DISCUSSION SECTION NUMBER TO RETURN EXAM _____

STATISTICS 2023 **NAME, IN INK (print)**_____

EXAM THREE **SIGNATURE, IN INK**_____

SPRING 2000 **SS NUMBER, 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. The point estimate for the population mean is always the center of a confidence interval to estimate the population mean.

T 2. A 95% confidence interval to estimate the population mean is about four standard errors wide.

T 3. Of the set of all confidence intervals built with 95% confidence level, 5% of all the intervals possible will not contain the parameter being estimated.

F 4. The numbers that describe the sample data are called population parameter values.

F 5. The width of a confidence interval will always decrease if the confidence level and sample variance remain constant when the sample size is decreased.

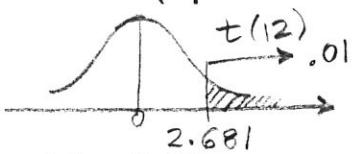
F 6. If the null hypothesis is not rejected then the conclusion states that the null hypothesis has been proven true.

F 7. In a hypothesis test if the value of the Z test statistic is equal to 1 then the null hypothesis could be rejected with a reasonable error rate.

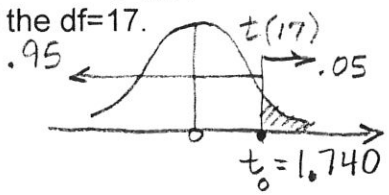
T 8. . The p-value of a hypothesis test is the error rate that the researcher must tolerate if the statement in the null hypothesis is rejected.

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

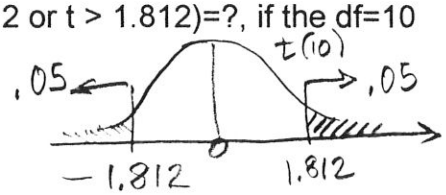
.01 9. What is the P(t > 2.681) if df=12?



1.740 10. State the value of t_o, if the P(t < t_o)=.95 and the df=17.

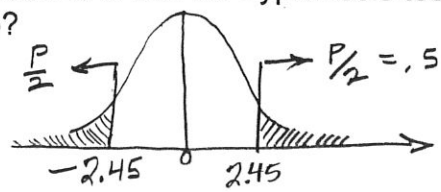


.10 11. P(t < –1.812 or t > 1.812)=?, if the df=10



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

.0142 12. What is the p-value of a two-tail hypothesis test based on a large sample if the test statistic value is 2.45?

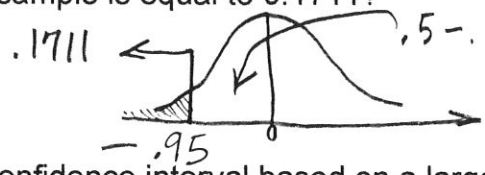


$\Rightarrow P = 2(.0071) = .0142$

356.5 13. If a 99% confidence interval to estimate a population mean is (345, 368) what is the value of the point estimate for the population mean?

$\hat{M} = \bar{X} = \frac{345 + 368}{2} = 356.5$

−.95 14. What is the value of the test statistic if the p-value in a left-tail hypothesis test based on a large sample is equal to 0.1711?



12 15. If a 95% confidence interval based on a large sample to estimate a population mean is (796, 843.04) then what is the value of the standard error of the point estimate for the population mean?

$W = 2B = 2 z_{\frac{.05}{2}} \cdot S_{\bar{x}} = 843.04 - 796 = 47.04$

$2(1.96) S_{\bar{x}} = 47.04 \Rightarrow S_{\bar{x}} = \frac{47.04}{2(1.96)} = 12$

38.35 OR 38.358 OK

38.36 16. Consider a 95% confidence interval to estimate a population mean based on a sample of 16 observations with a sample mean of 125 and a sample standard deviation of 36. How wide is this interval? State two digits past the decimal. State the width of the interval.

$W = 2B = 2 t_{\frac{.05}{2}(15)} S_{\bar{x}} = 2(2.131)\frac{36}{\sqrt{16}} = 38.358$

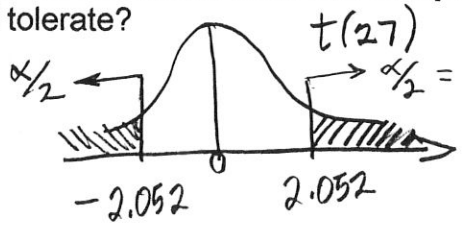
6.86 17. If repeated samples of 100 are drawn from a population with a standard deviation of 35, then 95% of all the sample means will be within how many units of the population mean? State your answer with two digits past the decimal.

$1.96\,\sigma_{\bar{x}} = 1.96\left(\frac{35}{\sqrt{100}}\right) = 6.86$

16 18. How large of a sample of seagulls would be required to construct a 95% confidence interval to estimate the mean wingspan for seagulls within 1.5 inches if the range of the wingspan of seagulls is 12 inches?

$n \geq \frac{z_{.05/2}^2 \cdot \sigma^2}{B^2} = \frac{1.96^2\left(\frac{12}{4}\right)^2}{1.5^2} = 15.37 \Rightarrow n \geq 16$

.05 19. If the rejection region in a two-tail hypothesis test based on a sample with 28 observations drawn from a population whose variance is unknown is below -2.052 and above 2.052 what is the maximum error rate of rejecting a true null hypothesis which this researcher will tolerate?



