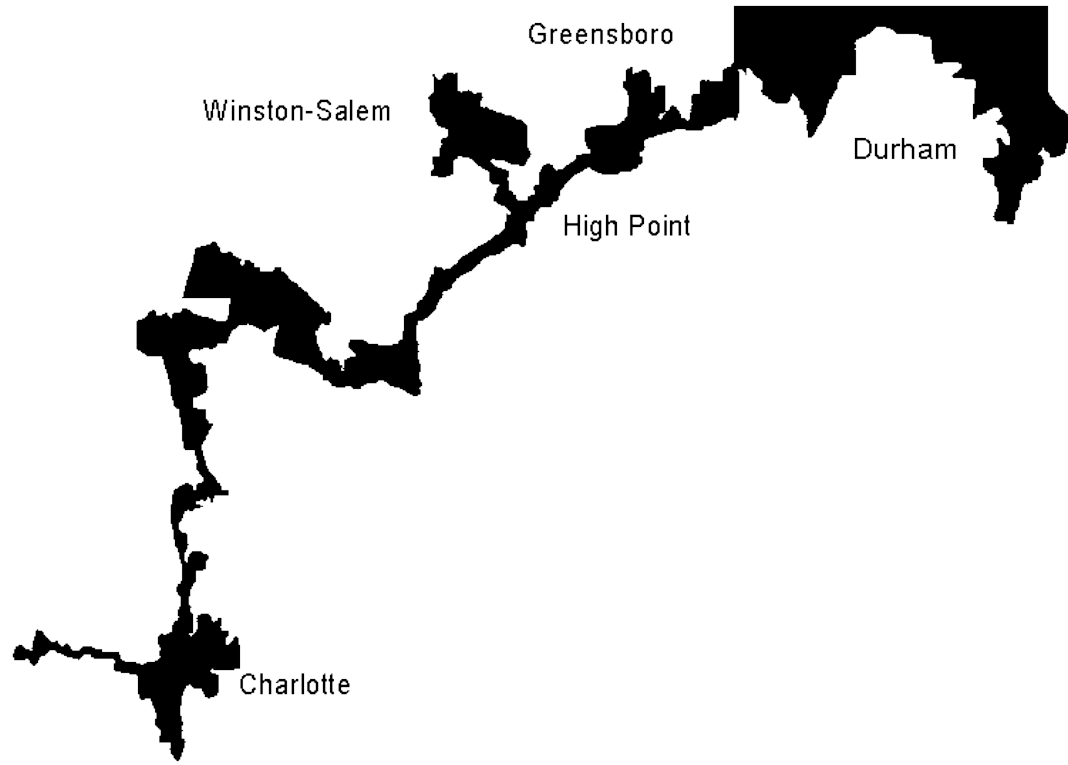


A complex network diagram with various sized nodes (black, blue, and grey) connected by thin grey lines. Some nodes are highlighted with larger circles. The background is white with faint grey circular patterns.

Mathematics and Redistricting

Trinity College, Fall 2021 (Kyle Evans)

Racial Gerrymandering



14th Amendment (1868)

- Equal Protection Clause

“No state shall deny to any person the equal protection of the laws”

- Applied to voting districts

“This Clause prohibits a state from separating its citizens into different voting districts on the basis of race”

- Racial gerrymandering

The deliberate distortion of district boundaries for racial purposes

Challenges under 14th Amendment

- To have standing, need to live in a racially gerrymandered district
- Race as a consideration does not imply racial gerrymandering
- Cases must look at individual districts, not state as a whole
- Need to show race was the predominant factor in district boundaries
 - Odd-shaped districts (low compactness)
 - Direct evidence from people involved in redistricting
 - Use of racial and voting data in the technology

15th Amendment (1870)

- Jim Crow era – literacy tests, poll taxes, state constitution tests, harassment, intimidation, violence, etc.

“The right of citizens of the United States to vote shall not be denied by the United States or by any State on the basis of race, color, or previous condition of servitude.”

- It's one thing to enact a law but it's another to enforce it
- 95 years later we get the Voting Rights Act

Voting Rights Act of 1965

- VRA: State and local governments cannot pass voting laws that discriminate against racial or language minorities
- Vote denial – minorities denied opportunity to vote
- Vote dilution – laws dilute strength of minority votes
 - “diminish ability to elect their candidate(s) of choice”
- (Section 5) Federal oversight – for states with history of discrimination, need to submit any changes in voting laws/procedures to U.S. government
 - Includes redistricting plans

Shelby County v. Holder (2013)

