DISCUSSION SECTION NUMBER_____

STATISTICS 2023 NAME, IN INK 2E3 F96 V1. CH1

EXAM THREE SIGNATURE, IN INK_____

FALL 1996 SS NUMBER, IN INK_____

RETAIN THIS EXAM FOR GRADE VERIFICATION AFTER IT IS RETURNED TO YOU.
TRUE OR FALSE. Answer with a capital T or F. (3 points each)

T 1. A confidence interval to estimate a certain parameter is centered around the point estimator for that parameter.

F 2. The t-multiplier in the bound of error in a 95% confidence interval to estimate the mean of a population with unknown variance based on only 18 observations would be the value 1.740, not 2.110.

T 3. The magnitude of the standard error of the sample mean is determined by the spread in the sampled population and the sample size.

T 4. If the research conclusion is to support the statement in the alternative hypothesis then the null hypothesis has been indicated to be false by the observed data.

T 5. In a hypothesis test on the population mean if the value of the Z test statistic is equal to 10 then the sample mean is 10 standard errors from the hypothetical value of the population mean.

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 7. In a hypothesis test the null hypothesis would not be rejected if the observed data is similar to what the researcher expected under the assumption of a true null hypothesis.

T 8. If a large sample is drawn from a population the resulting sample mean is a variable with an approximately normal distribution and a mean value equal to the mean of the original sampled population.

T 9. If a large sample is drawn from a population the resulting sample mean values go toward the center of the original population and thus have less variance than the original population.

T 10. The p-value of a hypothesis test is the error rate which must be tolerated if the null hypothesis is rejected.

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

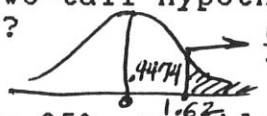
.0582 11. What is the p-value of a right-tail hypothesis test based on a large sample if the test statistic value is 1.57?

$P(z>1.57) = .5 - .4418 = .0582$

51.5 12. If a 90% confidence interval to estimate a population mean is (45, 58) what is the value of the point estimate for the population mean?

$\bar{X}$ is the center of the interval. $\bar{x} = 45 + \frac{13}{2} = 58 - \frac{13}{2} = 51.5$

1.62 13. What is the absolute value of the test statistic if the p-value in a two-tail hypothesis test based on a large sample is equal to 0.1052?



$\frac{P}{2} = \frac{.1052}{2} = .0526 \Rightarrow P(0<z<z_0) = .4474 \Rightarrow z_0 = 1.62$

555 14. If a 95% confidence interval based on a large sample to estimate a population mean is (533.44, 576.56) then what is the value of the point estimate for the population mean?

$\bar{X}$ is the center of the interval, $\bar{x} = \frac{533.44 + 576.56}{2} = 555$

11. or 10.99 15. If a 95% confidence interval based on a large sample to estimate a population mean is (533.44, 576.56) then what is the value of the standard error of the point estimate for the population mean?

$W = 2B = 2 z_{\alpha/2} S_{\bar{x}} = 576.56 - 533.44 = 43.12$

$2(1.96) S_{\bar{x}} = 43.12 \Rightarrow S_{\bar{x}} = \frac{43.12}{2(1.96)} = 11$

5.992 16. Consider a 99.9% confidence interval to estimate a population mean based on a sample of 25 observations with a sample mean of 125 and a sample variance of 16. How wide is this interval? Do not round your answer.

$Width = 2B = 2\left(t_{\frac{.001}{2}, 24}\right) S_{\bar{x}} = 2(3.745)\left(\frac{4}{5}\right) = 5.992$

24.13 17. If a data set with sixty observations yields an uncorrected sum of squares of 1,618 and a sum of 108 what would be the value of the estimate for the population variance?

$n = 60,\ \Sigma x^2 = 1{,}618,\ \Sigma x = 108$

$\sigma^2 = S^2 = \frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1} = \frac{1{,}618 - \frac{108^2}{60}}{59} = 24.1288$

18 18. How many adult male coyotes would a wildlife researcher have to sample in order to estimate the average weight of adult male coyotes to within 2 pounds with 95% accuracy? Previous studies on adult male coyotes have indicated the variance of their weights is eighteen units.

$n \geq \frac{z_{\alpha/2}^2 \cdot \sigma^2}{B^2} = \frac{1.96^2 (18)}{2^2} = 17.2872 \Rightarrow n \geq 18$

0.02 19. If the rejection region in a two-tail hypothesis test based on a sample with 20 observations drawn from a population whose variance is unknown is below -2.539 and above 2.539 what is the maximum error rate of rejecting a true null hypothesis which this researcher will tolerate?

