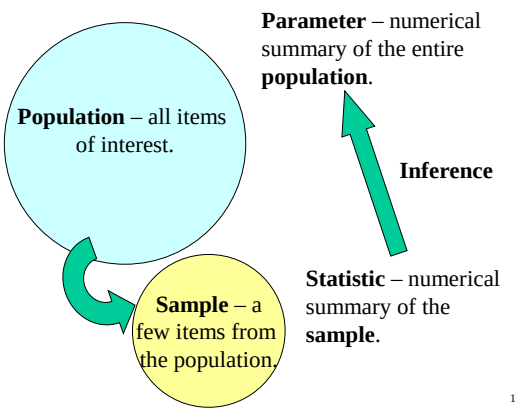
Stat 104 – Lecture 21



1

Poll on the Environment

- ABC/Washington Post poll conducted June 18 – 21, 2009
- "Do you think the federal government should or should not regulate greenhouse gases from sources like power plants, cars and factories in an effort to reduce global warming?"

2

Poll on the Environment

- Population – all adults in the United States.
- Population Parameter – proportion of all adults in the U.S. who think greenhouse gases should be regulated.

3

Stat 104 – Lecture 21

Poll on the Environment

- Sample – 1,001 adults in the United States.
- Sample Statistic – proportion of the 1,001 who think greenhouse gases should be regulated.

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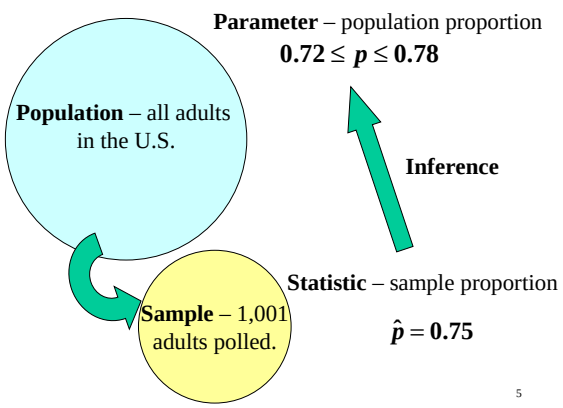

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Poll on the Environment

- Description – 75% of the sample think greenhouse gases should be regulated.
- Inference – between 72% and 78% of the entire population would think the federal government should regulate greenhouse gases.

6

Margin of Error

- The approximate margin of error is given by

$$\frac{1}{\sqrt{n}} \times 100\%$$

7

68-95-99.7 Rule

- 95% of the time a sample proportion, $\hat{p}$, will be within 2 standard deviations of the population proportion, p.

8

68-95-99.7 Rule

- 95% of the time the sample proportion, $\hat{p}$, will be between

$$p - 2\sqrt{\frac{p(1-p)}{n}} \text{ and } p + 2\sqrt{\frac{p(1-p)}{n}}$$

9

Standard Deviation

- Because p, the population proportion is not known, the standard deviation

$$\mathbf{SD}(\hat{p}) = \sqrt{\frac{p(1-p)}{n}}$$

is also unknown.

10

Standard Error

- Substitute $\hat{p}$ as our estimate (best guess) of p.
- The standard error of $\hat{p}$ is:

$$SE(\hat{p}) = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

11

- About 95% of the time the sample proportion, $\hat{p}$, will be within

$$2SE(\hat{p}) = 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

two standard errors of p.

12

- About 95% of the time the population proportion, p, will be within

$$2SE(\hat{p}) = 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

two standard errors of $\hat{p}$.

13

Confidence Interval for p

- We are 95% confident that p will fall between

$$\hat{p} - 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \text{ and } \hat{p} + 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

14

Example

$$\hat{p} = 0.75$$

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{0.75(0.25)}{1001}} = 0.0137$$

$$0.75 - 2(0.0137) \text{ to } 0.75 + 2(0.0137)$$

$$0.723 \text{ to } 0.777$$

15

Interpretation

- We are 95% confident that the population proportion of all adults in the U.S. who think greenhouse gases should be regulated is between 72.3% and 77.7%.

16

Interpretation

- Plausible values for the population parameter p.
- 95% confidence in the process that produced this interval.

17

95% Confidence

- If one were to repeatedly sample at random 1001 adults in the U.S. and compute a 95% confidence interval for each sample, 95% of the intervals produced would contain the population proportion p.

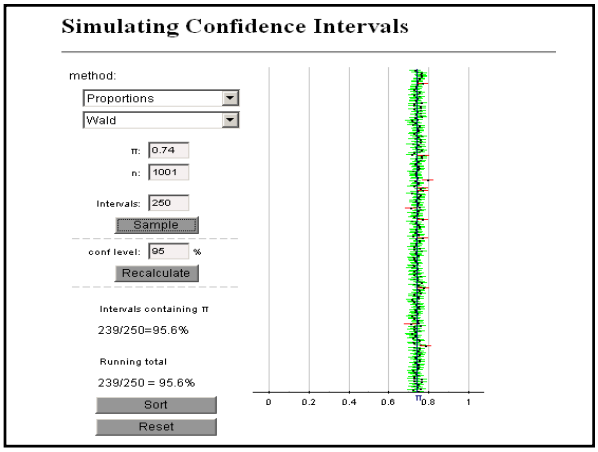
18

Stat 104 – Lecture 21

Simulation

http://statweb.calpoly.edu/chance/applets/Confsim/Confsim.html

19



Margin of Error

- The approximate margin of error is 2 standard errors with 95% confidence and $\hat{p} = 0.5$

$$2\sqrt{\frac{0.5(1-0.5)}{n}} = \frac{1}{\sqrt{n}} \times 100\%$$

21