PSC 202
SYRACUSE UNIVERSITY

INTRODUCTION TO POLITICAL ANALYSIS

HYPOTHESIS TESTING WHEN USING SAMPLES, PART 1

EXAM

- **Next week Monday: Exam #2**
  - Can bring a calculator (no phone etc.)
  - Allowed to bring one single-page letter-size (8.5x11) sheet with you. Front side only. What you put on it is up to you, but it has to be your own.
- Wednesday: Review
  - Email questions etc. by tomorrow evening
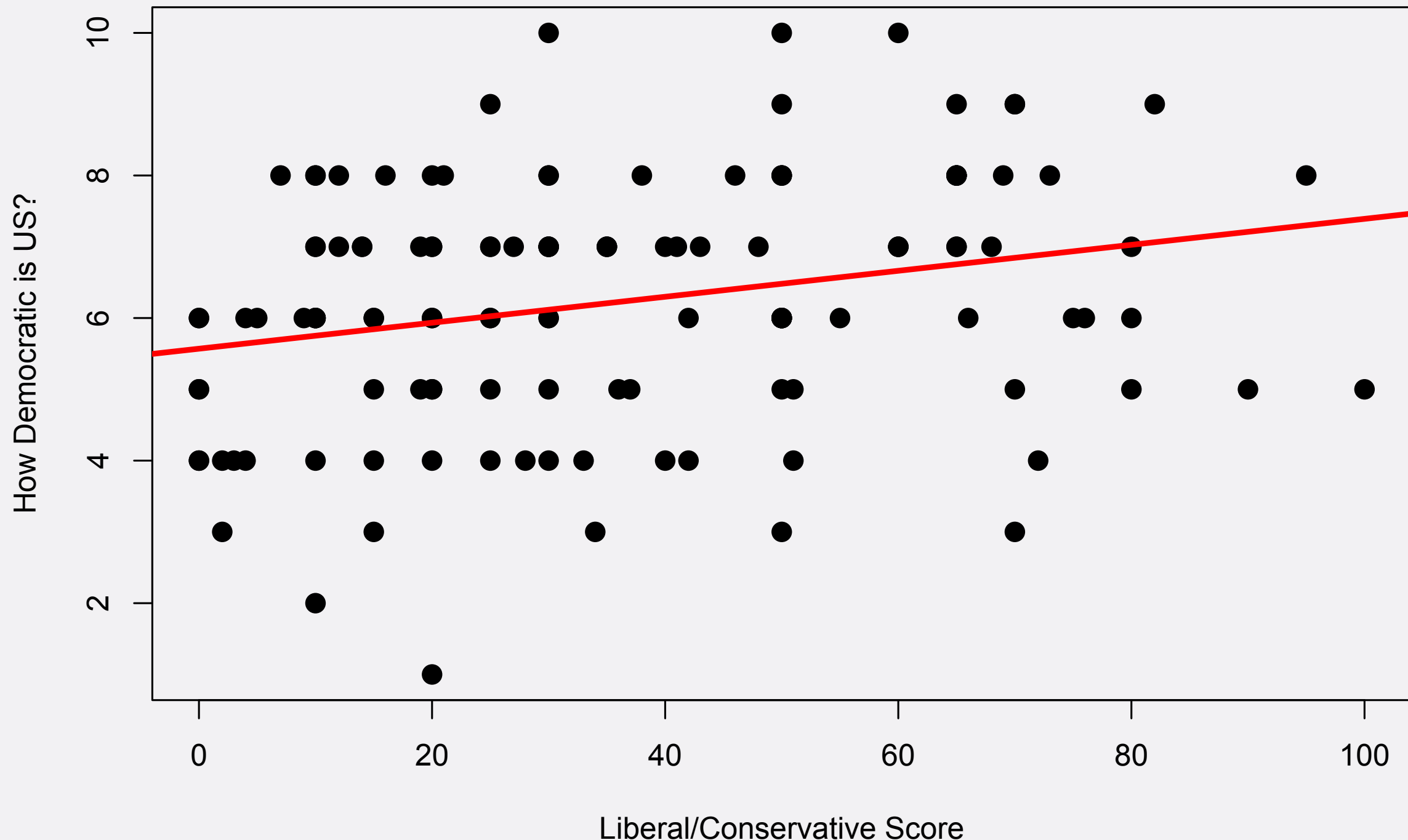- **If you take exams at CDR, please sign up now!**
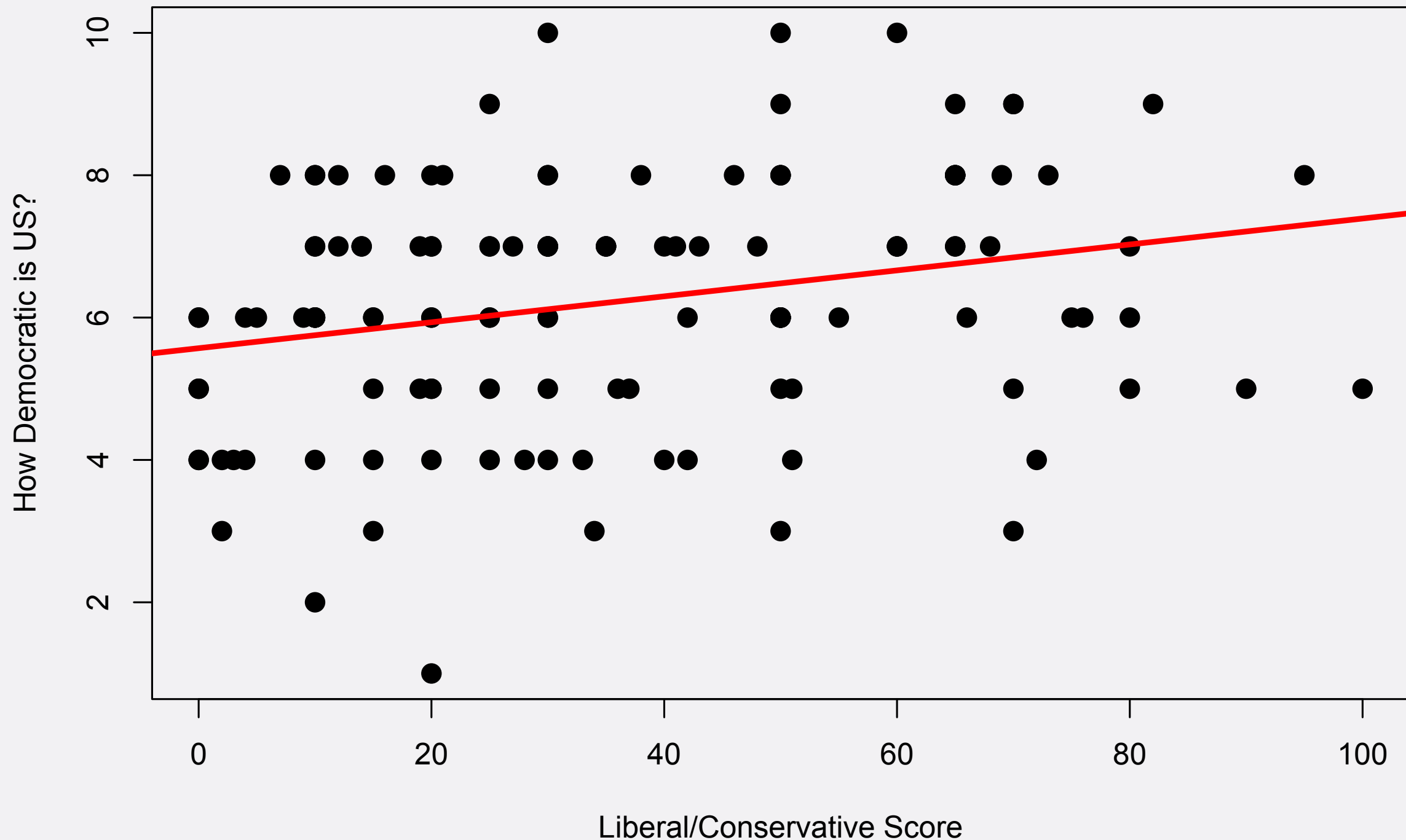
BIVARIATE RELATIONSHIPS

