STATISTICS 2023 NAME, PRINT IN INK Key

EXAM THREE SIGNATURE, IN INK _____

SPRING 2011 CWID, IN INK _____

Once this exam is graded and returned to you retain it for grade verification.

TRUE OR FALSE. Answer with a capital T or F. **(3 points each)**

T 1. One percent of all the confidence intervals generated from the 99% confidence interval equation do not contain the value of the parameter that is estimated.

F 2. The decision in an hypothesis test is whether to reject or to not reject the alternative hypothesis.

T 3. In an hypothesis test if the value of the Z test statistic is equal to 7.9 then the null hypothesis could be rejected with a very small error rate.

T 4. Small samples are only appropriate to construct confidence intervals and perform tests of hypothesis if the sampled population is assumed to be normally distributed.

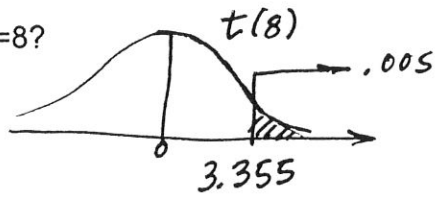
F 5. As the sample size increases the standard errors of the point estimates also increase.

F 6. If the data provides a very large p-value then a researcher would conclude that the data supports the statement in the alternative hypothesis.

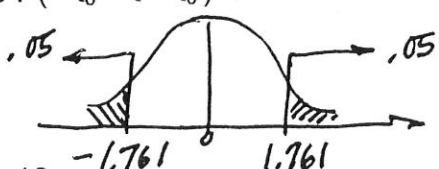
T 7. A confidence interval that estimates a population mean is centered on a point estimate for the population mean.

Questions on the t-table. **State the answer on the line. (3 points each)**

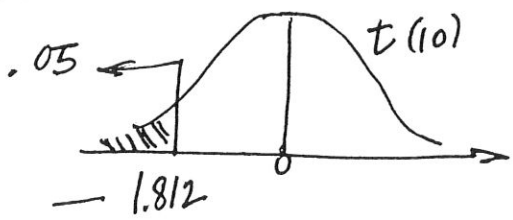
.005 8. What is the P(t > 3.355) if df=8?



1.761 9. State the value of t_o, if the P($-t_o < t < t_o$)=.90 and the df=14.



.05 10. P(t < –1.812)=?, if the df=10



STATE THE ANSWER. State the answer on the line given. (3 points each)

203.1 11. If a 99% confidence interval to estimate a population mean is (102.3, 303.9) what is the value of the point estimate for the population mean?

$\bar{X}$ is the center of the interval, $\bar{X} = \frac{102.3 + 303.9}{2}$

2 12. If a 95% confidence interval based on a large sample to estimate a population mean is (46.08, 53.92) then what is the value of the standard error of the point estimate for the population mean?

$width = 2B = 2(z_{.025})s_{\bar{x}} = 2(1.96)s_{\bar{x}} = 53.92 - 46.08 = 7.84$

$s_{\bar{x}} = \frac{7.84}{2(1.96)} = 2$

43 13. How many flights would have to be sampled in order to estimate the average amount of time (in minutes) a flight is late with a 95% confidence that is 12 minutes wide? Assume the standard deviation of the time a flight is late is 20 minutes.

$n \geq \frac{z_{\alpha/2}^2 \sigma^2}{B^2} = \frac{1.96^2 \, 20^2}{6^2} = 42.684 \Rightarrow 43$

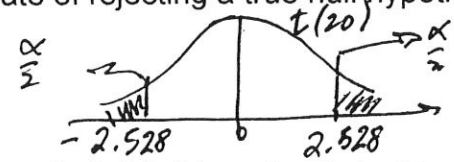
0.09 14. What is the point estimate for population proportion if a 96% confidence interval for the proportion of college students who binge drink is (.01, .17)?

(.3523, .4318) $\hat{p}$ is the center of the interval, $\hat{p} = \frac{.01 + .17}{2}$

(.3522, .4318) 15. If out of 1000 people surveyed 392 said they preferred Pepsi to Coca-Cola calculate a 99% confidence interval for the population proportion? Round the answer to 4 decimal places.

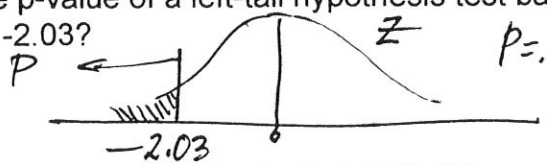
$\hat{p} \pm z_{\frac{.01}{2}} s_{\hat{p}} \Rightarrow \hat{p} \pm z_{.005} \sqrt{\frac{\hat{p}\hat{q}}{n}} \Rightarrow .392 \pm 2.576 \sqrt{\frac{.392(1-.392)}{1000}} \Rightarrow$

.02 16. If the rejection region in a two-tail hypothesis test based on a sample with 21 observations drawn from a population whose variance is unknown is below –2.528 and above 2.528 what is the maximum error rate of rejecting a true null hypothesis which this researcher will tolerate?



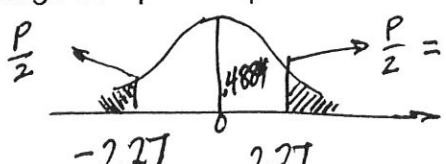
$\frac{\alpha}{2} = .01 \Rightarrow \alpha = .02$

.0212 17. What is the p-value of a left-tail hypothesis test based on a large sample if the test statistic value is -2.03?



