STATISTICS 2023 NAME, IN INK Key

FINAL EXAM SIGNATURE, IN INK_____

FALL 1998 SS NUMBER, IN INK_____

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

T 1. Confidence intervals used to estimate population parameters are centered on values of point estimates.

T 2. The confidence level associated with the equation to generate confidence intervals tells the percent of all confidence intervals that contain the true value of the parameter being estimated.

T 3. The significance level, α, of a hypothesis test represents the largest error rate the researcher will tolerate in order to reject the null hypothesis.

F 4. The standard deviation of a sample measures the center of the data set.

T 5. The p-value of a hypothesis test represents the error rate that must be tolerated if the researcher concludes that the data supports the statement in the alternative hypothesis.

F 6. The point estimates used to estimate population parameters are almost always equal to the parameter being estimated.

T 7. The standard errors of point estimates depend on the spread in the population from which the sample was drawn and the size of the sample.

F 8. The mean of the t and Z distributions is the value three.

F 9. If a Z hypothesis test generates a test statistic value that is less than 1.0 in magnitude the null hypothesis would be rejected for a significance level of 1%, regardless of the sign in the alternative hypothesis.

F 10. In a linear regression situation the line that is fitted to bivariate data runs through at least half of the data points.

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

.0160 11. If a hypothesis test based on a large sample has a test statistic value of 2.41 and the researcher is trying to prove that the population mean is not equal to some stated value what is the p-value of the hypothesis test?

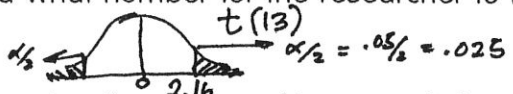
$P/2 = .5 - .4920 = .0080$

$P = 2(.008) = .0160$

1.97 12. If the p-value in a right tail hypothesis test based on a z-test statistic is equal to 0.0244 what is the numerical value of the test statistic?

Find z_0 : $P(Z > z_0) = .0244 \Rightarrow z_0 = 1.97$

2.16 13. In a two-tail hypothesis test based on a small sample of 14 observations the absolute value of the test statistic must exceed what number for the researcher to reject the null hypothesis with only a 0.05 error rate?



$\alpha/2 = .05/2 = .025$

$\mu_1 - \mu_2 > 5$ 14. If a researcher who was comparing the means of two populations was attempting to prove that the mean of population one is more than 5 units larger than the mean of population two what is the appropriate alternative hypothesis? $\mu_1 - \mu_2 > 5$

2.5 15. If the mean of the sample from population one is 12.3 and the mean of the sample from population two is 9.8 what is the numerical value of the point estimate for the mean of population one minus the mean of population two?

$\mu_1 - \mu_2 = \bar{x}_1 - \bar{x}_2 = 12.3 - 9.8 = 2.5$

4.995 16. If a sample of 23 observations had a sample variance of 4.5 and a sample of 19 observations had a sample variance of 5.6 then what is the numerical value of the pooled variance estimate based on these two samples? State three digits past the decimal.

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2} = \frac{(23-1)4.5 + (19-1)5.6}{23+19-2} = 4.995$$

A sample of weights in tons is (43, 21, 88, 43, 97, 68). Use this sample to answer the remaining questions on this page.

60 17. State the numerical value of the point estimate for the mean of the population of weights.

29.38 18. State the numerical value of the point estimate for the standard deviation of the population of weights. Round your answer to two digits past the decimal.

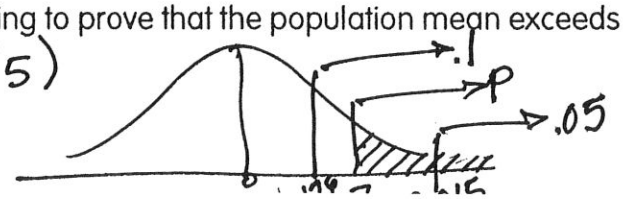
9.998 19. Assume that the standard deviation of the above sample of weights is 24.49, then what is the numerical value of the estimated standard error of the point estimate for the population mean? Round your answer to three digits past the decimal.

$$s_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{24.49}{\sqrt{6}}$$

1 20. Assume that the standard error of the point estimate for the population mean is 10, then what is the numerical value of the test statistic to test if the population mean is equal to 50?

$$t = \frac{\bar{x} - \mu_0}{s_{\bar{x}}} = \frac{60-50}{10} = 1$$

.05<P<.10 21. The p-value is between what two values if the value of the test statistic is 1.7 and the researcher is trying to prove that the population mean exceeds 50?