Independent Variable

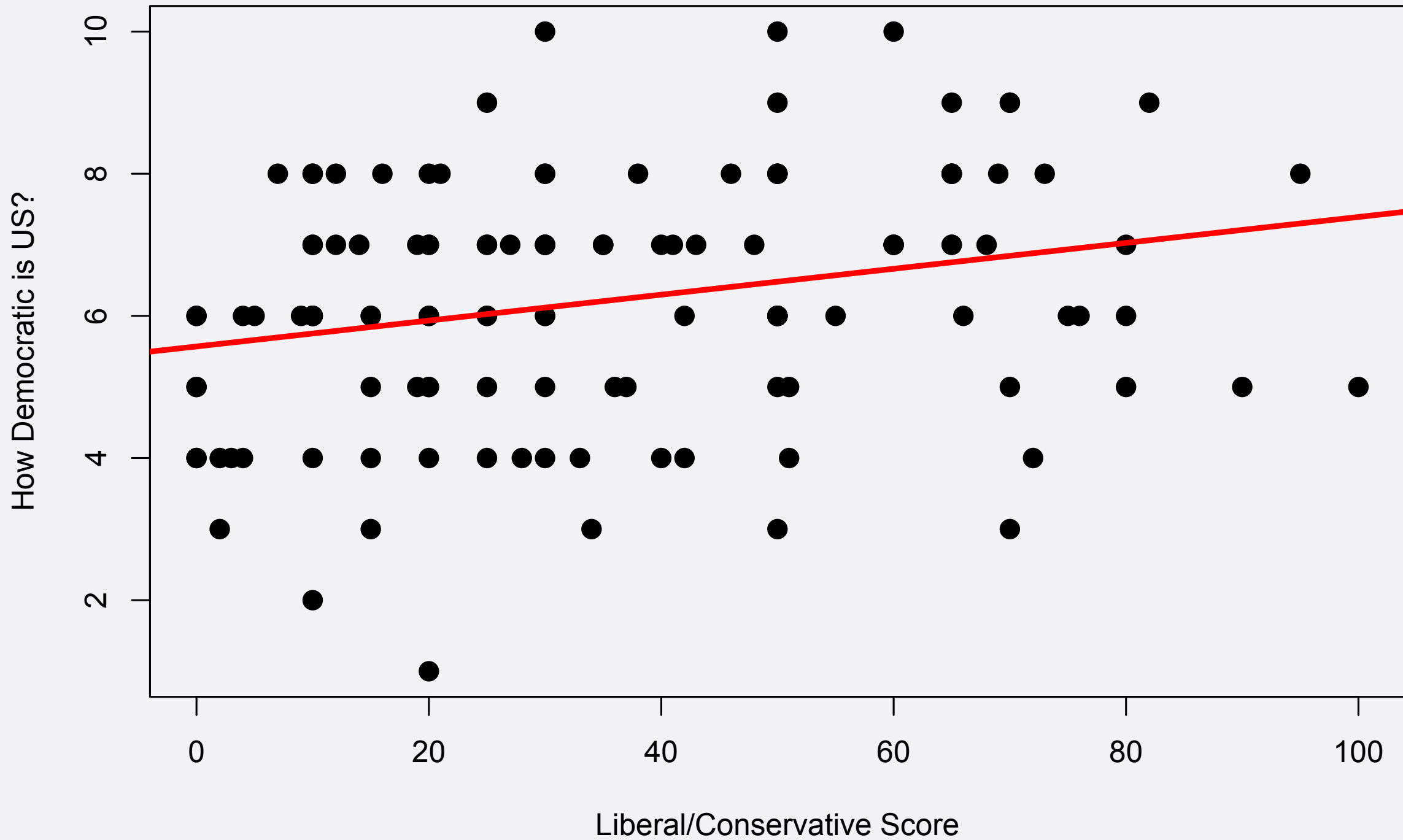|	Nominal/Ordinal	Interval
Nominal/Ordinal (Dependent Variable)	Cross-Tabulation	Not In This Class…
Interval	Mean Comparison	Correlation Coefficient, Linear Regression

