

- \* A larger (wider) interval makes you more confident that it contains the unknown parameter.
- \* We can also get a smaller interval by collecting more data (increase " $n$ ")

### \* Confidence Interval \*

- 1) State the Population (ALL)
- 2) State the parameter of interest ( $P$  or  $\mu$ )
- 3) Type of Interval
- 4) Check Conditions ✓
- 5) Formula & Interval (STAT CRUNCH)
- 6) Interpret the Interval

\* Confidence Interval = statistic  $\pm$  (critical value)  $\times$  SD of statistic

$$CI = (\hat{p} \text{ or } \bar{x}) \pm (z^* \text{ or } t^*) (SE_{\hat{p}}, SE_{\bar{x}})$$

$$\rightarrow \hat{\sigma}_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} \rightarrow SE_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$\hat{\sigma}_{\bar{x}} = \frac{s}{\sqrt{n}} \rightarrow SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

CI for proportions  $\hat{p} \pm z^* \left( \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \right)$

Proportions  
Always  $Z^*$

Never given  
a standard  
deviation

## Confidence Intervals for Sample means $Z$ or $t$

$Z$

When we know  
the standard  
deviation of  
the population

( $\sigma$ )  
=

$t$

When we  
DO NOT have  
the standard  
deviation of the  
population, and  
we have to  
use " $s$ "  
SD of sample

Sample Means

Ex: (population) S.D is 10

Z or t?  
↑  
↑ =  
(S)

n = 50, sample mean ( $\bar{x}$ ) = 55  
90% Confidence Interval

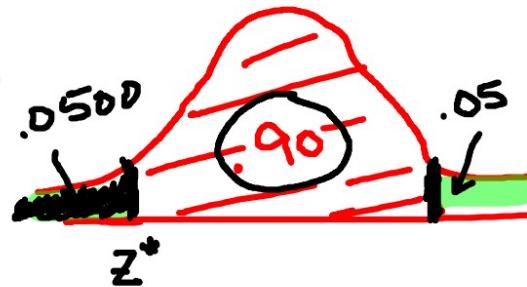
$$CI = \bar{x} \pm Z^* \left( \frac{S}{\sqrt{n}} \right)$$
$$(52.674, 57.326)$$

Interpret  
\*a CI.

We are  $\_ \%$  confident that the  
(parameter in context) is somewhere  
between  $\underline{\quad}$  &  $\underline{\quad}$ .

$$SE\bar{x} = \frac{S}{\sqrt{n}}$$

$$SE\bar{x} = \frac{S}{\sqrt{n}}$$



90% Confidence

$$(Z = 1.645)$$

within 5%.

means the margin of error can not be more than 5%.

$$5\% = .05$$

Margin of Error Proportions  $\{Z\}$

$$P = .46$$

$$\text{CI} = \text{statistic} \pm (\text{crit. value})(\text{SD of stat.})$$

$$ME = Z^* \left( \sqrt{\frac{P(1-P)}{n}} \right)$$

ME

$$1 - .46 = .54$$

$$*.05 \geq \frac{1.645}{1.645} \left( \sqrt{(.46)(.54)} \right)$$

$$n \geq \frac{(1.645)^2 \cdot (.54)}{.0009239}$$

$$.030395^2 \geq \sqrt{\frac{(.46)(.54)}{n}}$$

$$n \geq 268.9$$

$$(n) .0009239 \geq \frac{(.46)(.54)}{n}$$

n has to be at least 269

60% } ME to be within  $\frac{3\%}{(.03)}$  \* What sample size  
 $P = .6$   
 95% confident ( $Z = 1.96$ ) is needed

$$ME = Z \left( \sqrt{\frac{P(1-P)}{n}} \right)$$

$$\frac{.03}{1.96} = \frac{1.96 \left( \sqrt{(.6)(.4)} \right)^2}{1.96}$$

$$\left( \frac{.03}{1.96} \right)^2 = \sqrt{\frac{(.6)(.4)}{n}}$$

SAMP. SIZE AT LEAST

1025

$$ME = \frac{(\text{crit. value})(\text{SD of stat.})}{\sqrt{n}}$$

$$P = .6$$

$$1 - P = .4$$

$$.0002343 = \frac{(.6)(.4)}{n}$$

$$\frac{(n) .0002343}{.0002343} = \frac{.24}{.0002343}$$

$$n = \underline{1024.3}$$

$$2. \hat{P} = \frac{229}{525} \approx \underline{\underline{.4362}}$$

"P" .46  
 $(\underline{.4006}, \underline{.4718})$

90% CI

3. We are 90% confident that the proportion of females in the U.S Labor force is somewhere between .4006 & .4718.

4. 90% confidence means if we took many different samples (All possible samples) about 90% of them would yield an interval that contains the true proportion.

1) A company that produces light bulbs is concerned about the distribution of the life expectancy of the bulbs. The company takes a simple random sample of 100 bulbs and computes the sample mean to be 950 hours per bulb.

**and interpret**  $n = 100$  ✓

- a. Construct a 95% confidence interval for the unknown mean life expectancy assuming that the sample standard deviation was 30 hours. (Include all aspects of a CI)

✓ Population: All light bulbs produced by a company.

✓ Parameter: ( $\mu$ ) Avg. # of hours a light bulb lasts

✓ Type of Interval: 1-Sample "t" interval

Conditions:

- Random Samp ✓
- $10n < \text{Pop Size}$  ✓
- $n \geq 30$  ✓

✓ Q5: CI

✓ Formula: Interval

$$\bar{x} \pm t \left( \frac{s}{\sqrt{n}} \right)$$

$$[944.05, 955.95]$$

$$\bar{x} = 950$$

$$s = 30$$

$$n = 100$$

we are 95% confident that the actual mean life expectancy for light bulbs produced at this company is between (944.05, 955.95)

## Types of CI Intervals

Quantitative

$\sigma$  Known

1-Sample Z Interval

$\sigma$  Unknown ( $s$ )

1-Sample t Interval

Categorical

1-Proportion Interval