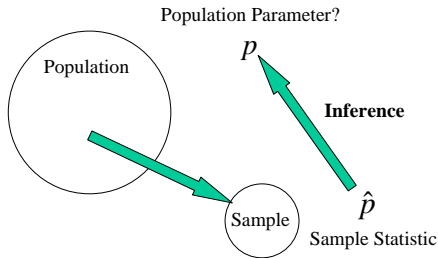


Stat 101 – Lecture 23

Sampling Distribution Models



1

Sampling Distribution of \hat{p}

- Shape: Approximately Normal
- Center: The mean is p .
- Spread: The standard deviation is

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

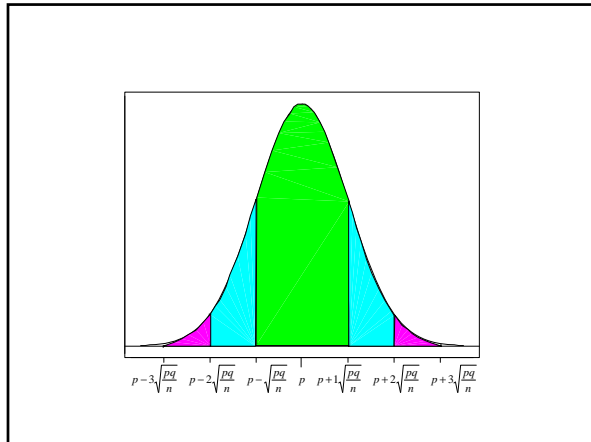
2

Sampling Distribution of \hat{p}

- Conditions:
 - 10% Condition: The size of the sample should be less than 10% of the size of the population.
 - Success/Failure Condition: np and $n(1-p)$ should both be greater than 10.

3

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Probability

- If the population proportion, p , is known, we can find the probability or chance that \hat{p} takes on certain values using a normal model.

5

Inference

- The population parameter, p , is most often unknown and we would like to use a sample to tell us something about p .
- Use the sample proportion, \hat{p} , to make inferences about the population proportion p .

6

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Example

- Population: All adults in the U.S.
- Parameter: Proportion of all adults in the U.S. who believe climate change is a major threat. Unknown!

7

Example

- Sample: 1,004 randomly selected adults nationwide. Bloomberg Poll, Sept. 10-14, 2009.
- Statistic: 402 of the 1004 adults in the sample (40%) think that climate change is a major threat.

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

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68-95-99.7 Rule

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

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

two standard deviations of p .

10

Standard Deviation

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

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

is also unknown.

11

Standard Error

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

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

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