Agenda for Wednesday, Nov 13th 2024

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 σ is known, is:

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

- Formula for a confidence interval for a population mean when σ is not known, is:

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

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

- Formula for finding a specific sample size, n to achieve a certain margin of error, ME:
  - When σ is known:

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

  - When σ is not known:

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

Confidence interval for proportions

population: all CLC student

$p = ?$

p: population proportion

sample $n = 100$

$x = 23$ said yes I have a find

sample proportion:

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

$\hat{p}$ - 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

$x : \hat{p}n = (.597)500 = 298. = 299$

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

$n = 500$

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

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

$(0.5609, 0.6331)$ 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 → TESTS ↓ 1-PropZInterval

x : # of successes in sample (or $\hat{p}\, n$ always round up)

n : sample size

C level : as a decimal (ex .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 → TESTS ↓ 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 $\hat{p} = 0.5$.

$n = ?$

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 $3\% = 0.03$

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

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

$= 752$ people