STAT 2023 Exercise Lesson 16 **Name in clear print** ______________________

WRITE THE SOLUTIONS SHOWN IN CLASS ON THIS PAGE TO RECEIVE PARTICIPATION CREDIT.

Legal Signature ______________________

CWID write clearly ______________________

Bad Bulb Problem. You purchase 1000 light bulbs that are on sale for ½ price. A sign indicates that that 10% of the bulbs are defective. After checking the bulbs you realize that 800 of them are bad or defective. Use this information to answer the questions on this page.

1. Write a description of the parameter of concern in this situation:

The parameter of interest is the proportion of defective bulbs.

0.80 2. What is the estimate of the proportion of defective bulbs from this sample of 1000?

$$\hat{p} = \frac{X}{n} = \frac{800}{1000} = .8$$

0.0126 3. What is the estimated standard error based on the data for the estimate of the proportion of defective bulbs from this sample of 1000?

$$S_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{.8(1-.8)}{1000}} = 0.012649$$

$p = .10$ 4. What is the appropriate null hypothesis to test if the proportion of defective bulbs is equal to 10%?

$$H_0: p = .10$$

$p \neq .10$ 5. What is the appropriate alternative hypothesis if the question is, "Do the data support the idea that the proportion of defective bulbs differs from 10%?"

$$H_A: p \neq .10$$

55.34 6. What is the value of the Z test statistic to test whether the proportion of defective bulbs is equal to 10%?

$$Z_{calc} = \frac{\hat{p} - p_0}{S_{\hat{p}}} = \frac{.8 - .1}{\sqrt{\frac{.8(1-.8)}{1000}}} = 55.34$$

(0.775, 0.825) 7. Based on these data, what is the 95% confidence interval to estimate the proportion of defective bulbs?

$$\hat{p} \pm Z_{\frac{.05}{2}} \cdot S_{\hat{p}} \Rightarrow .8 \pm 1.96\sqrt{\frac{.8(1-.8)}{1000}}$$

$$\Rightarrow (0.775, \ 0.825)$$

8. Based on the above confidence interval generated in #7 would the hypothesis that the proportion of defective bulbs equals 10% be rejected at the 5% level of significance?

$H_0: p = .10$ is rejected based on above interval, since .10 is not contained in the interval.

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During a recent automotive race eight-hundred fans were surveyed about their attendance at other types of professional sporting events. Out of the 800 fans surveyed, 212 of them answered that they did attend other types of professional sporting events. Use this information to answer the remaining questions on this page.

$n = 800, \; X = 212$

0.265 9. Based on this sample what is the numerical value of the point estimate for the proportion of automotive race fans who also attend other professional sports events?

$$\hat{p} = \frac{X}{n} = \frac{212}{800} = 0.265 \text{ or } 26.5\%$$

0.0156 10. What is the numerical value of the estimated standard error for the point estimate for the proportion of automotive race fans who also attend other professional sports events? Round the answer to four digits past the decimal.

$$S_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{.265(1-.265)}{800}} = 0.015603$$

1.2 11. Assume that the estimated standard error for the point estimate for the proportion of automotive race fans who also attend other professional sports events is 0.0125. What is the numerical value of the test statistic to test the hypothesis that 25% of automotive race fans also attend other professional sports events versus the alternative hypothesis that the proportion is different from 25%? $S_{\hat{p}} = 0.0125$ then,

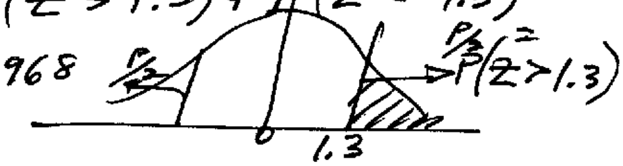
$$z_{calc} = \frac{\hat{p} - p_0}{\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}} = \frac{.265 - .25}{.0125} = 1.2$$

0.1936 12. Assume the value of the z test statistic is 1.3. What is the p-value in that case?

If $z_{calc} = 1.3$ then $p = P(Z > 1.3) + P(Z < -1.3)$

$\frac{p}{2} = P(Z > 1.3) = .5 - .4032 = .0968$

So $p = 2(.0968) = .1936$



No 13. Assume the p-value in this case is 0.1936, can the null hypothesis be rejected at the 5% significance level? If $p = .1936 > .05 = \alpha \Rightarrow$ Do not reject $H_0 \Rightarrow$ No

$(0.2405, 0.2895)$ 14. Assume that the estimated standard error for the point estimate for the proportion of automotive race fans who also attend other professional sports events is 0.0125. What is the 95% confidence interval to estimate that proportion of automotive race fans who also attend other professional sports events based on the data described above? $S_{\hat{p}} = 0.0125$ then,

$$\hat{p} \pm z_{\frac{.05}{2}} S_{\hat{p}} \Rightarrow .265 \pm 1.96(0.0125) \Rightarrow .265 \pm .0245$$

$$\Rightarrow (0.2405, \; 0.2895)$$

15. Based on the confidence interval generated in #14, will the null hypothesis that the proportion is equal to .25 be rejected? Write a sentence answer.

Since .25 is contained in the 95% confidence interval that value would not be rejected if tested as $p = .25$.