REGRESSION RECAP

- **How democratic are the United States? 0 (not democratic at all) to 10 (very democratic)**

REGRESSION RECAP

- Democracy Score = 5.6 + 0.02 * Lib/Cons

REGRESSION RECAP

- R-squared: 0.07

- Is this effect real?
- Or is this just something we found in our sample, but lib/cons actually has no effect on perceptions of democracy in the population?

REMEMBER

Biden Averaged 41% Job Approval in His Second Year

Results for this Gallup poll are based on telephone interviews conducted Jan. 2-22, 2023, with a random sample of 1,011 adults, aged 18 and older, living in all 50 U.S. states and the District of Columbia. For results based on the total sample of national adults, the margin of sampling error is ±4 percentage points at the 95% confidence level. All reported margins of sampling error include computed design effects for weighting.
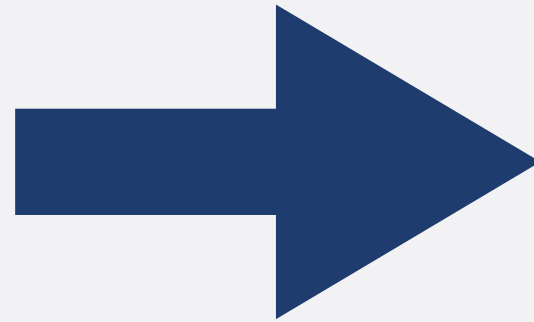
BIVARIATE RELATIONSHIP
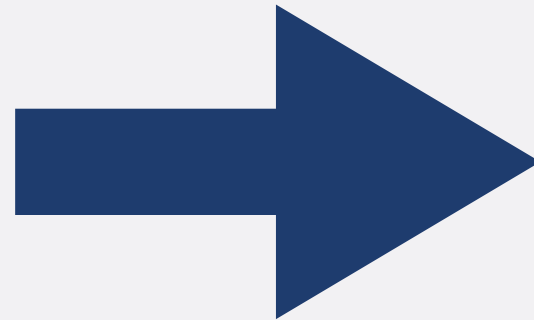
? ➡️ Approval for J. Biden

- What explains why some people approve of J. Biden while others do not?

BIVARIATE RELATIONSHIP

Gender $\longrightarrow$ Approval for J. Biden

- **Hypothesis: In a comparison of individuals, women are more likely to approve of J. Biden than men**
  - "gender gap"

BIVARIATE RELATIONSHIP

Biden Approval Ratings Diverge by Gender, Education, Race

Job Approval Ratings of President Biden, by Subgroup

	Approve	Disapprove	N
	%	%	
All U.S. adults	56	39	2,937
Gender			
Men	49	45	1,643
Women	62	34	1,294

PROBLEM

- **Is the effect of gender on approval real?**
  - **Does it exist in the population?**
- **Or is it only something that we found in this sample, but gender actually has no effect in the population?**

PROBLEM

- We have a *random sample*
  - Men: 49% approval
  - Women: 62% approval
- Want to know: is mean approval rating of men and women in the *population* the same or not?

