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1) Determine the critical value $z_{\alpha/2}$ that corresponds to a 88% level of confidence.
A) 1.175 **B)** 0.1894 **C)** 0.8106 **D)** –0.23 **E)** 1.555

2) A study involves 634 randomly selected deaths, with 29 of them caused by accidents. Construct a 98% confidence interval for the percentage of all deaths that are caused by accidents.
A) (2.95%, 6.20%) **B)** (3.4%, 5.8%) **C)** (2.43%, 6.71%)
D) (2.64%, 6.50%) **E)** (3.21%, 5.94%)

3) A senator wishes to estimate the proportion of United States voters who favor abolishing the Electoral College. How large a sample is needed in order to be 98% confident that the sample proportion will not differ from the true proportion by more than 3%?
A) 20 **B)** 1068 **C)** 1509 **D)** 3017 **E)** 565

4) A pollster wishes to estimate the number of left-handed scientists. How large a sample is needed in order to be 95% confident that the sample proportion will not differ from the true proportion by more than 4%? A previous study indicates that the proportion of left-handed scientists is 8%.
A) 177 **B)** 125 **C)** 193 **D)** 24 **E)** 8675309

5) Find the *t*-value such that the area to the right of the *t*-value is 0.01 with 8 degrees of freedom.
A) 2.896 **B)** 4.501 **C)** 2.998 **D)** 3.057 **E)** None of these.

6) Find the critical *t*-value that corresponds to 99% confidence and a sample size of 10.
A) 2.821 **B)** 3.250 **C)** 2.262 **D)** 1.833 **E)** None of these.

7) Find the critical *t*-value that corresponds to 95% confidence and a sample size of 16.
A) 2.602 **B)** 2.947 **C)** 2.131 **D)** 1.753 **E)** None of these.

8) A random sample of 40 full-grown lobsters had a mean weight of 20 ounces. Assume that $s = 3.9$ ounces. Construct a 96% confidence interval for the population mean μ.
A) 18.734 to 21.266 ounces **B)** 18.592 to 21.408 ounces
C) 11.720 to 28.280 ounces **D)** 17.857 to 22.143 ounces
E) 18.691 to 21.309 ounces

9) Determine the point estimate of the population mean for the confidence interval that has a lower bound of 124 and an upper bound of 166.
A) 145 **B)** 21 **C)** 124 **D)** 166 **E)** 42

10) The weekly earnings of students in one age group are normally distributed with a standard deviation of 10 dollars. A researcher wishes to estimate the mean weekly earnings of students in this age group. Find the sample size needed to assure with 95% confidence that the sample mean will not differ from the population mean by more than 2 dollars.
A) 9 **B)** 10 **C)** 68 **D)** 96 **E)** 97

11) The significance level and *P*-value of a hypothesis test are given. Decide whether the null hypothesis should be rejected. $\alpha = 0.05$, *P*-value = 0.056.
A) Reject the null hypothesis. **B)** Do not reject the null hypothesis.

12) The mean utility bill in one city during the summer was less than \$95. Write the null and alternative hypotheses.
A) $H_0 : \mu < 95$, $H_1 : \mu = 95$ **B)** $H_0 : \mu = 95$, $H_1 : \mu < 95$ **C)** $H_0 : \mu = 95$, $H_1 : \mu \neq 95$ **D)** $H_0 : \mu = 40$, $H_1 : \mu > 95$ **E)** $H_0 : \mu > 40$, $H_1 : \mu = 95$

13) The level of significance, α, is the probability of making a
A) Type II error **B)** Type I error **C)** Correct decision **D)** Type β error

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14) If we reject the null hypothesis when the null hypothesis is actually true, then we have made a
A) Correct decision **B)** Type II error **C)** Type I error **D)** Type α error

15) If we do not reject the null hypothesis when the null hypothesis is actually false, then we have made a
A) Type β error **B)** Type I error **C)** Correct decision **D)** Type II error

16) What is the probability associated with **not** making a Type II error?
A) $(1 - \alpha)$ **B)** α **C)** β **D)** $(1 - \beta)$

17) The mean monthly gasoline bill for one household is greater than \$120. If a hypothesis test is performed, how should you interpret a decision that rejects the null hypothesis?
A) There is sufficient evidence to support the claim $\mu > \$120$.
B) There is sufficient evidence to reject the claim $\mu > \$120$.
C) There is not sufficient evidence to reject the claim $\mu > \$120$.
D) There is not sufficient evidence to support the claim $\mu > \$120$.

