Answer on Question #74153 – Math – Statistics and Probability

The average price of a gallon of unleaded regular gasoline was reported to be $2.75 in northern Kentucky. Use this price as the population mean, and assume the population standard deviation is $.20.

Question

a. What is the probability that the mean price for a sample of 30 service stations is within $.03 of the population mean?

Solution

$$z = \frac{x - \mu}{\sigma/\sqrt{n}}$$

$$z = \frac{0.03}{0.20/\sqrt{30}} = 0.8216$$

$$P(|z| \le 0.8216) \approx 2(0.7939) - 1 = 0.5878$$

Question

b. What is the probability that the mean price for a sample of 50 service stations is within $.03 of the population mean?

Solution

$$z = \frac{x - \mu}{\sigma/\sqrt{n}}$$

$$z = \frac{0.03}{0.20/\sqrt{50}} = 1.06066$$

$$P(|z| \le 1.06066) = 2(0.8554) - 1 = 0.7108$$

Question

c. What is the probability that the mean price for a sample of 100 service stations is within $.03 of the population mean?

Solution

$$z = \frac{x - \mu}{\sigma/\sqrt{n}}$$

$$z = \frac{0.03}{0.20/\sqrt{100}} = 1.5$$

$$P(|z| \le 1.5) = 2(0.9332) - 1 = 0.8664$$

Question

d. Which, if any, of the sample sizes in parts (a), (b), and (c) would you recommend to have at least a .95 probability that the sample mean is within $.03 of the population mean?

Solution

None of the sample sizes in parts (a), (b), and (c) are large enough.

$$P(|z| \leq 1.96) = 2(0.975) - 1 = 0.95$$

$$\frac{0.03}{0.20/\sqrt{n}} \geq 1.96$$

$$n \geq \left(\frac{1.96(0.2)}{0.03}\right)^2 => n \geq 171$$