STATISTICS 2023 NAME, IN PRINT Key

EXAM THREE SIGNATURE, IN INK

SPRING 2015 CWID, IN INK

Retain this exam for grade verification once it is returned to you.

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

T 1. A confidence interval constructed with 95% confidence to estimate the population mean will definitely contain the value of the sample mean.

F 2. The data in a sample can be used to calculate the parameter values that are used to estimate the sample statistics.

T 3. The width of a confidence interval will always increase if the confidence level is increased when sample variance and sample size remain the same.

F 4. If the data does not support the alternative hypothesis, then the null hypothesis is shown to be true by the data.

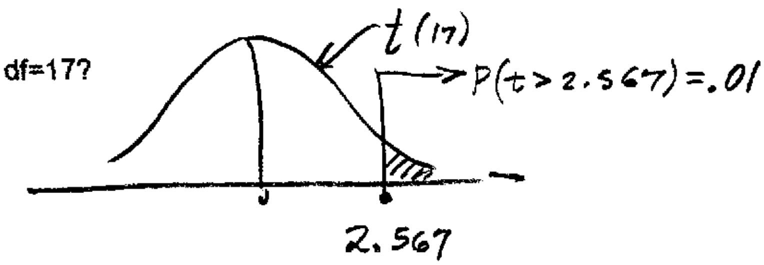
T 5. If the value of the Z test statistic is equal to six, then the null hypothesis could be rejected in a right tail test with a reasonable error rate.

F 6. Increasing the sample size in a research project increases the magnitude of the standard errors associated with the point estimates in the study.

t table questions **(3 points each)**

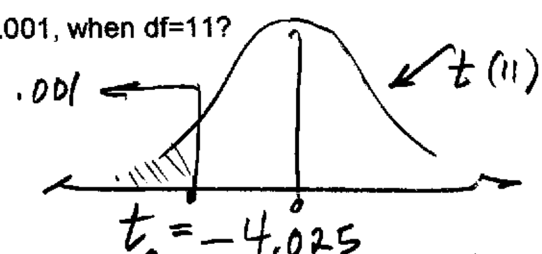
0.01 7. What is the $P(t > 2.567)$ in the t with df=17?

df	$t_{.01}$
17	2.567



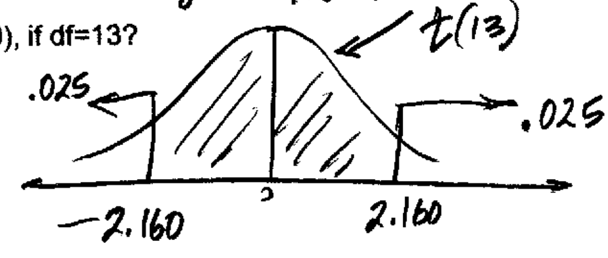
−4.025 8. What is the value of t_o if $P(t < t_o) = .001$, when df=11?

df	$t_{.001}$
11	4.025



0.95 9. What is the $P(-2.160 < t < 2.160)$, if df=13?

df	$t_{.025}$
13	2.160



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

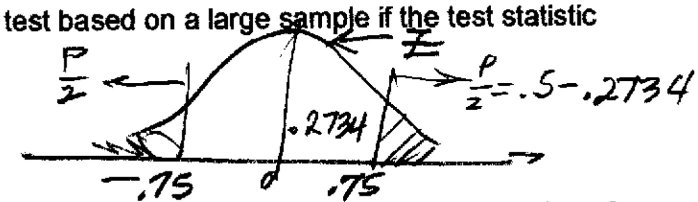
12.48 10. If a data set with fifty observations yields a sum of squares of 12,687.52 and a sum of 624 what is the value of the point estimate for the population mean?

$$\bar{X} = \hat{\mu} = \frac{\Sigma X}{n} = \frac{624}{50} = 12.48$$

0.4532 11. What is the p-value of a two-tail hypothesis test based on a large sample if the test statistic value is -0.75?

$$\frac{P}{2} = .5 - .2734 \Rightarrow$$

$$P = 2(.2266) = .4532$$



375.5 12. If a 90% confidence interval to estimate a population mean is (353, 398) what is the value of the point estimate for the population mean?

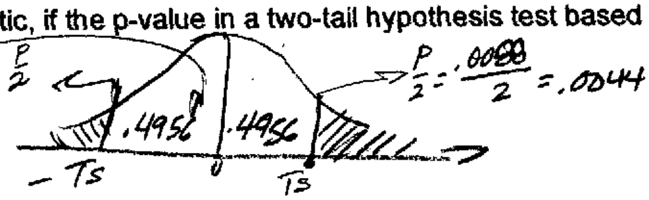
$\bar{X} = \hat{\mu}$ is the center of the interval

$$\bar{X} = \frac{353 + 398}{2} = 375.5$$

2.62 13. What is the positive value of the test statistic, if the p-value in a two-tail hypothesis test based on a large sample is equal to 0.0088?

$$.5 - .0044 = .4956$$

$$TS = 2.62$$



12.5 14. If a 95% confidence interval based on a large sample to estimate a population mean is (636, 685) then what is the value of the standard error of the point estimate for the population mean? State your answer with one digit past the decimal.

$$\text{width} = 2B = 2 z_{\alpha/2} S_{\bar{x}} \Rightarrow$$

$$\text{width} = 685 - 636 = 49 = 2(1.96) S_{\bar{x}} \Rightarrow S_{\bar{x}} = \frac{49}{2(1.96)} = 12.5$$

20.93 15. Consider a 98% confidence interval to estimate a population mean based on a sample of 1024 observations with a sample mean of 425 and a sample standard deviation of 144. How wide is this interval? Round to two digits past the decimal.

$$\text{width} = 2B = 2 z_{\frac{.02}{2}} S_{\bar{x}} = 2(2.326)\frac{S}{\sqrt{n}} = 2(2.326)\frac{144}{\sqrt{1024}} =$$

$$= 20.934$$

3 16. What is the value of the z test statistic, if the hypothesized parameter value for the mean is 22, the point estimate for the mean is 28, and the standard error of the sample mean is 2?