$P = .5 - .4788 = .0212$

2.27 18. What is the magnitude of the test statistic if the p-value in a two-tail hypothesis test based on a large sample is equal to 0.0232?



$\frac{P}{2} = \frac{.0232}{2} = .0116$

$.5 - .0116 = .4884$ inside area

STATE THE ANSWER. Write the answer on the line. (3 points each)

College students carry more credit card debt on average than they did one decade ago. A consumer credit organization is studying the debt of college students. They collected credit information from 900 college students across the US. This sample yielded a mean debt of $2748 and a standard deviation of $252. $n=900,\ \bar{x}=\$2{,}748,\ s=\$252$

2,748 20. What is the numerical value of the point estimate for the mean amount of credit card debt for college students?

$\hat{\mu}=\bar{x}=\$2{,}748$

8.4 21. What is the numerical value of the estimated standard error for the point estimate for the mean amount of credit card debt for college students?

$s_{\bar{x}}=\frac{s}{\sqrt{n}}=\frac{252}{\sqrt{900}}=8.4.$

17.64 22. Assume that the estimated standard error of the point estimate for the mean amount of credit card debt for college students is 9. What is the numerical value of the bound of error for a 95% confidence interval to estimate the mean amount of credit card debt for college students? State two digits past the decimal.

$B=z_{\alpha/2}\cdot s_{\bar{x}}=1.96(9)=17.64$

2.5 23. If the estimated standard error for the point estimate for the mean amount of credit card debt for college students is 9 what is the numerical value of the test statistic to test whether the mean amount of credit card debt for college students is $2725.50?

$z=\frac{\bar{x}-M_0}{s_{\bar{x}}}=\frac{2748-2725.5}{9}=2.5$

It is believed that 75% of college students have taken out student loans. A sample of 400 students was taken and 328 students said they had taken out student loans. $n=400,\ X=328$

.82 24. Based on this sample what is the numerical value of the point estimate for the proportion of students have taken out student loans?

$\hat{p}=\frac{X}{n}=\frac{328}{400}=.82$

.019 25. What is the numerical value of the estimated standard error value for the point estimate for the proportion of students who have taken out student loans? Calculate the estimated standard error based on the p-hat value. Round to three digits past the decimal.

$s_{\hat{p}}=\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}=\sqrt{\frac{.82(1-.82)}{400}}=.019209372$

1 26. Assume that the estimated standard error of the point estimate for the proportion of students who have taken out student loans is 0.07. What is the numerical value of the test statistic to test the hypothesis that more than 75% of students have taken out student loans?

Assume $s_{\hat{p}}=.07$ $z=\frac{\hat{p}-p}{s_{\hat{p}}}=\frac{.82-.75}{.07}=1$

.1372 27. Assume that the estimated standard error of the point estimate for the proportion of students who have taken out student loans is 0.07. What is the bound of error for a 95% confidence interval to estimate the proportion of students who have taken out student loans?

$B=z_{\frac{.05}{2}}\ s_{\hat{p}}=1.96(.07)=.1372$

HYPOTHESIS TEST QUESTIONS. State the answer on the line. (3 points each)

During a time of national crisis, households in America follow internet news more closely than they normally would. Assume that internet viewing times are normally distributed. A group analyzing the internet viewing habits during a recent crisis sampled 16 households and produced a mean viewing time for websites of 30.2 hours per week with a standard deviation of 16.4. Use this information to answer the following questions.

$n = 16, \quad \bar{X} = 30.2, \quad S = 16.4$

$\mu > 21.18$ 27. State the alternative hypothesis if the research question is, "Do the data support the idea that the mean internet viewing time exceeds the mean of 21.18 hours per week that is typically observed in American households?"

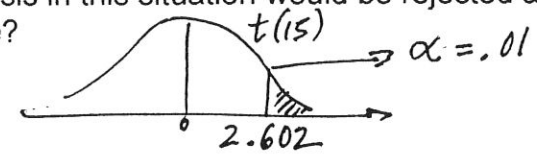
2.2 28. State the numerical value of the test statistic that would result from this situation. State one digit past the decimal.

$$t = \frac{\bar{X} - \mu_0}{S_{\bar{X}}} = \frac{30.2 - 21.18}{\frac{16.4}{\sqrt{16}}} = \frac{9.02}{4.1} = 2.2$$

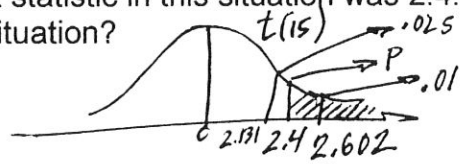
$t(15)$ 29. What is the name of the distribution that represents the set of possible test statistic values if in fact the mean internet viewing time per week during a time of national crisis is 21.18 hours per week?

If H_0 is true then $t_{calc} \sim t(n-1) = t(15)$

2.602 30. The null hypothesis in this situation would be rejected at the 1% level if the test statistic is more than what value?



.01, .025 31. Assume that the value of the test statistic in this situation was 2.4. The p-value in this case is between what two values in this situation?



No 32. Assume the p-value in this hypothesis test is 0.07. Would the null hypothesis be rejected at the 1% significance level in this case? Answer with a YES or NO.

$p = .07 > .01 = \alpha \Rightarrow$ Do not Reject H_0.

Yes 33. Assume the p-value in this hypothesis test is 0.008 Do the data indicate that the mean internet viewing time per week during a national crisis is more than 21.18 hours at the 1% significance level stated above? Answer with a YES or NO.

$p = .008 < .01 = \alpha \Rightarrow$ Reject $H_0 \Rightarrow$ Support H_A.