- (Section 5) Federal oversight – for states with history of discrimination, need to submit any changes in voting laws/procedures to U.S. government
- Supreme Court ruled that the criteria for determining states with history of discrimination was out of date (despite evidence that this federal oversight was effective in preventing racial discrimination in voting)
 - States no longer need to adhere to *preclearance* (federal oversight guidelines)
- Higher potential risk for discriminatory maps this redistricting cycle
 - Loss of Section 5 of Voting Rights Act
 - Expedited drawing processes (pandemic) and less time for legal challenges

Voting Rights Act Challenges

- Vote dilution – laws dilute strength of minority votes
 - “diminish ability to elect their candidate(s) of choice”
 - “dispersal of minorities into districts in which they constitute an ineffective minority of voters or concentrated into districts in which they constitute an excessive majority”
(aka packing and cracking)
- Evidence of racially polarized voting
- Evidence of other discriminatory voting practices or other areas that hinder effective democratic participation

Thornburg v. Gingles (1986)

Established a test for claims of (racial) vote dilution preventing racial minority groups from electing “candidates of choice”:

- A racial minority group forms a numerical majority of voting-age population in a compact area
- Minority group is “politically cohesive” – vote similarly
- Majority group votes similarly to defeat minority’s preferred candidate

If all these conditions are met, then there is required to be a Majority-Minority district in that area (also called VRA district)

- Majority of the population is of a minority race, ethnic, or language group

Racially Polarized Voting

- 1) Is it possible to draw a geographically compact district that includes the majority of the racial or language minority's members?
- 2) Does the racial or language minority tend to vote as a bloc and back the same preferred candidate?
- 3) Does the remaining population also generally vote as a bloc and in doing so defeat the candidate backed by the racial or language minority?

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View demographic maps such as [Connecticut](#)

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Requires some statistical analysis

Hypothetical example

Suppose a city has 60% ★ voters and 40% ◆ voters.

The racial makeup of the city is 55% White and 45% non-White.

In the most recent election, ★ wins every district and local activists are prepared to file a lawsuit for dilution of minority votes under the Voting Rights Act of 1965, but to have a legitimate case they need to show evidence that Whites vote in bloc for ★ and that non-Whites vote in bloc for ◆.

Keep in mind that individual votes are always “secret”, so we can only use group totals to infer voting patterns of different groups.

Hypothetical example

	★ voters	◆ voters	Totals
White voters	??	??	55
Non-white voters	??	??	45
Totals	60	40	100

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Hypothetical example

	★ voters	◆ voters	Totals	
White voters	45	10	55	$45/55 = 82\%$
Non-white voters	15	30	45	$15/45 = 33\%$
Totals	60	40	100	

Hypothetical example

	★ voters	◆ voters	Totals	
White voters	30	25	55	$30/55 = 55\%$
Non-white voters	30	15	45	$30/45 = 67\%$
Totals	60	40	100	

Ecological Inference

“Ecological inference is the process of using aggregate (historically called “ecological”) data to draw conclusions about individual-level behavior when no individual-level data are available. The fundamental difficulty with such inferences is that many different possible relationships at the individual level can generate the same observation at the aggregate level.”

Relevant methods:

- Homogeneous precincts
- Scatterplots and regression lines
- Confidence intervals

Homogeneous Precincts

Suppose there was a voting precinct in which 90% of voters are White and 95% of votes were for ★.

	★ voters	◆ voters	Totals
White voters	??	??	90
Non-white voters	??	??	10
Totals	95	5	100

Homogeneous Precincts

Suppose there was a voting precinct in which 90% of voters are White and 95% of votes were for ★.

	★ voters	◆ voters	Totals
White voters	85-90	0-5	90
Non-white voters	5-10	0-5	10
Totals	95	5	100

$$85/90 = 94\%+$$

Ecological Inference

Analyzing districts where a high percentage of voters are of the same race can give valuable information about the voting patterns of the different races. (One potential downside is the assumption that people in racially dominant areas vote the same as people in racially mixed areas.)

This is the first step in detecting potential Racially Polarized Voting.

We should also look at a scatterplot of:

% of a racial group in each precinct vs. % of ★ votes in each precinct

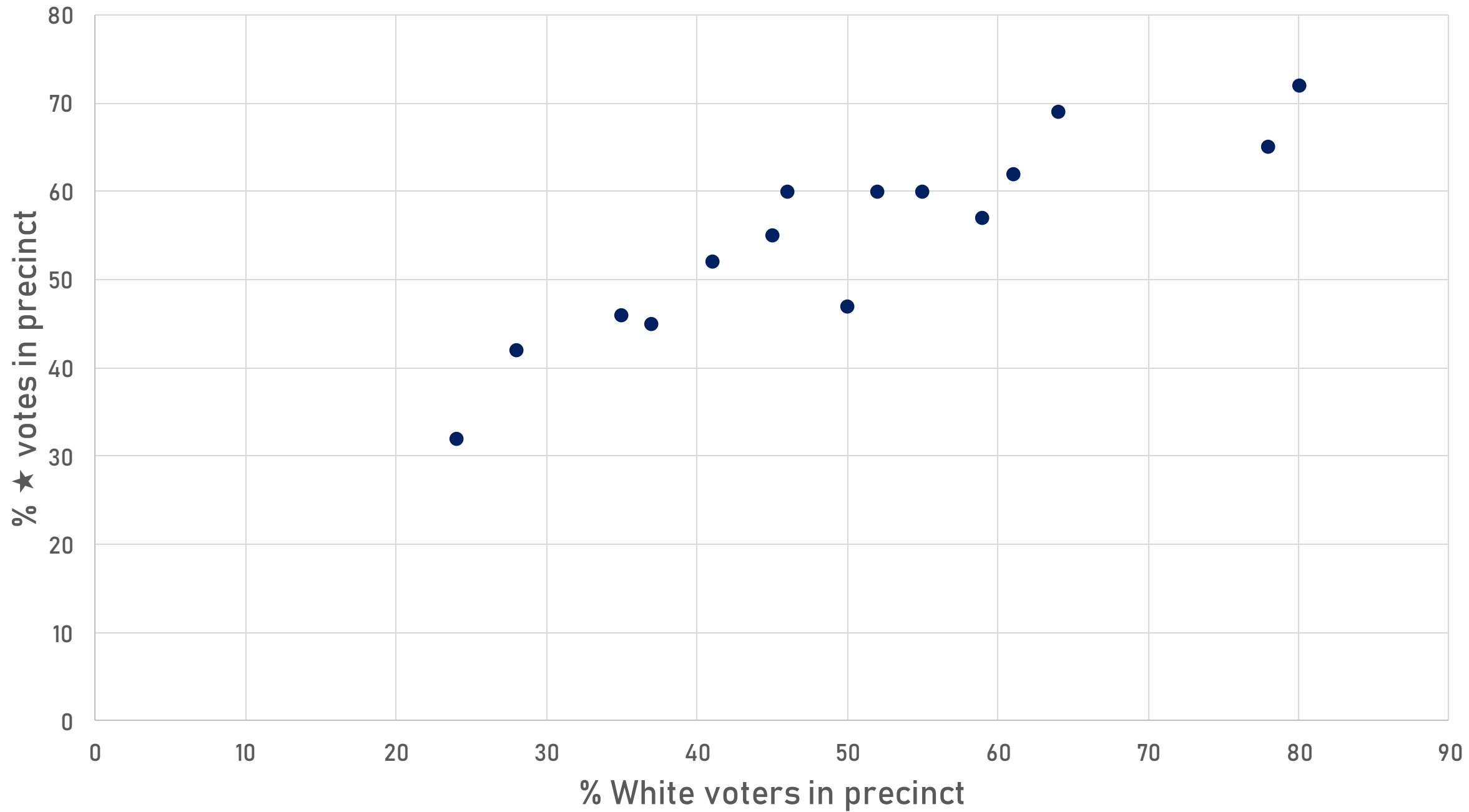
Hypothetical example

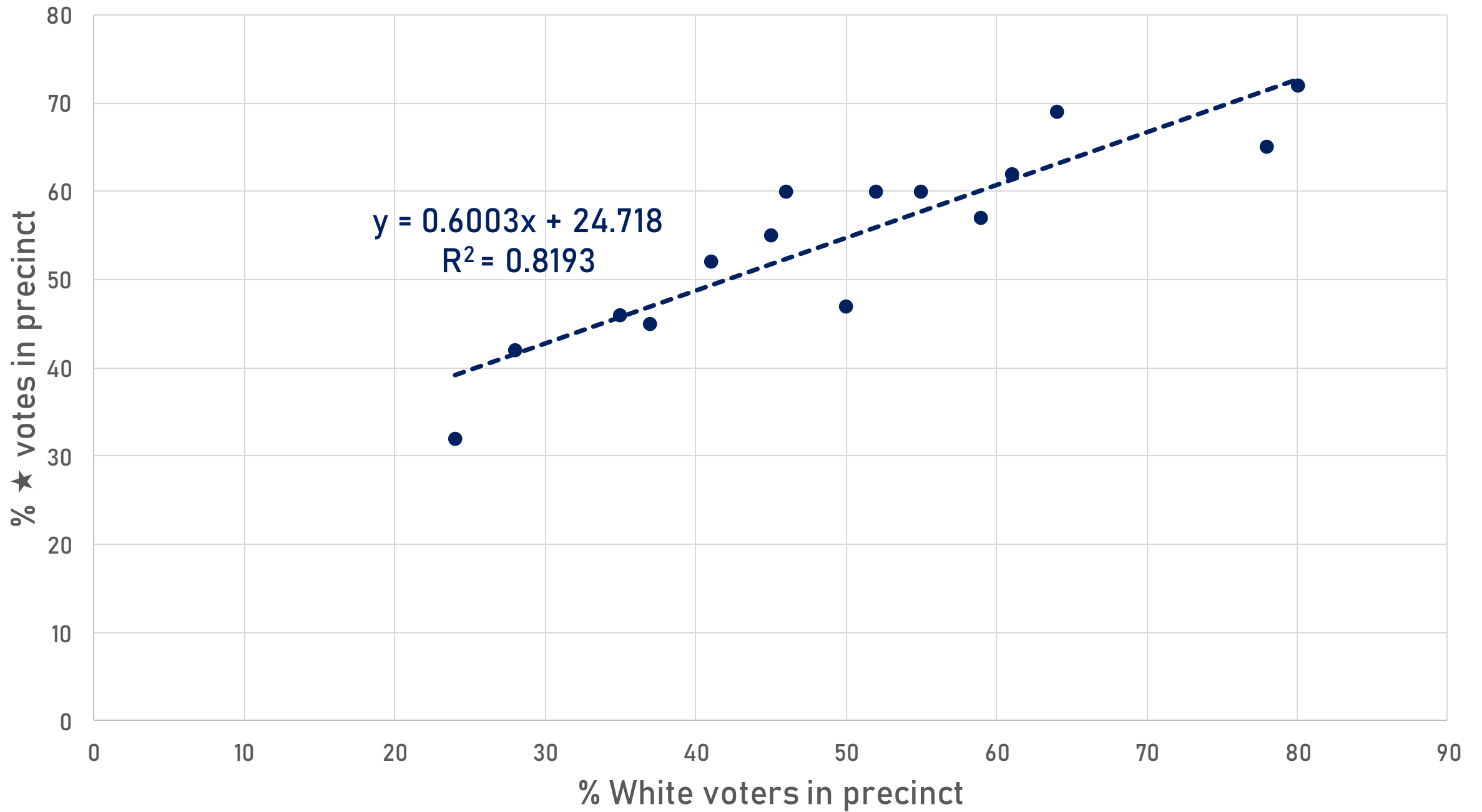
The table at right shows hypothetical data from the 15 voting precincts in the town.

For each precinct, the % of White voters and the % of votes for ★ are shown.

Each of these pairs will become a (x, y) coordinate point on a scatterplot.

Precinct	% White	% ★
1	80	72
2	45	55
3	64	69
4	78	65
5	50	47
6	59	57
7	61	62
8	35	46
9	41	52
10	24	32
11	52	60
12	28	42
13	46	60
14	37	45
15	55	60





Regression Line

How do we interpret the equation of the regression line?

Also called “line of best fit” – a regression line is the line that minimizes the total distance from the points to the line

In our example we got $y = 0.6x + 24.7$ or using the variables:

$$(\% \text{ of votes for } \star) = 0.6 (\% \text{ of White voters}) + 24.7$$

This can be used to predict the voting patterns of each group!

Regression Line

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$$(\% \text{ of votes for } \star) = 0.6 (\% \text{ of White voters}) + 24.7$$

This can be used to predict the voting patterns of each group!

If a precinct is 0% White, then % of \star votes = $0.6 (0) + 24.7 = 24.7\%$

If a precinct is 100% White, then % of \star votes = $0.6 (100) + 24.7 = 84.7\%$

Note: Prediction only accurate for values within range of data, extrapolation can lead to illogical conclusions.

Correlation

Correlation coefficient – a measure of the strength of a linear relationship between two variables (denoted by r)

- r can only be between -1 and 1
 - Negative values mean line of best fit has negative slope
- Closer to zero means weak/no linear relationship
- Closer to 1 or -1 means strong linear relationship
- In redistricting cases, $r > 0.7$ ($r^2 > 0.5$) has been used as benchmark for significant linear relationship

Putting the Pieces Together

To make the strongest case for racial gerrymandering, you should show:

- That you can draw a majority-minority district that is compact
- That there is a significant difference in preferred candidate by racial group
- Spatial data – maps that show location of minority group(s) and location of votes for each candidate*

(*In real life, demographic data from Census doesn't match up exactly to voting precincts)

Main Question

How do we balance the competing goals of minority representation within a district vs. minority representation across all districts of a state?

How can we measure racial gerrymandering, especially among other redistricting criteria such as communities of interest?

Case Study Assignment

As a class, we will investigate 8 different court cases involving claims of racial gerrymandering.

Each of you will have a court case and write a summary of the case and as a small group create 2-3 slides about the case for next class.