1. Of 380 randomly selected medical students, 21 said that they planned to work in a rural community. Find a 95% confidence interval for the true proportion of all medical students who plan to work in a rural community.

$$\hat{p} \pm z_{\alpha/2} \cdot \sqrt{\frac{\hat{p} \cdot \hat{q}}{n}}$$

$$\hat{p} = 21/380 = 0.0553$$
$$\hat{q} = 0.9447$$

$$0.0553 \pm 1.96 \cdot \sqrt{\frac{0.0553 \cdot 0.9447}{380}}$$
$$0.0553 \pm 0.0230$$
$$(0.0323, 0.0783)$$

2. Which of the following critical values is appropriate for a 98% confidence level where n = 7; $\sigma = 27$ and the population appears to be normally distributed.

   Answer: 2.326 or 2.33 to two decimal places

3. Use the given degree of confidence and sample data to construct a confidence interval for the population mean μ. Assume that the population has a normal distribution. A laboratory tested twelve chicken eggs and found that the mean amount of cholesterol was 185 milligrams with s = 17.6 milligrams. Construct a 95% confidence interval for the true mean cholesterol content of all such eggs.

$$\bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$185 \pm 2.201 \cdot \frac{17.6}{\sqrt{12}}$$

$$185 \pm 11.2$$

$$(173.8, 196.2)$$

4. A laboratory tested 82 chicken eggs and found that the mean amount of cholesterol was 228 milligrams with $\sigma = 19.0$ milligrams. Construct a 95% confidence interval for the true mean cholesterol content, μ, of all such eggs.

Answer to #4:

$$n = 82 \qquad \bar{x} = 228 \qquad \sigma = 19.0 \qquad 95\%\ CI$$

$$\bar{x} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

$$228 \pm 1.96 \cdot \frac{19}{\sqrt{82}}$$

$$228 \pm 4.1$$

$$(223.9, \quad 232.1)$$

5. Use the given degree of confidence and sample data to construct a confidence interval for the population mean μ. Assume that the population has a normal distribution.
n = 30, x = 84.6, s = 10.5, 90% confidence

$$\bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$84.6 \pm 1.6991 \cdot \frac{10.5}{\sqrt{30}}$$

$$84.6 \pm 3.26$$

$$(81.34, \quad 87.86)$$

6. A group of 59 randomly selected students have a mean score of 29.5 with a standard deviation of 5.2 on a placement test. What is the 90% confidence interval for the mean score, μ, of all students taking the test?

$$\bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$29.5 \pm 1.672 \cdot \frac{5.2}{\sqrt{59}}$$

$$29.5 \pm 1.13$$

$$(28.37, \quad 30.63)$$

7. Use the given data to find the minimum sample size required to estimate the population proportion. Margin of error: 0.008; confidence level: 98%; p and q unknown

No estimate of $\hat{p}$ known; therefore use $\hat{p} = \hat{q} = 0.5$

$Error = 0.008$

$n = \hat{p} \cdot \hat{q} \left(\frac{z_{\alpha/2}}{E}\right)^2$

$n = 0.50 \cdot 0.50 \left(\frac{2.33}{0.008}\right)^2 = 21206.64\ldots => 21{,}207$

Note: n is always rounded up to the next integer.

8. Express the confidence interval 0.039 < p < 0.479 in the form of p ± E.

Since intervals are construct as follows:

$$\hat{p} - E < p < \hat{p} + E$$

Then,

$$\hat{p} - E = 0.039 \qquad and$$
$$\hat{p} + E = 0.479$$

solving the system of equations:

$2\hat{p} = 0.518$ from which it follows that $\hat{p} = 0.259$

Now, using $\hat{p} + E = 0.479$ substitute in $\hat{p} = 0.259$ and find $E = 0.220$

Answer: 0.259 ± 0.220

9. Identify the distribution that applies to the following situation: In constructing a confidence interval of μ, you have 50 sample values and they appear to be from a population with a skewed distribution. The population standard deviation is not known.
   A) Normal distribution B) Soudent t distribution

Answer: When the population standard deviation (σ) is not known, we cannot use the normal distribution (which requires σ). Instead, we use the Student's t-distribution, which is designed to handle cases where σ is unknown and the sample standard deviation (s) is used as an estimate.