$.05 < P < .10$

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

The average costs for two types of advertising were compared using the following data. Ten weeks of sales were recorded for each type of advertising. Use this information to answer the questions on this page.

Advertising Type One	Advertising Type Two
$n_1=10$	$n_2=10$
$\bar{x}_1 = \$590$	$\bar{x}_2 = \$575$
$s_1^2 = \$1{,}600$	$s_2^2 = \$2{,}500$

15 22. What is the numerical value of the point estimate for the difference between the average costs for these two types of advertising? $\mu_1-\mu_2 = \bar{X}_1-\bar{X}_2 = 590-575 = 15$

$\mu_1-\mu_2 \neq 0$ OR $\mu_1 > \mu_2$ 23. What is the appropriate alternative hypothesis if the research question is "Do the data indicate that the average sales for advertising type one are more than the average sales for advertising type two?"

.74 24. What is the numeric value of the test statistic that would be used to attempt to support the alternative hypothesis described in the above question? Two digits.

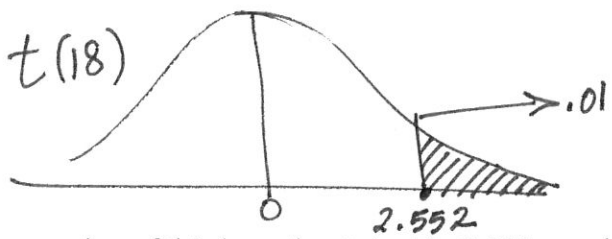
$$t = \frac{\bar{X}_1-\bar{X}_2-D_0}{S_{\bar{X}_1-\bar{X}_2}} = \frac{590-575-0}{\sqrt{\frac{2050}{10}+\frac{2050}{10}}} = \frac{15}{\sqrt{410}} = .740797$$

$$S_p^2 = \frac{9(1{,}600)+9(2{,}500)}{18} = 2050$$

t(18) 25. If the sales averages for the two advertising types are equal what is the name of the distribution of the test statistic?

If $H_0: \mu_1-\mu_2=0$ is true then $t \sim t(n_1+n_2-2)$

2.552 26. In this situation the null hypothesis would be rejected at the 1% significance level if the observed test statistic value is more than what value?



Yes 27. If the p-value of this hypothesis test is 0.009 would one conclude that the average sales for advertising type one is more than the average sales for advertising type two at the 5% significance level? Answer with YES or NO.

$p = .009 < .05 = \alpha \Rightarrow$ Rej $H_0 \Rightarrow$ Conclude, data indicates $\mu_1 > \mu_2$.

A bivariate data set had the following observed values. Use this data to answer the next three questions. (3 points each)

x	1	2	2	1	3	3
y	5	7	9	4	10	12

3.25 28. State the numeric value of the least-squares estimate of the slope that would result from the bivariate data above. State your answer with two digits past the decimal.

$1.\overline{3}$ 29. State the numeric value of the least-squares estimate of the y-intercept that would result from the bivariate data above. Round your answer to two digits past the decimal.

.949 .9498 30. State the numeric value of the estimated linear correlation that would result from the bivariate data above. Round your answer to four digits past the decimal.

.95

Assume a linear model is fitted to a bivariate data set and the least-squares estimated regression equation that resulted is stated below. Use this information to answer the remaining questions on this page. (3 points each)

$$\hat{y} = 25.2 + 2.7x$$

44.64 31. What is the numeric value of the least squares estimate of the average y-value when x = 7.2?

$$\hat{y}_{x=7.2} = 25.2 + 2.7(7.2) = 44.64$$

6.75 32. How much does the least-squares estimate of y increase when x increases by 2.5?

$$2.5\hat{\beta}_1 = 2.5(2.7) = 6.75$$

2 33. If the standard error of the least squares estimate of the slope is 1.35 what is the numeric value of the t-test statistic to test if the slope is equal to zero?

$$\text{If } S_{\hat{\beta}_1} = 1.35 \text{ then } t = \frac{\hat{\beta}_1}{S_{\hat{\beta}_1}} = \frac{2.7}{1.35} = 2$$