November 3, 2021

Confidence Intervals

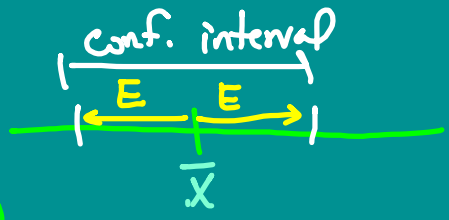
$Z = \frac{x - \mu}{\sigma}$

Inferential Statistics – Using a sample to represent a population

Confidence Interval – an interval about the sample mean ($\bar{x}$) in which the population mean lies within a certain level of confidence.

$\bar{x} \pm E$

↑ margin of error



90%
95%
99%

3 Steps to find a confidence interval.

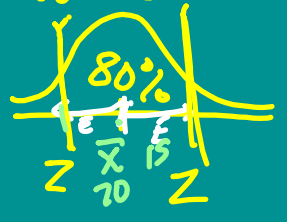
1) Find standard deviation of the sampling distribution. (standard error of the mean = $\sigma_{\bar{x}}$)

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{s}{\sqrt{n}} \leftarrow n \geq 30$$

2) Find margin of error (E)

$$E = z \cdot \sigma_{\bar{x}}$$

z is based on % confident



3) Find conf. interval

$$\bar{x} \pm E$$

Mean weight of 36 h.s. wrestlers is 136.4 lb.
Standard dev = 14.1 lb. Find a 90% conf. interval.
for the mean weight of all h.s. wrestlers.

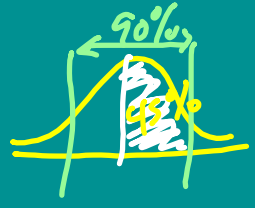
1) $\sigma_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{14.1}{\sqrt{36}} \simeq 2.35$

2) $E = z \cdot \sigma_{\bar{x}}$
$E = 1.65 * 2.35$
$= 3.88$ lb.

3) $\bar{x} \pm E$

136.4 ± 3.88

$132.52 - 140.28$



A → 0.4500
z = 1.65

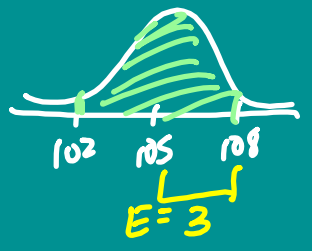
You are 90% confident that the mean of all h.s wrestlers fall between 132.52 lb. + 140.28 lb.

81 cattle fed a special diet

Mean wt. gain = 105 lb. $s = 10$ lb.

What is the probability (% confidence) a cow gained 102 lb – 108 lb.?

$$\sigma_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{10}{\sqrt{81}} = 1.11$$



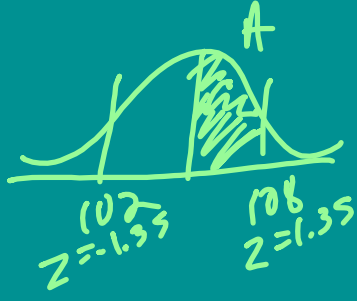
Find z.

$$E = z \cdot \sigma_{\bar{x}}$$

$$\frac{3}{1.11} = \frac{z \cdot 1.11}{1.11}$$

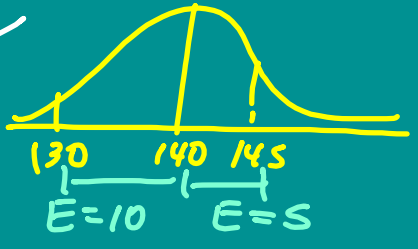
$$1.35 = z$$

$$z = \frac{E}{\sigma_{\bar{x}}}$$



0.4115 × 2 = 0.823

Find prob. 130 — 145 $\bar{x} = 140$



$10 = z \cdot 1.35$ $5 = z \cdot 1.35$

Sample Size

$$n = \left(\frac{Z \cdot \sigma}{E}\right)^2$$

$$n = \left(\frac{1.75 \cdot 1.4}{0.2}\right)^2$$

≈ 150.062

Sample 151

Always round up!

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$$E = Z \cdot \sigma_{\bar{x}}$$

$$\frac{E}{Z} = \sigma_{\bar{x}}$$

$$(\sqrt{n})^2 = \left(\frac{\sigma}{\sigma_{\bar{x}}}\right)^2$$

$$n = \left(\frac{\sigma}{\sigma_{\bar{x}}}\right)^2$$

$$n = \left(\frac{\sigma}{\frac{E}{Z}}\right)^2$$

92% prob.

Mean GPA 3.1–3.5

$\sigma = 1.4$