ALTERNATIVE HYPOTHESIS

- There *is* a relationship between the independent and dependent variable in the population

- H_A or H_1

NULL HYPOTHESIS

- In the population, there is *no relationship* between dependent and independent variable
  - If there is a difference in the sample, it is due to random sampling error

- H_0

IN OUR CASE

- H_0: In a comparison of individuals, there is *no difference* between men and women in approval of J. Biden
- H_A: In a comparison of individuals, there *is* a difference between men and women in approval of J. Biden

BACK TO MISTAKES

- Idea: Use relation between two variables in *sample* to make inference about relation between two variables in *population*
  - Of course, means we can make mistakes

ERRORS

	There Is A Relation In The Population	There Is No Relation In The Population
We Conclude There Is A Relation	✔	✘
We Conclude There Is No Relation	✘	✔

ERRORS

	There Is A Relation In The Population	There Is No Relation In The Population
We Conclude There Is A Relation	✔	✘
We Conclude There Is No Relation	✘	✔

TYPE I ERROR

- **We conclude there is a relationship between X and Y when in reality there is not**
  - Example: There is no difference between men and women in approval rating in the population, but we conclude that there is

TYPE I ERROR

- We conclude there is a relationship between X and Y when in reality there is not
  - "Type I error"
  - We falsely reject H_0

ERRORS

	There Is A Relation In The Population	There Is No Relation In The Population
We Conclude There Is A Relation	✔	✘
We Conclude There Is No Relation	✘	✔

TYPE II ERROR

- We conclude there is no relationship between X and Y when in reality there is
  - Example: There is a difference between men and women in approval rating in the population, but we conclude that there is none

TYPE II ERROR

- **We conclude there is no relationship between X and Y when in reality there is**
  - "Type II error"
  - We falsely do not reject H_0

ERRORS

	There Is A Relation In The Population	There Is No Relation In The Population
We Conclude There Is A Relation	✔	✗ Type I
We Conclude There Is No Relation	✗ Type II	✔

DECISION

- **It's bad if we conclude there is a relationship when in reality there is not (Type I error)**
  - Type II error is also not great, but not as bad
- **We privilege H_0**

DECISION

- **By default: We start out with assumption that there is no relationship in population (so H_0 is true)**
  - **No difference between men and women in Biden approval in population**

DECISION

- **Ask: Is there enough evidence in the *sample* to reject H_0?**
  - **Is the observed difference between mean and women in *sample* large enough to reject null hypothesis that no difference between them in population?**

DECISION

Job Approval Ratings of President Biden, by Subgroup

	Approve %	Disapprove %	N
All U.S. adults	56	39	2,937
Gender			
Men	49	45	1,643
Women	62	34	1,294

- **The larger the difference in approval ratings between men and women in our samples, the less likely it is that the mean in the population is the same**

P-VALUE

- Q: When do we decide that we have "enough" evidence?
- A: When the chance of falsely rejecting H_0 is 5% or less
    - Equivalent: Change of Type I error less than 5%
    - Probability of falsely rejecting H_0 is called the "p-value"

IDEA

- We start out thinking H_0 is true
  - No difference between men and women population
- We have a sample that shows some difference
  - Do we reject H_0?
- Ask: If H_0 is true, what is the probability (p) of observing a difference at least as large as we did in our sample?
  - If less than 5% ($p<0.05$): we reject H_0
 - If more than 5% ($p>0.05$): we don't reject H_0

SIGNIFICANCE

- **If less than 5% (p<0.05): we reject H_0**
  - "Statistically significant difference between men and women in support for Biden"
- **If more than 5% (p>0.05): we don't reject H_0**
  - "Difference between men and women in support for Biden is not statistically significant"

REJECTING H0

- **So: High bar before we reject H_0 that X has no effect on Y**
  - **We are conservative and need a lot of evidence before we are willing to reject H_0**

