

**Instructions:** Show all work. You may use your calculator rather than compute formulas by hand, but if you do, 'show work' by saying which program you used to obtain the result and what information you entered. Round measures of center to one decimal place more than the data, and variance/standard deviation to two decimal places more than the original data. Round probabilities to three decimal places (or percent plus one decimal place).

1. Suppose that a random sample of 65 bottles of wine found a mean alcohol content of 8.9%, and suppose that it has been previously determined that the standard deviation of the alcohol content in wine is known to be 1.4%. Find a 95% confidence interval for the true alcohol content of wine.

$$n = 65 \quad \bar{x} = .089 \quad \sigma = .014$$

z-interval stats

$$\sigma = .014$$

$$\bar{x} = .089$$

$$n = 65$$

C-Level: .95

$$\Rightarrow (.0856, .0924)$$

$$\text{or } (8.56\%, 9.24\%)$$

2. Write the confidence interval above in terms of the standard error and the point estimate.

$$\pm 1.96 \frac{\sigma}{\sqrt{n}} = 1.96 * \frac{.014}{\sqrt{65}} = E = .0034$$

$$\frac{\sigma}{\sqrt{n}} = .001736...$$

$$.089 \pm .0034 \quad \text{or} \quad 8.9\% \pm .34\%$$

3. The NSF recently reported that 26% Americans do not know that the Earth revolves around the Sun. If 1500 people were surveyed, what is the standard error for the proportion of Americans that don't know that the Earth revolves around the Sun? What sample size would be required to make the 99% confidence interval have a maximum width of only 1%?

$$\hat{p} = 26\%$$

$$n = 1500 \Rightarrow X = 390$$

$$.28917 - .26 = .03917$$

$$z_{\alpha/2} = 2.5758$$

$$E = .03917 = z_{\alpha/2} \cdot \text{Standard error}$$

$$\text{Standard error} = .0152$$

C-Level = .99

$$(.23083, .28917)$$

$$n \approx \frac{4(2.576)^2(.26)(.74)}{(.01)^2} \Rightarrow n \approx 51,069$$