18) The mean monthly gasoline bill for one household is greater than \$120. If a hypothesis test is performed, how should you interpret a decision that fails to reject the null hypothesis?
A) There is sufficient evidence to support the claim $\mu > \$120$.
B) There is sufficient evidence to reject the claim $\mu > \$120$.
C) There is not sufficient evidence to reject the claim $\mu > \$120$.
D) There is not sufficient evidence to support the claim $\mu > \$120$.

19) Determine the critical values for a two-tailed test with $\alpha = 0.05$.
A) ± 1.28 **B)** ± 1.645 **C)** ± 1.96 **D)** ± 2.33 **E)** ± 2.575

20) Determine the critical value for a left-tailed test with $\alpha = 0.05$.
A) -1.28 **B)** -1.645 **C)** -1.96 **D)** -2.33 **E)** -2.575

21) Determine the critical value for a right-tailed test of a population mean at the $\alpha = 0.005$ level of significance with 28 degrees of freedom.
A) 2.771 **B)** 1.701 **C)** -2.763 **D)** 2.763

22) Determine the critical value for a left-tailed test of a population mean at the $\alpha = 0.025$ level of significance based on a sample size of $n = 18$.
A) -2.110 **B)** -3.222 **C)** -2.110 **D)** 2.101

23) Determine the critical values for a two-tailed test of a population mean at the $\alpha = 0.01$ level of significance based on a sample size of $n = 21$.
A) ± 2.845 **B)** ± 2.831 **C)** ± 2.528 **D)** ± 2.518

24) Suppose you want to test the claim that $p \neq 0.712$. Given a sample size of $n = 51$ and a level of significance of $\alpha = 0.01$, when should you reject H_0 ?
A) Reject H_0 if the standardized test statistic is greater than 1.96 or less than -1.96
B) Reject H_0 if the standardized test statistic is greater than 2.33 or less than -2.33.
C) Reject H_0 if the standardized test statistic is greater than 1.645 or less than -1.645
D) Reject H_0 if the standardized test statistic is greater than 2.575 or less than -2.575.

25) Suppose you want to test the claim that $p < 0.654$. Given a sample size of $n = 35$ and a level of significance of $\alpha = 0.10$, when should you reject H_0?
A) Reject H_0 if the standardized test statistic is less than -2.575.
B) Reject H_0 if the standardized test statistic is less than -2.33.
C) Reject H_0 if the standardized test is less than -1.645.
D) Reject H_0 if the standardized test statistic is less than -1.28.

26) Suppose you want to test the claim that $p > 0.123$ Given a sample size of $n = 43$ and a level of significance of $\alpha = 0.01$, when should you reject H_0?
A) Reject H_0 if the standardized test statistic is greater than 2.33.
B) Reject H_0 if the standardized test statistic is greater than 1.28.
C) Reject H_0 if the standardized test statistic is greater than 2.575.
D) Reject H_0 if the standardized test statistic is greater than 1.96.

27) In a test of statistical hypothesis, the *P*-value tells us:
A) the probability that the sample mean is equal to the population mean.
B) if the null hypothesis is true.
C) if the alternative hypothesis is true.
D) the largest level of significance at which the null hypothesis can be rejected.
E) the smallest level of significance at which the null hypothesis can be rejected.