$\Rightarrow \alpha = .05$

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

A merchandiser on the web is interested in estimating the mean shopping time for a single visit of a customer to a certain web site. Assume that a random sample of 400 customer visits to the web site has an observed average shopping time equal to 12.8 minutes with a standard deviation of 2.4 minutes. Use this information to answer the next four questions.

12.8 20. What is the numerical value of the point estimate for the mean shopping time for a customer visit to the web site?

$\hat{M} = \bar{x} = 12.8$

.12 21. What is the numerical value of the estimated standard error for the point estimate for the mean shopping time per customer visit at this web site? Round to 3 digits past the decimal. $S_{\bar{x}} = \frac{S}{\sqrt{n}} = \frac{2.4}{\sqrt{400}} = 0.12$

.294 22. Assume that the estimated standard error of the point estimate for the mean shopping time per customer visit at this web site is .15. What is the numerical value of the bound of error for a 95% confidence interval to estimate the mean shopping time per customer visit at this web site? Assume $S_{\bar{x}} = .15$

$B = z_{\frac{.05}{2}} \cdot S_{\bar{x}} = 1.96(.15) = .294$

— 2.2 23. If the estimated standard error for the point estimate for the mean shopping time per customer visit at this web site is .15 what is the numerical value of the test statistic to test whether the mean shopping time per customer visit is 13.13 minutes?

$z = \frac{\bar{x} - \mu_0}{S_{\bar{x}}} = \frac{(12.8 - 13.13)}{.15} = -2.2$

Online genealogy research is a growing segment of web traffic. Out of 8,000 web users who filled in surveys about their online activities 3,040 said they had visited genealogy sites on the web. Use this information to answer the remaining questions on this page.

.38 24. Based on this sample what is the numerical value of the point estimate for the proportion of web users who have visited genealogy sites on the web?

$\hat{p} = \frac{x}{n} = \frac{3,040}{8,000} = .38$

.0054 25. What is the numerical value of the estimated standard error for the point estimate for the proportion of web users who have visited genealogy sites on the web? Round your answer to four digits past the decimal.

$S_{\hat{p}} = \sqrt{\frac{\hat{p}\hat{q}}{n}} = \sqrt{\frac{.38(.62)}{8,000}} = .005426785$

.01372 26. If the estimated standard error of the point estimate for the proportion of web users who have visited genealogy sites on the web 0.007. What is the numerical value of the bound of error for a 95% confidence interval to estimate the proportion of web users who have visited genealogy sites on the web? State your answer with five digits past the decimal. $S_{\hat{p}} = .007$

$B = z_{\frac{.05}{2}} \cdot S_{\hat{p}} = 1.96(.007) = .01372$

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

A manufacturer of laundry soap labels the soap bottles as containing 15 ounces. A random sample of twenty-five bottles of the laundry soap off the manufacturing line produced a mean of 15.2 ounces with a standard deviation of 0.25 ounce.

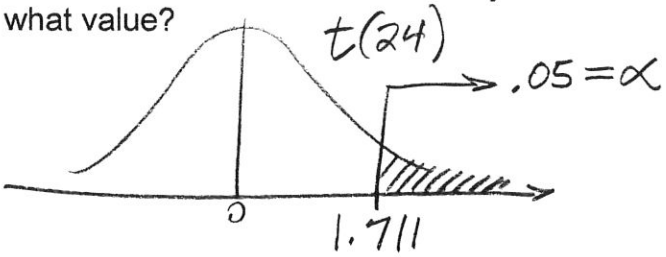
$\mu > 15$ 27. State the alternative hypothesis if the research question is "Do the data support the idea that the mean weight of the laundry soap bottles is more than 15 ounces?"

4 28. State the numerical value of the test statistic that would result from this situation.

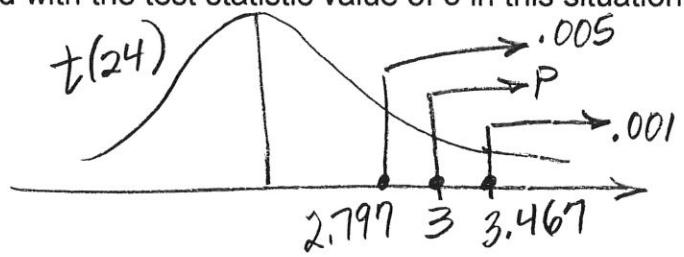
$$t = \frac{\bar{X} - M_0}{S_{\bar{X}}} = \frac{\bar{X} - M_0}{\frac{S}{\sqrt{n}}} = \frac{15.2 - 15}{\frac{.25}{\sqrt{25}}} = 4$$

$t(24)$ 29. What is the name of the distribution that represents the set of possible test statistic values if in fact the mean weight of the laundry soap bottles is 15 ounces?

1.711 30. The null hypothesis in this situation would be rejected at the 5% level if the test statistic is more than what value?



$.001 < P < .005$ 31. Assume that the value of the test statistic in this situation was 3. What is the p-value associated with the test statistic value of 3 in this situation?



Yes 32. Assume the p-value in this hypothesis test is 0.002. Would the null hypothesis be rejected at the 1% significance level in this case? Answer with a YES or NO.

$P = .002 < .01 = \alpha \Rightarrow$ Reject H_0

Yes 33. Assume the p-value in this hypothesis test is 0.002. Do the data indicate that the average weight of the laundry soap bottles is more than 15 ounces at the 1% significance level stated above? Answer with a YES or NO.

$P = .002 < .01 = \alpha \Rightarrow$ Reject $H_0 \Rightarrow$ Support H_A