STAT 2023 Exercise Lesson 13 **Name in clear print** ____________________

Estimation of the Mean **Legal Signature** ____________________

Exercise Two on Lesson 13 **CWID write clearly** ____________________

A marketing executive at Amazon is interested in estimating the mean number of products that a visitor to the Amazon.com views in one visit to the site. A random sample of 625 visitors to the Amazon site indicated that visitors viewed an average of 15.6 products per visit. Assume the population standard deviation of the number of products viewed per visitor is 7.5. Use this information to answer the following questions.

$n = 625, \quad \bar{x} = 15.6, \quad \sigma = 7.5$

1. What is the point estimate for the mean number of products viewed per visitor to the Amazon site?

$$\bar{x} = \hat{\mu} = 15.6$$

2. What is the standard error of the point estimate for the mean number of products viewed per visitor to the Amazon site?

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{7.5}{\sqrt{625}} = 0.3$$

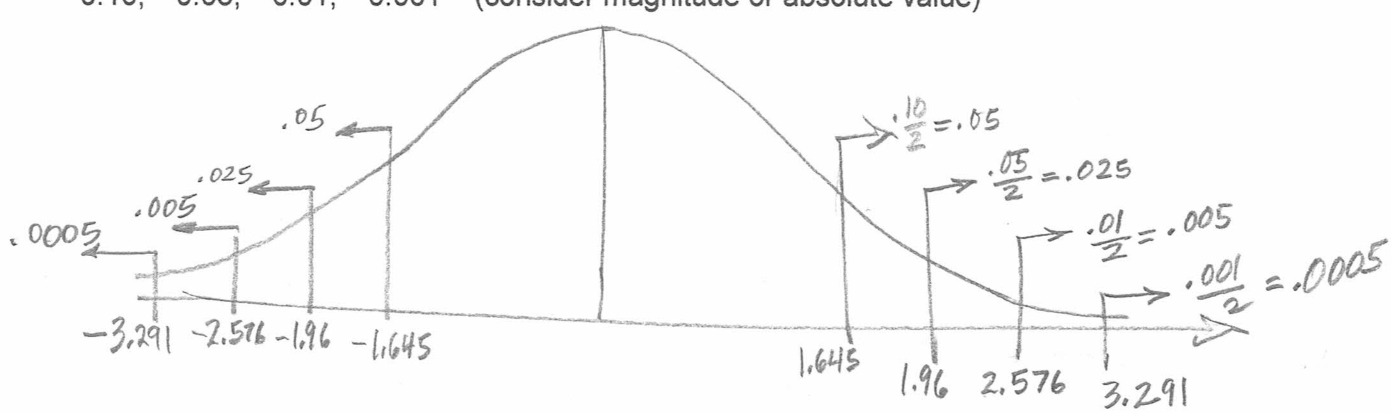
3. What is the 95% confidence interval to estimate the mean number of products viewed per visitor to the Amazon site?

$$\bar{x} \pm z_{\frac{.05}{2}} \cdot \sigma_{\bar{x}}$$
$$\bar{x} \pm z_{.025} \cdot \frac{\sigma}{\sqrt{n}}$$
$$15.6 \pm 1.96\left(\frac{7.5}{\sqrt{625}}\right)$$
$$15.6 \pm 1.96(.3) \Rightarrow 15.6 \pm .588 \Rightarrow (15.012,\ 16.188).$$

4. What does it mean that the interval above is associated with 95% confidence?

The equation for the interval has a 95% change of generating an interval based on data that actually contains μ. But; there is a 5% chance that the equation for the interval when applied to data will generate an interval that does not contain μ. When the numerical interval is stated it is not known whether the one stated is one of the good 95% or Bad 5%.

5. Identify Z values associated with the set of sample means that are unlikely at the following levels: 0.10, 0.05, 0.01, 0.001 (consider magnitude or absolute value)



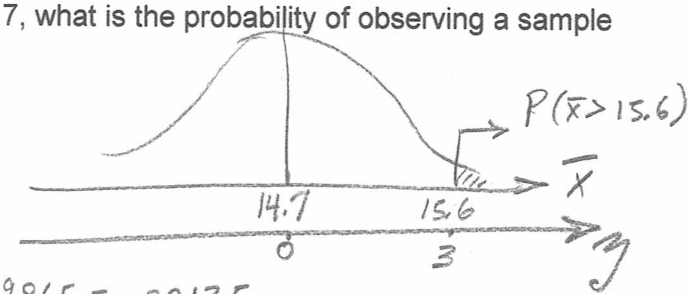
STAT 2023 Lesson 13 Second Exercise, page two

Same Problem, continued from front page:

6. If the population mean, μ, is equal to the value of 14.7, what is the probability of observing a sample mean that is at least 15.6?