28) Use a table of *t*-values to estimate the *P*-value for the specified one-mean *t*-test.
Left-tailed test, $n = 12$, $t = -4.812$.
A) $P > 0.0005$ **B)** $0.0005 < P < 0.001$ **C)** $P < 0.0005$ **D)** $P > 0.25$

29) Use a table of *t*-values to estimate the *P*-value for the specified one-mean *t*-test.
Right-tailed test, $n = 19$, $t = 2.518$.
A) $0.01 < P < 0.02$ **B)** $0.05 < P < 0.10$ **C)** $0.025 < P < 0.05$ **D)** $0.02 < P < 0.025$

30) Use a table of *t*-values to estimate the *P*-value for the specified one-mean *t*-test.
Two-tailed test, $n = 21$, $t = 2.309$.
A) $0.01 < P < 0.02$ **B)** $0.005 < P < 0.01$ **C)** $0.02 < P < 0.04$ **D)** $0.05 < P < 0.10$

31) An airline claims that the no-show rate for passengers booked on its flights is less than 6%. Of 380 randomly selected reservations, 18 were no-shows. Find the *P*-value for a test of the airline's claim
A) 0.2984 **B)** 0.1230 **C)** 0.0746 **D)** 0.1995 **E)** 0.1492

32) A random sample of 140 forty-year-old men contains 25% smokers. Find the *P*-value for a hypothesis test to determine whether the percentage of forty-year-old men that smokes **differs** from 22%.
A) 0.19 **B)** 0.39 **C)** 0.14 **D)** 0.48 **E)** 0.26

33) **Golf Robots.** Serious golfers and golf equipment companies sometimes make use of golf equipment test labs to obtain precise information about particular club heads, club shafts, and golf balls. One golfer requested information about the Jazz Fat Cat 5-iron from Golf Laboratories, Inc. The company tested the club by using a robot to hit a Titleist NXT Tour ball six times with a head velocity of 85 miles per hour. The golfer wanted a club that, on average, would hit the ball more than 180 yards at that club speed. The total yards each ball traveled was 180, 187, 181, 182, 185, 181. At the 5% significance level, is there evidence to conclude that the club does what the golfer wants? (Note: The sample mean and sample standard deviation of the data are 182.7 yards and 2.7 yards, respectively and you may assume the variable total yards traveled is approximately normal.)

Using a hypothesis test to test this claim, which of the following is true?
A) Reject the null hypothesis of $\mu = 180$ with a *P*-value between 2.5% and 5%. There is sufficient evidence to conclude that the club, on average, would hit the ball more than 180 yards.
B) Fail to reject the null hypothesis of $\mu = 180$ with a *P*-value between 2.5% and 5%. There is not sufficient evidence to conclude that the club, on average, would hit the ball more than 180 yards.
C) Fail to reject the null hypothesis of $\mu = 180$ with a *P*-value between 5 and 10%. There is not sufficient evidence to conclude that the club, on average, would hit the ball more than 180 yards.
D) Reject the null hypothesis of $\mu = 180$ with a *P*-value 5% and 10%. There is sufficient evidence to conclude that the club, on average, would hit the ball more than 180 yards.

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34) Use the one-proportion z-test to perform the specified hypothesis test.

$$x = 30 \quad , \quad n = 169 \quad , \quad H_0 : p = 0.11 \quad , \quad H_1 : p \neq 0.11 \quad , \quad \alpha = 0.05$$

A) $z =$ 2.81 , Critical values = ±1.96 , Reject H_0.
B) $z =$ 2.81 , Critical values = ±1.645 , Reject H_0.
C) $z =$ 1.36 , Critical values = ±1.96 , Reject H_0.
D) $z =$ 1.36 , Critical values = ±1.645 , Reject H_0..
E) None of the above; Do Not Reject H_0.

35) A researcher wants to perform a hypothesis test to determine whether the mean length of marriages in California differs from the mean length of marriages in Texas. Determine the null and alternative hypotheses for the proposed hypothesis test.
A) Let μ_1 denote the mean length of marriages in California and let μ_2 denote the mean length of marriages in Texas. The null and alternative hypotheses are $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 < \mu_2$.
B) Let μ_1 denote the mean length of marriages in California and let μ_2 denote the mean length of marriages in Texas. The null and alternative hypotheses are $H_0 : \mu_1 < \mu_2$ and $H_1 : \mu_1 > \mu_2$.
C) Let μ_1 denote the mean length of marriages in California and let μ_2 denote the mean length of marriages in Texas. The null and alternative hypotheses are $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$.
D) Let μ_1 denote the mean length of marriages in California and let μ_2 denote the mean length of marriages in Texas. The null and alternative hypotheses are $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 > \mu_2$.

