Math 10 MPS - Homework 5 Answers

1. A researcher wanted to estimate the MPG for municipal busses in a large city. 100 busses were samples and the sample mean price was 9.8 MPG. For the following questions, assume the population standard deviation is 1.2 MPG.

   a. Find a 95% confidence interval for the population mean. Explain what this interval means in the context of the problem.

   $$9.8 \pm 1.96(1.2)/\sqrt{100} \rightarrow 9.8 \pm .235 \rightarrow (9.565, 10.035)$$

   We are 95% confident that mean MPG for busses is between 9.565 and 10.035 MPG

   b. Find a 99% confidence interval for the population mean. Why does the confidence interval have a larger margin of error?

   $$9.8 \pm 2.576(1.2)/\sqrt{100} \rightarrow 9.8 \pm .31 \rightarrow (9.50, 10.11)$$

   To be more confident, we need a bigger target, more margin of error.

   c. Suppose you wanted to redo the sampling or the 95% confidence interval in order to get a margin of error of plus or minus 0.1 MPG. Determine the necessary sample size.

   $$n = \left[\frac{(1.96)(1.2)}{0.1} \right]^2 = 554$$

2. The department of education conducted a survey of 1100 undergraduate college students and determined that 761 have received some form of financial aid.

   a. Determine the point estimate for the proportion of undergraduate college students who have received some form of financial aid.

   $$\hat{p} = \frac{761}{1100} = .692$$

   b. Find a 95% confidence interval for the proportion of the undergraduate students who have received some form of financial aid. Explain what this interval means in the context of the problem.

   $$0.692 \pm 1.96\sqrt{(0.692)(0.308)/1000} \rightarrow 0.692 \pm 0.027 \rightarrow (0.665, 0.719)$$

   We are 95% confident that the percentage of undergraduate students who have received some form of financial aid is between for busses is between 66.5% and 71.9%

   c. Suppose you wanted to redo the sampling in order to get a margin of error of plus or minus 0.02. Determine the necessary sample size assuming you know nothing about the actual proportion.

   $$n = (0.5)(0.5) \left[\frac{(1.96)}{0.2} \right]^2 = 2401$$

3. The mean number of years of post secondary education of employees in an industry is 1.5. A company claims that this *mean* is higher for its employees. A random sample of 16 of its employees has an *mean* of 2.1 years of post secondary education with a *sample standard deviation* of 0.6 years.

   a. Find a 95% confidence interval for the mean number years of post secondary education for the company's employees. How does this compare with the industry value?

   $$2.1 \pm 2.131(0.6)/\sqrt{16} \rightarrow 2.1 \pm .32 \rightarrow (1.78,\ 2.42)$$ **The company is well above the industry average.**

   b. Find a 95% confidence interval for the *standard deviation* of number years of post secondary education for the company's employees.

   $$\left(\sqrt{\frac{(15)(0.6^2)}{27.488}},\ \sqrt{\frac{(15)(0.6^2)}{6.262}} \right) = (0.443,\ 0.929)$$ **(Chi-square with 15 df)**

4. When polling companies report a margin of error, they are referring to a 95% confidence interval. Go to the website www.pollingreport.com and **verify** the stated margins of error for 2 polls.

   Many answers possible