REJECTING H0
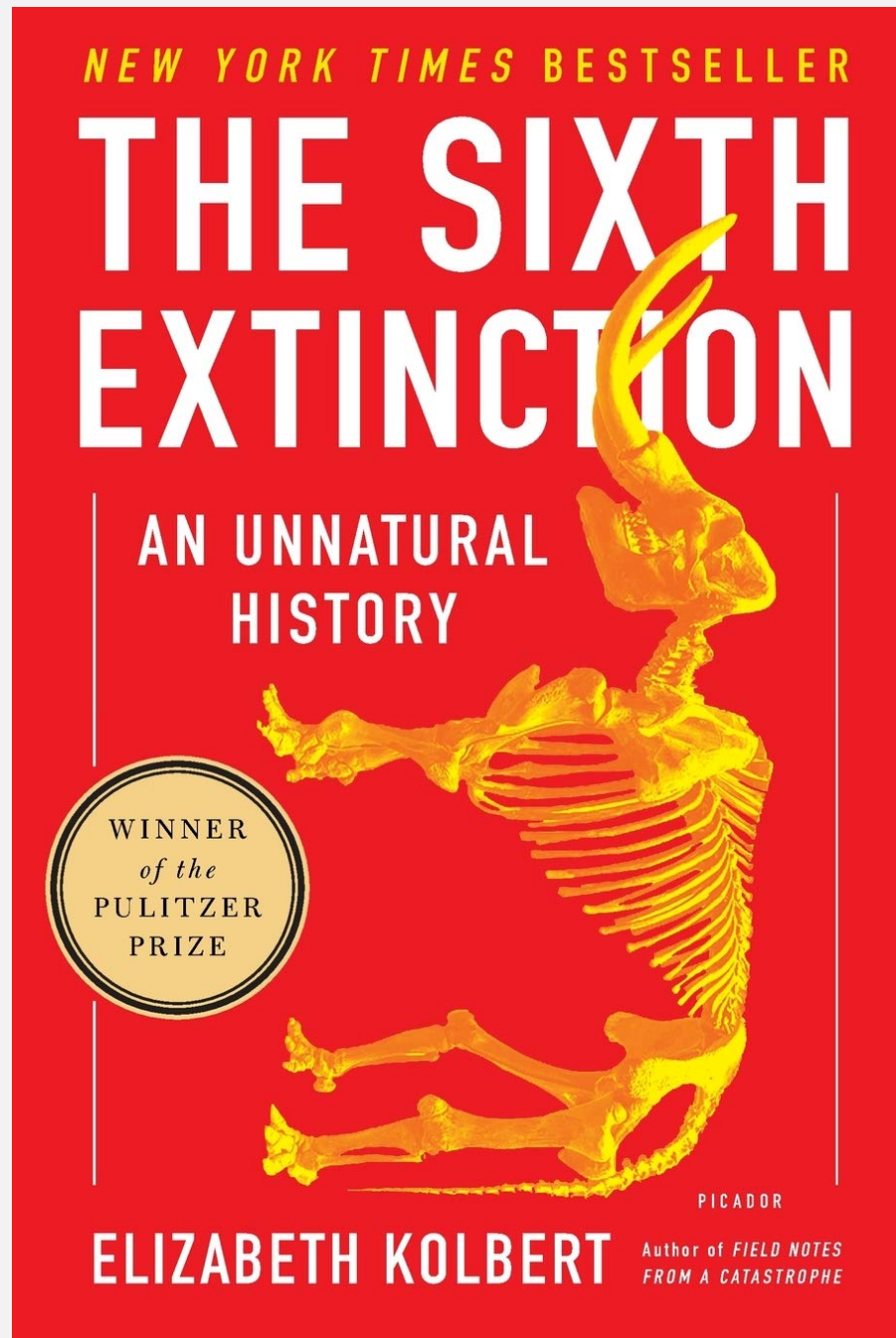
PODCAST
Longform Podcast
#315: Elizabeth Kolbert

00:00 ———————————— 00:00

PLAY IN NEW WINDOW   DOWNLOAD

Elizabeth Kolbert, author of *Field Notes from a Catastrophe: Man, Nature, and Climate Change* and *The Sixth Extinction: An Unnatural History*, is a staff writer at *The New Yorker*.

- **longform.org/posts/longform-podcast-315-elizabeth-kolbert**

- **How exactly do we do this hypothesis testing?**
  - How do we compute a p-value, etc.?