DISCUSSION SECTION TO RETURN EXAM_____

STATISTICS 2023 NAME IN PRINT Key

EXAM THREE SIGNATURE IN INK_____

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

T **1.** A confidence interval provides a set of reasonable and plausible values for the population parameter that is being estimated.

F **2.** The width of a confidence interval to estimate the population mean can be increased by decreasing the magnitude of the sample mean.

T **3.** A point estimate is a single number used to estimate a population parameter.

T **4.** The standard error of the sample mean is the expected mistake when an observed value of the sample mean is used to estimate the population mean.

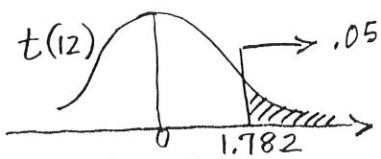
T **5.** In a hypothesis test the null hypothesis is rejected if the data the researcher observes is highly unlikely when assuming the null hypothesis is true.

F **6.** In a hypothesis test the decision is whether to reject or accept the value of the population parameter stated in the null hypothesis.

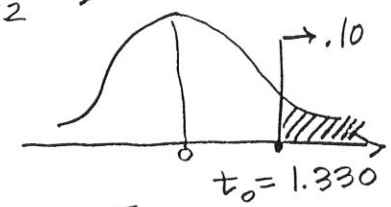
F **7.** The rejection region in a hypothesis test identifies the values of the test statistic that would be most likely to occur assuming the null hypothesis is true.

Questions on the t-table. Write your answer on the line. **(3 points questions)**

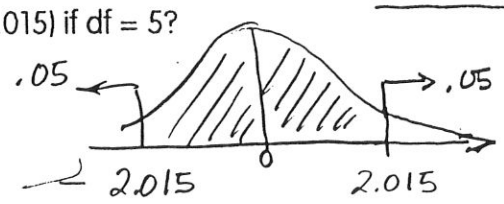
0.05 **8.** What is the P(t > 1.782) if df = 12?



1.330 **9.** State the value of t_o, if the P(t > t_o) = .10 and the df = 18.



0.90 **10.** What is the P(- 2.015 < t < 2.015) if df = 5?



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

.01 **11.** What is the right tail area of the value 2.552 in the t-distribution with 18 degrees of freedom?

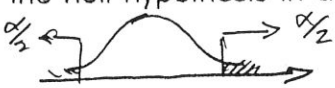
17 **12.** If the sum of the data in a sample with 50 observations is 850 what is the numerical value of the point estimate for the mean of the population from which the sample was drawn?

$$\hat{\mu} = \bar{x} = \frac{\Sigma x}{n} = \frac{850}{50} = 17.$$

.0854 **13.** If the researcher is checking to see if the data will support the idea that the mean is not equal to a certain value and the z test statistic is equal to 1.72 what is the p-value or observed significance level of the hypothesis test?

$H_A: \mu \neq \mu_0, z = 1.72$

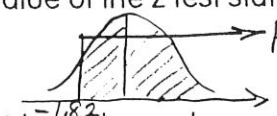
1.645 **14.** The magnitude of the z test statistic must be greater than what numerical value in order to reject the null hypothesis in a two-tail test with 10% significance level?



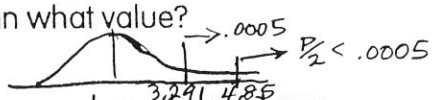
$z_{.05} = 1.645$

.9656 **15.** If in a hypothesis test a researcher is interested in showing that the mean is greater than some specific value, but the value of the z test statistic is -1.82 what is the p-value in this situation?

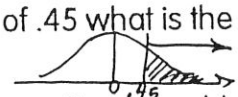
$H_A: \mu > \mu_0, z = -1.82$



.001 **16.** If in a two tail hypothesis test based on a large sample of data the test statistic value is 4.85, then the p-value of the hypothesis test is less than what value?



.3264 **17.** If a right-tail hypothesis test on the population mean based on a large sample provides a z test statistic value of .45 what is the p-value of the hypothesis test?



35 **18.** How many observations would be required to estimate the average miles per gallon for a certain type of car with 95% confidence interval that is 3 units wide if the range in the miles per gallon for this type of car is known to be 18 units?

$$n \geq \frac{z_{\alpha/2}^2 \cdot \sigma^2}{B^2} = \frac{1.96^2 \left(\frac{18}{4}\right)^2}{1.5^2} = 34.57 \Rightarrow n \geq 35$$

.36 **19.** Assume a 95% confidence interval to estimate the proportion of students who commute to campus from outside the Stillwater city limits is (0.28, 0.44). What is the numerical value of the proportion of students who commute to campus from outside Stillwater that was observed in the sample from which the above confidence interval was calculated?

.62 OK $\hat{p}$ is the center of the interval.

(23.77, 24.63) **20.** A sample of 16 red tail hawks had an average wingspan of 24.2 inches and a standard deviation of 0.8. Based on this sample, what is the 95% confidence interval to estimate the average wingspan of the population of hawks from which this sample was drawn? Round the upper and lower bounds on your interval to two digits past the decimal.

$$24.2 \pm 2.131 \frac{.8}{\sqrt{16}}$$

$$24.2 \pm .4262$$

$$(23.7738, 24.6262)$$

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

A sample of twenty-five observations produced a mean of 43 and a standard deviation of 15. Use this information to answer the next four questions.