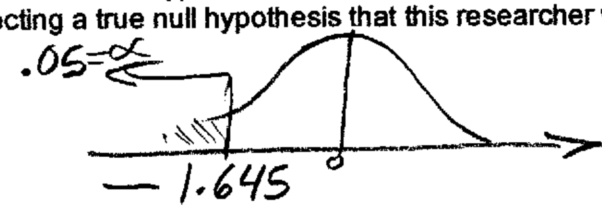
$$z_{calc} = \frac{\bar{X} - \mu_0}{S_{\bar{x}}} = \frac{28 - 22}{2} = 3$$

84 17. How large of a sample would be required to construct a 95% confidence interval estimate a population mean with an interval that is 8 units wide, if the population variance was known to be 347 units?

$$n \geq \frac{z_{\frac{.05}{2}}^2 \sigma^2}{B^2} = \frac{1.96^2(347)}{4^2} = 83.3147 \Rightarrow n \geq 84$$

.05 18. If the rejection region in a left-tail hypothesis test based on a large sample is below -1.645, what is the maximum error rate of rejecting a true null hypothesis that this researcher will tolerate?

df	$t_{.05}$
∞	1.645



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 $3748 and a standard deviation of $252.

$n = 900,\ \bar{x} = 3748,\ S = 252$

3748 19. What is the numerical value of the point estimate for the mean amount of credit card debt for college students?

$\bar{X} = \hat{\mu} = 3748$

8.4 20. 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 21. 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.

$S_{\bar{x}} = 9,\quad B = z_{\frac{\alpha}{2}} \cdot S_{\bar{x}} = 1.96(9) = 17.64$

2.5 22. 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 $3725.50? $S_{\bar{x}} = 9$ then

$z_{calc} = \frac{\bar{X} - \mu_0}{S_{\bar{x}}} = \frac{3748 - 3725.50}{9} = 2.5$

Out of 400 students surveyed, 320 of them were identified as having student loans. Use this information to address the remainder of the questions on this page.

$n = 400,\ x = 320$

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

$\hat{p} = \frac{x}{n} = \frac{320}{400} = 0.8$

0.02 24. 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.

$S_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{.8(1-.8)}{400}} = 0.02$

1 25. Assume that the estimated standard error of the point estimate for the proportion of students who have taken out student loans is 0.05. What is the numerical value of the test statistic to test the hypothesis that more than 75% of students have taken out student loans? $S_{\hat{p}} = .05$ then

$z_{calc} = \frac{\hat{p} - p_0}{S_{\hat{p}}} = \frac{.8 - .75}{.05} = 1$

0.098 26. Assume that the estimated standard error of the point estimate for the proportion of students who have taken out student loans is 0.05. What is the bound of error for a 95% confidence interval to estimate the proportion of students who have taken out student loans? $S_{\hat{p}} = .05$ then

$B = z_{\alpha/2} S_{\hat{p}} = 1.96(.05) = 0.098$

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 do. 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.

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

$\mu > 21.18$ 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?"

$H_0: \mu = 21.18$

$H_A: \mu > 21.18$

2.2 28. State the numerical value of the test statistic that would be used to test the hypothesis that the mean is equal to 21.18 hours per week. State your answer with one digit past the decimal.

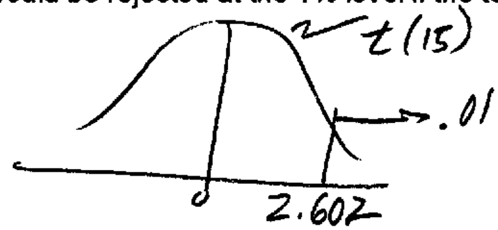
$$t_{calc} = \frac{\bar{X} - \mu_0}{S_{\bar{x}}} = \frac{\bar{X} - \mu_0}{\frac{S}{\sqrt{n}}} = \frac{30.2 - 21.18}{\frac{16.4}{\sqrt{16}}} = 2.2$$

$t(15)$ 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?

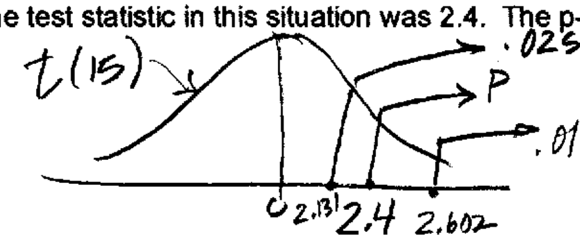
If H_0 is true then $\mu = \mu_0$ and $t_{calc} \sim t(15)$

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?

df	$t_{.01}$
15	2.602



.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.

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

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.

If $p = .008 < .01 = \alpha \Rightarrow$ Reject H_0 at $\alpha = .01 \Rightarrow$ Data supports that $\mu > 21.18 \Rightarrow$ yes.