36) The numbers of successes and the sample sizes are given for independent simple random samples from two populations. Construct a 95% confidence interval for the difference between the population proportions $p_1 - p_2$.

$$x_1 = 35 \quad , \quad n_1 = 50 \quad , \quad x_2 = 40 \quad , \quad n_2 = 60$$

(If you are not using a graphing calculator, the formula is $\hat{p}_1 - \hat{p}_2 \pm z_{\frac{\alpha}{2}} \cdot \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$).

A) –0.132 to –0.008 **B)** –0.871 to 0.872 **C)** –1.341 to 1.781
D) –2.391 to 3.112 **E)** –0.141, 0.208

37) The numbers of successes and the sample sizes are given for independent simple random samples from two populations. Test the hypothesis that $p_1 < p_2$ at a 1% significance level.

$$x_1 = 38 \quad , \quad n_1 = 100 \quad , \quad x_2 = 55 \quad , \quad n_2 = 140$$

(If you are not using a graphing calculator, the formula to use here is $z_0 = \dfrac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})} \cdot \sqrt{\left(\frac{1}{n_1}\right) + \left(\frac{1}{n_2}\right)}}$

where $\hat{p} = \dfrac{x_1 + x_2}{n_1 + n_2}$. To help simplify your calculations, $\sqrt{\hat{p}(1-\hat{p})} = 0.4872$).

A) $z =$ –0.20, Critical value = –2.33, Reject H_0.
B) $z =$ –0.20, Critical value = –2.33, Do Not Reject H_0.
C) $z =$ –4.37, Critical value = –2.33, Do Not Reject H_0.
D) $z =$ –4.37, Critical value = –2.33, Reject H_0.
E) None of these.

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38) A medical researcher suspects that the pulse rate of drinkers is higher than the pulse rate of non-drinkers. Use the sample statistics below to test the researcher's suspicion. Use $\alpha = 0.05$.

Drinkers	Non-Drinkers
$\bar{x}_1 = 84$	$\bar{x}_2 = 82$
$s_1 = 4.9$	$s_2 = 5.3$
$n_1 = 65$	$n_2 = 75$

(If you are not using a graphing calculator, the formula to use here is $t_0 = \dfrac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\left(\frac{s_1^2}{n_1}\right) + \left(\frac{s_2^2}{n_2}\right)}}$ and df = 137).

A) There is sufficient evidence to conclude that the pulse rate of drinkers is higher than the pulse rate of non-drinkers. Reject H_0.
B) There is not sufficient evidence to conclude that the pulse rate of drinkers is higher than the pulse rate of non-drinkers. Do Not Reject H_0.
C) There is not sufficient evidence to conclude that the pulse rate of drinkers is higher than the pulse rate of non-drinkers. Reject H_0.
D) There is sufficient evidence to conclude that the pulse rate of drinkers is higher than the pulse rate of non-drinkers. Do Not Reject H_0.

39) For a χ^2 -curve with 18 degrees of freedom, find the χ^2 -value having area 0.975 to its right.
A) 9.390 **B)** 7.564 **C)** 8.231 **D)** 31.526 **E)** None of these.

40) The following table is obtained from a random sample of 40 absences.

Day	Mon	Tue	Wed	Thurs	Fri
Number Absent	6	8	9	7	10

You wish to test the claim that the absences occur on the five days with equal frequency. What is the value of the χ^2 test statistic?

A) $\chi^2 = 0.75$ **B)** $\chi^2 = 1.25$ **C)** $\chi^2 = 1.33$ **D)** $\chi^2 = 1.75$ **E)** $\chi^2 = 2.25$

41) A random sample of 160 car purchases are selected and categorized by age. The results are listed below. The age distribution of drivers for the given categories is 18% for the under 26 group, 39% for the 26-45 group, 31% for the 45-65 group, and 12% for the group over 65. Find the P-value to test the claim that all ages have purchase rates proportional to their driving rates. Use $\alpha = 0.05$.