43 **21.** What is the numerical value of the point estimate for the mean of the population from which the above sample was drawn?

$$\hat{\mu} = \bar{x} = 43$$

3 **22.** What is the numerical value of the estimated standard error of the point estimate for the population mean based on the above sample information?

$$S_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{15}{\sqrt{25}} = 3$$

6.844 ~~5.133~~ **23.** If the standard error for the sample mean is 4 what is the numerical value of the bound of error for a 90% confidence interval to estimate the mean of the population from which the sample was drawn? State your answer with three digits past the decimal.

$$B = t_{\frac{.10}{2}(24)} \cdot S_{\bar{x}} = t\frac{s}{\sqrt{n}} = 1.711\,\frac{15}{4\sqrt{25}} = \frac{5.133}{6.844}$$

(35.4, 50.6) **24.** If the bound of error for a 90% confidence interval is 7.6 units what is the 90% confidence interval to estimate the population mean based on the sample mean stated above? State the interval.

$$\bar{x} \pm B \Rightarrow 43 \pm 7.6 \Rightarrow (35.4,\ 50.6)$$

Six thousand college students at universities in the State of Oklahoma were questioned about whether or not they support the NATO actions in Serbia, a country located in southeastern Europe. Out of the six thousand students questioned 3,480 of the students responded that they fully supported the NATO actions in Serbia. Use this information to answer the remaining questions on this page.

0.58 **25.** Based on this sample what is the numerical value of the point estimate for the proportion of students who support the NATO actions in Serbia?

$$\hat{p} = \frac{x}{n} = \frac{3,480}{6,000} = 0.58$$

.00637 **26.** What is the numerical value of the estimated standard error for the point estimate for the proportion of students who support the NATO actions in Serbia? Round your answer to five digits past the decimal.

$$S_{\hat{p}} = \sqrt{\frac{\hat{p}\hat{q}}{n}} = \sqrt{\frac{.58(.42)}{6,000}} = .00637\,1813.$$

4 **27.** Assume the estimated standard error of the point estimate for the proportion of students who support the NATO actions in Serbia 0.005. What is the numerical value of the z test statistic to check if the proportion is equal to 56% against an alternative that the proportion is more than 56%? Assume $S_{\hat{p}} = .005$

$$z = \frac{\hat{p} - p_o}{S_{\hat{p}}} = \frac{.58 - .56}{.005} = 4$$

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

The advertisement for a certain brand of fertilizer claims that the fertilizer will produce at least 4 inches of growth per day on specific types of squash vines. The fertilizer was applied to this type of squash and the daily growth was measured on twenty-five randomly chosen days of the growing season. The twenty-five observations yielded a mean growth rate of 3.8 inches per day with a standard deviation of .5 inches. Use this data as a random sample to answer the questions on this page. $\bar{X} = 3.8,\ S = .5,\ n = 25$

$\mu < 4$ **28.** State the appropriate alternative hypothesis if the research question is, "Do the data provide evidence that the fertilizer produces less than the average growth of 4 inches per day?"

-2 **29.** What is the numerical value of the test statistic to test the null hypothesis that the average amount of growth produced by this fertilizer is at least 4 inches per day?

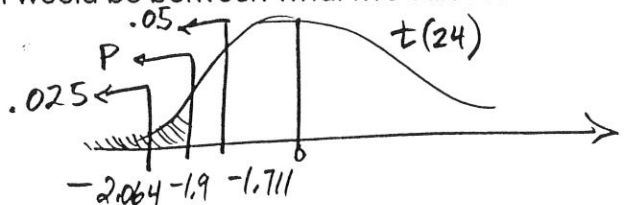
$$t = \frac{\bar{X} - \mu_0}{S_{\bar{X}}} = \frac{\bar{X} - \mu_0}{\frac{S}{\sqrt{n}}} = \frac{3.8 - 4}{\frac{.5}{\sqrt{25}}} = \frac{-.2}{.1} = -2.$$

$t(24)$ **30.** What is the name of the distribution of the test statistic if in fact the average growth produce by this fertilizer is at least 4 inches?

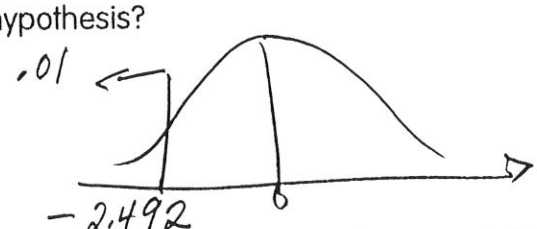
$t \sim t(n-1) \equiv t(24)$ if H_0 is True.

$.025, .05$ **31.** If the numerical value of the test statistic in this case were -1.9 then the p-value of this hypothesis test would be between what two values?

$.025 < P < .05$



-2.492 **32.** If the researcher performing this hypothesis test can not tolerate more than 1% chance of rejecting a true null hypothesis then what value must the test statistic be less than in order to reject the null hypothesis?



Yes **33.** If the p-value of this hypothesis test is between 0.005 and 0.01 and the significance level chosen by the researcher is 0.05 should the null hypothesis be rejected? Answer YES or NO.

$.005 < P < .01 < .05 < \alpha \Rightarrow$ Reject H_0.