

11/27/18

Test 3 Class Review Problems

1. A Gallup poll asked 1006 adult Americans how much it would bother them to stay in a room on the 13th floor of a hotel. Interestingly, 135 said it would bother them. Construct a 95% confidence interval for the population proportion of people who would be bothered by staying in a room on the 13th floor of a hotel.

Answers

$$\hat{p} = \frac{135}{1006} = .1342$$

$$n\hat{p}(1-\hat{p}) = 1006(.1342)(.8658) \\ = 116.9 > 10$$

$$z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 1.96 \sqrt{\frac{.1342(.8658)}{1006}} \\ = 1.96(.0107)$$

$$\left. \begin{array}{l} \text{upper: } .1342 + \{1.96(.0107)\} \\ \text{lower: } .1342 - \{1.96(.0107)\} \end{array} \right\} 95\% \text{ C.I. } (.1132, .1552)$$

2. According to a study done by the Pew Research Center, 39% of adult Americans believe that marriage is now obsolete.
- a. Suppose a random sample of 500 adult Americans is asked whether marriage is obsolete. Describe the sampling distribution of the sample proportion of adult Americans who believe marriage is obsolete.

Answer:

$$\mu_{\hat{p}} = .39$$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} \\ = \sqrt{\frac{.39 \times .61}{500}}$$

$$= \boxed{.0218}$$

$$np(1-p) > 10$$

$$500(.39)(.61) > 10$$

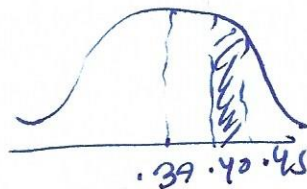
$$118.95 > 10$$

Approximately normal.

- b. What is the probability that in a random sample of 500 adult Americans between 40% and 45% believe that marriage is obsolete?

$$z_1 = \frac{.40 - .39}{.0218} = 0.46$$

$$z_2 = \frac{.45 - .39}{.0218} = 2.75$$



$$P(Z < 0.46) = .6772$$

$$P(Z < 0.40) = .6772$$

$$P(Z < 2.75) = .9970$$

$$P(Z < 0.45) = .9970$$

$$P(.40 < \hat{p} < .45)$$

$$= .9970 - .6772$$

$$= \boxed{.3198}$$

- c. What is the probability that in a random sample of 500 adult Americans less than 38% believe that marriage is obsolete?

$$z = \frac{.38 - .39}{.0218} = -0.46$$

$$P(Z < -0.46) = .3228$$

$$P(\hat{p} < .38) = .3228$$

3. General Electric manufactures a decorative Crystal Clear 60-watt light bulb that is advertised will last 1500 hours. Suppose that the lifetimes of the light bulbs are approximately normally distributed, with a mean of 1550 hours and a standard deviation of 57 hours.

a. What percentage of the light bulbs will last less than the advertised time?

$$z = \frac{1500 - 1550}{57} = -0.88$$

$$P(Z < -0.88) = 0.1894$$

$$P(X < 1500) = \boxed{0.1894}$$

b. What percentage of the light bulbs will last more than 1650 hours?

$$z = \frac{1650 - 1550}{57} = 1.75$$

$$0.9599 = P(Z < 1.75) = 1 - 0.0401$$

$$\text{left} \quad P(X > 1650) = \boxed{0.0401}$$

c. What is the probability that a randomly selected GE Crystal Clear 60-watt light bulb will last between 1625 and 1725 hours?

$$z_1 = \frac{1625 - 1550}{57} = 1.32 \quad P(Z < 1.32) = 0.9066$$

$$z_2 = \frac{1725 - 1550}{57} = 3.07 \quad P(Z < 3.07) = 0.9989$$

$$P(1625 < X < 1725) = 0.9989 - 0.9066 = \boxed{0.0923}$$

