

## Agenda for Wednesday, Nov 13th 2024

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| More on Confidence Intervals . . . . . | 1 |
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## Coming up

- Student Hours today 3:45pm-5pm in C162
- HW 17 posted
- Excel Assignment 4 due today

## Recall: Confidence intervals

- Formula for a confidence interval for a population mean when  $\sigma$  is known, is:

$$CI = \bar{x} \pm z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

- Formula for a confidence interval for a population mean when  $\sigma$  is not known, is:

$$CI = \bar{x} \pm t^* \cdot \frac{s}{\sqrt{n}}$$

$$t_{\alpha/2} = t^*$$

- Formula for finding a specific sample size,  $n$  to achieve a certain margin of error, ME:

– When  $\sigma$  is known:

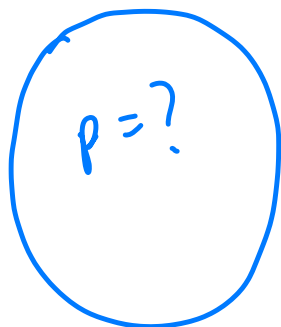
$$n = \left( \frac{Z_{\alpha/2} \cdot \sigma}{ME} \right)^2$$

– When  $\sigma$  is not known:

$$n = \left( \frac{t^* \cdot s}{ME} \right)^2$$

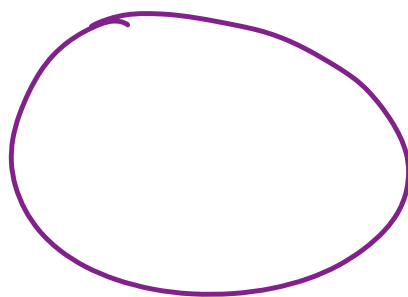
# Confidence interval for proportions

population: all CUC student



$p$ : population proportion

sample  $n = 100$



$X = 23$

said  
yes  
I  
have  
a final

sample proportion:

$$\hat{p} = \frac{x}{n} = \frac{23}{100} = .23$$

$\hat{p}$  - point estimate

Confidence interval for a proportion:

$$CI: \left( \hat{p} - z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}, \hat{p} + z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \right)$$

as long as  
 $n\hat{p} \geq 10$   
 $n(1-\hat{p}) \geq 10.$

**Example 1.** For a class project, a political science student at a large university wants to estimate the percent of students who are registered voters. The student surveys 500 students and finds that 59.7% are registered voters. Compute a 90% confidence interval for the true percent of students who are registered voters, and interpret the confidence interval.

w/ calculator

$$X: \hat{p}n = (.597)(500) \\ = 298.5 \\ = 299$$

$$\hat{p} = 59.7\% = 0.597$$

$$n = 500$$

$$z_{\alpha/2} = 1.645 \text{ (notes Day 22)}$$

$$\left( 0.597 - 1.645 \sqrt{\frac{0.597(1-0.597)}{500}}, 0.597 + 1.645 \sqrt{\frac{0.597(1-0.597)}{500}} \right)$$

$$(0.5609, 0.6331) \text{ or } (56.09\%, 63.31\%)$$

We are 90% confident that the true percent of students who are registered voters is between 56.09% and 63.31%.

$$\hat{p} = \frac{x}{n} \Rightarrow x = \hat{p} n$$

Calculator instructions:

STAT  $\rightarrow$  TESTS  $\downarrow$  1-PropZInterval  
 $x$ : # of successes in sample (or  $\hat{p}n$  always round up)  
 $n$ : sample size  
 C level: as a decimal ( $.9$  for 90%).

**Example 2.** Suppose 250 randomly selected people are surveyed to determine if they own a tablet. Of the 250 surveyed, 98 reported owning a tablet. Using a 95% confidence level, compute a confidence interval estimate for the true proportion of people who own tablets. ~~Find the 95% confidence interval.~~

STAT  $\rightarrow$  TESTS  $\downarrow$  1-PropZint  
 $x$ : 98  
 $n$ : 250  
 C level: .95

Ans: CI for  $p$ : (33.15%, 45.25%)

Finding a specific sample size,  $n$  to achieve a certain margin of error, ME for proportion confidence intervals:

$$n = \hat{p}(1-\hat{p}) \left( \frac{z_{\alpha/2}}{ME} \right)^2$$

If  $\hat{p}$  is not given, use  $\hat{p} = 0.5$ .

**Example 3.**

Suppose a mobile phone company wants to determine the current percentage of customers aged 50+ who use text messaging on their cell phones. How many customers aged 50+ should the company survey in order to be 90% confident that the estimated (sample) proportion is within three percentage points of the true population proportion of customers aged 50+ who use text messaging on their cell phones?

ME desired is  
 $3\% = 0.03$

$$n = \hat{p}(1-\hat{p}) \left( \frac{z_{\alpha/2}}{ME} \right)^2$$

$$n = 0.5(1-0.5) \left( \frac{1.645}{0.03} \right)^2 = 751.67$$

$= 752 \text{ people}$