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

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

Assume that a sample of eight runners times were randomly drawn from the hundreds of people who ran a certain foot race. The eight times observed are:

14.4, 12.1, 14.2, 13.8, 17.9, 11.5, 12.9, 13.8

Use these data to address the following two questions.

13.825 20. What is the numerical value of the point estimator for the average time required for a runner to run this certain foot race? (3 digits past the decimal)

$\bar{X} = \frac{\Sigma X}{n} = \frac{\quad}{\quad} =$

0.6855 21. What is the numerical value of the estimated standard error of the point estimate for the average time required for a runner to complete this certain foot race? (4 digits past)

$S_{\bar{x}} = \frac{S}{\sqrt{n}} = \frac{\quad}{\sqrt{8}} =$

Three-hundred current freshman students were questioned about whether or not they have a car on campus. One-hundred thirty-five students responded that they did have a car on campus. Use this information to answer the next two questions.

0.45 22. What is the numerical value of the point estimate for the proportion of freshman students who have a car on campus?

0.148 23. What is the numerical value of the width of a 99% confidence interval to estimate the proportion of freshman students who have a car on campus? Round to three digits past the decimal.

$W = 2B = 2(z_{.01/2})S_{\hat{p}} = 2(2.576)\sqrt{\frac{.45(.55)}{300}} = 0.147979933$

Assume that a random sample of 100 observations has been drawn from a population. The sum of the data in the sample is 530 and the corrected sum of squares for the data in the sample is 6,732. Use this information to answer the next 2 questions.

5.3 24. What is the numerical value of the point estimate for the mean of the population?

$\bar{X} = \frac{\Sigma X}{n} = \frac{530}{100} = 5.3$

0.825 25. What is the numerical value of the estimated standard error of the point estimate for the mean of the population? State your answer with three digits past the decimal.

$S_{\bar{x}} = \frac{S}{\sqrt{n}} = \frac{\sqrt{68}}{\sqrt{100}} = .82462125$

7.84 26. If the estimated standard error of the sample mean is 2 units what is the width of a 95% confidence interval to estimate the population mean in this situation?

$W = 2B = 2z_{.05/2}S_{\bar{x}} = 2(1.96)2 = 7.84$

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

The Oklahoma Highway Patrol (OHP) would like to use their new video equipment to check if the average speed of drivers exceeds the 70 miles per hour speed limit. Twenty-five randomly chosen speeds averaged 72 miles per hour with a standard deviation of 10 units. Use this information to answer the questions on this page.

$H_A: \mu > 70$ 27. State the appropriate alternative hypothesis if the question of interest is, "Do the data support the idea that the mean speed is in excess of 70 miles per hour?"

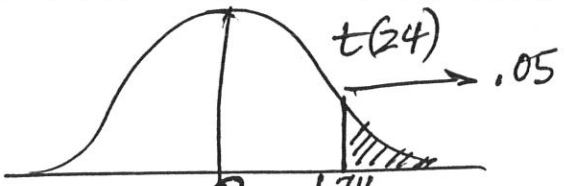
1 28. State the numerical value of the test statistic which would result from this situation.

$$t = \frac{\bar{X}-\mu_0}{s_{\bar{X}}} = \frac{\bar{X}-\mu_0}{\frac{s}{\sqrt{n}}} = \frac{72-70}{\frac{10}{\sqrt{25}}} = 1$$

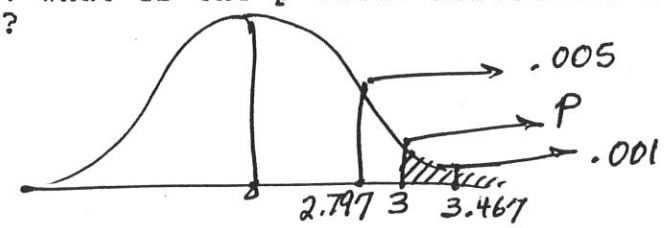
$t(24)$ 29. What is the name of the distribution which represents all the possible values of the test statistic in this situation if in fact the mean speed is 70 miles per hour?

$$t = \frac{\bar{X}-\mu_0}{s_{\bar{X}}} \sim t(n-1) \text{ if } \mu = \mu_0$$

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?



Yes 32. Assume the p-value in this hypothesis test is 0.001. Would the null hypothesis be rejected at the 1% significance level in this case? Answer with a YES or NO.

$$P = .001 < .01 = \alpha \Rightarrow \text{Reject } H_0$$

Yes 33. Assume the p-value in this hypothesis test is 0.001. Do the data indicate that the average speed is more than 70 miles per hour at the 1% significance level? Answer with a YES or NO.

$$P = .001 < .01 = \alpha \Rightarrow \text{Reject } H_0 \Rightarrow \text{Conclude } H_A$$