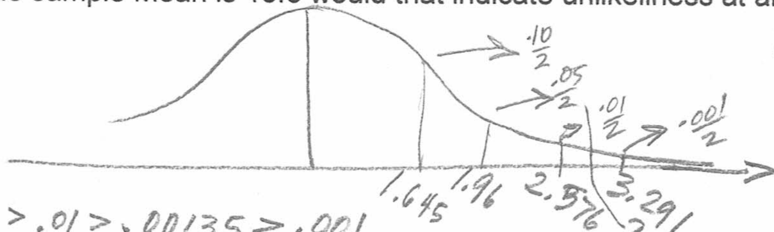
$P(\bar{x} > 15.6 \mid \mu = 14.7)$

$= P\left(\frac{\bar{x}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} > \frac{15.6-14.7}{\frac{7.5}{\sqrt{625}}}\right) =$



$= P(z > 3) = 1-P(z<3) = 1-.99865 = .00135$

7. If the sample mean is 15.6 would that indicate unlikeliness at any of the levels listed above?



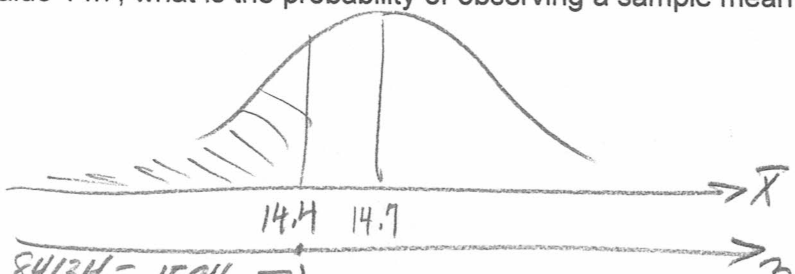
Yes, 3 is in a more unlikely region than .10, .05, or .01, but not .001.

$.10 > .05 > .01 > .00135 > .001$

8. If the population mean, μ, is equal to the value 14.7, what is the probability of observing a sample mean that is 14.4 or less?

$P(\bar{x} < 14.4) =$

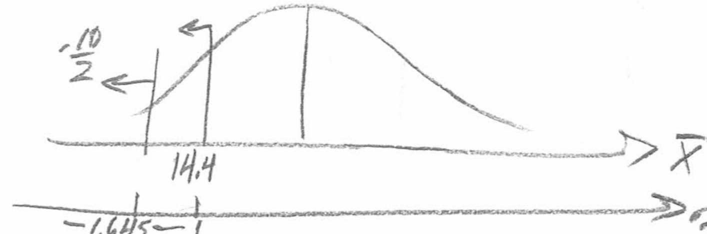
$= P\left(\frac{\bar{x}-\mu}{\sigma_{\bar{x}}} < \frac{14.4-14.7}{.3}\right)$



$= P(z < -1) = 1-P(z<1) = 1-.84134 = .15816$

9. If the sample mean is 14.4 would that indicate unlikeliness at any of the levels listed above?

$.15816 > .10 > .05 > .01 > .001$, so no 14.4 is not unlikely at any of the values listed.



Adequate Sample Size Problems

10. How many observations would be required to estimate the average standing height of roadrunners with 95% confidence interval to estimate the mean within 0.15 inches if the population standard deviation of roadrunner heights is known by ornithologist to be 0.4 inches?

$\alpha = .05$

$B = .15$

$\sigma = .4$

$$n \ge \frac{z_{\alpha/2}^2 \cdot \sigma^2}{B^2} = \frac{z_{.05/2}^2 (.4^2)}{.15^2} = \frac{1.96^2 (.4^2)}{.15^2} = 27.3 \Rightarrow n \ge 28$$

11. How many adult female coyotes would have to be sampled in order to estimate their average weight with a 95% confidence interval that is 2 pounds wide? Assume the population standard deviation of the weights for adult female coyotes is 1.8 pounds.

$\alpha = .05$

$B = 1$

$\sigma = 1.8$

$$n \ge \frac{z_{\alpha/2}^2 \cdot \sigma^2}{B^2} = \frac{z_{.05/2}^2\, \sigma^2}{B^2} = \frac{1.96^2 \cdot 1.8^2}{1^2} = 12.45 \Rightarrow n \ge 13$$