Age	Under 26	26–45	66–64	Over 65
Purchases	66	39	25	30

A) $0.01 < P < 0.025$ **B)** $P > 0.10$ **C)** $P < 0.005$ **D)** $0.005 < P < 0.01$

42) An engineering society wishes to determine by how much, if at all, the mean outcome of practicing mechanical engineers exceeds that of electrical engineers. Two independent random samples were drawn from populations that are normally distributed. A sample of 75 mechanical engineers had a mean of \$82,200 with a standard deviation of \$8400. A sample of 60 electrical engineers had a mean of \$81,400 with a standard deviation of \$8800. Construct a 90% confidence interval estimate for the difference in population means.

(If you are not using a graphing calculator, the formula to use here is $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} \cdot \sqrt{\left(\frac{s_1^2}{n_1}\right) + \left(\frac{s_2^2}{n_2}\right)}$, where $t_{\frac{\alpha}{2}}$ is computed using 123 degrees of freedom.)

A) (–3096, 4696.3) **B)** (–1282, 2882.4) **C)** (–1845, 3445.5) **D)** (–1676, 3275.6)

43) The American Pet Products Association conducted a survey in 2011. Below is a table giving the percentage distribution of dog owners who have only one dog, two dogs, or three or more dogs:

Number of dogs	Percentage
One dog	60
Two dogs	28
Three or more dogs	12

A random sample of 129 dog owners was surveyed and the data is shown below:

Number of dogs	Frequency
One dog	73
Two dogs	38
Three or more dogs	18

What is the value of the χ^2 test statistic?

A) $\chi^2 = 9.388$ **B)** $\chi^2 = 6.947$ **C)** $\chi^2 = 0.824$ **D)** $\chi^2 = 2.147$ **E)** $\chi^2 = 0.758$

44) An F-curve has df = (3,6). Find the F-value having area 0.01 to its right.
A) 23.70 **B)** 4.76 **C)** 27.91 **D)** 9.78 **E)** 132.85

45) A one-way ANOVA test is to be performed to conclude that a difference exists between the population means of total miles driven throughout a particular day of a certain rental sports car. The sample data is given below:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
51	29	34	46	62	22	101
64	31	51	91	34	123	125
98	35	40	33	49	111	26
44	46	44	47	21	74	59
28	40		85	99	85	71
31	12		41			55
	16					

What is the correct degrees of freedom needed to perform this test?
A) df = (7,39) **B)** df = (6,39) **C)** df = (32,6) **D)** df = (32,6) **E)** df = (6,32)

46) Four different types of insecticides are used on strawberry plants. The number of strawberries on each randomly selected plant is given in the table below.

Insecticide A	Insecticide B	Insecticide C	Insecticide D
6	8	6	3
7	5	3	5
6	5	4	3
5	5	3	4
7	5	2	4
6	6	3	5

Preliminary data analyses indicate that it is reasonable to consider the assumptions for one-way ANOVA satisfied. At the 1% significance level, test the hypothesis that the type of insecticide makes no difference in the mean number of strawberries per plant. Use a critical-value approach. (Note: The test statistic is 8.36)

A) The critical value from Table IX is 126.42, do not reject the null hypothesis.
B) The critical value from Table IX is 4.94, do not reject the null hypothesis.
C) The critical value from Table IX is 4.94, reject the null hypothesis.
D) The critical value from Table IX is 126.42, reject the null hypothesis.

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☺ **<u>Answers</u>:**
1) E; 2) D; 3) C; 4) A; 5) A; 6) B; 7) C; 8) E; 9) A; 10) E; 11) B; 12) B; 13) B; 14) C; 15) D; 16) D; 17) A; 18) D; 19) C; 20) B; 21) D; 22) C; 23) A; 24) D; 25) D; 26) A; 27) E; 28) C; 29) A; 30) C; 31) E; 32) B; 33) A; 34) A; 35) C; 36) E; 37) B; 38) A; 39) C; 40) B; 41) C; 42) D; 43) E; 44) D; 45) E; 46) C.

(Note #44, #45, & #46 is Chapter 13, which is part of the final and not Exam #3).