

# Chapter 1

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1. Jane has two purses. One contains two each of \$1 bills, \$5 bills, and \$10 bills. The other contains four \$1 bills and two \$5 bills. If Jane uses the following decision rule “Reject  $H_0$  if the selected bill is \$1, otherwise Accept  $H_0$ ,” then under this rule, what is the Type II error  $\beta$ ?

$H_0$  : The purse contains \$1, \$1, \$5, \$5, \$10, \$10

$H_1$  : The purse contains \$1, \$1, \$1, \$1, \$5, \$5

- a. 0.0
- b. 0.50
- c. 0.67
- d. 0.33

**Answer**  $\beta = P(H_0|H_1) = P(\$5, \$10|H_1) = 2/6 = 0.33$

2. Two different methods of teaching first-graders to read are being compared. Two first-grade teachers selected students for their respective classes and each teacher taught with one of the two methods. At the end of the school year, the two methods were evaluated on the basis of the test scores. It was found that there was no significant difference between the two methods at the 10% level. A possible *p-value* for this study is:

- a. 0.02
- b. 0.05
- c. 0.10
- d. 0.15

**Answer** 0.15

3. Machine A makes parts whose lengths are normally distributed with mean 10 mm and standard deviation of 2 mm. Machine B makes parts whose lengths are normally distributed with mean 8 mm and standard deviation of 2 mm. Suppose you have a box of parts that you believe are from Machine A, but you are not sure. You decide to test the hypothesis  $H_0$  : The parts are from Machine A versus  $H_1$  : The parts are from Machine B, by choosing one part from the box and measuring it. If you get a length of 6 mm, what is the *p-value* for the test?

- a. 0.1587
- b. 0.0228
- c. 0.9772
- d. 0.6826

**Answer** P-Value =  $P(X < 6|H_0) = P(X < 6|A) = P\left(Z < \frac{6-10}{2}\right) = P(Z < -2) = 0.0228$

## Chapters 2 and 3

1. A large study used records from Canada's national health care system to compare the effectiveness of two ways to treat prostate cancer. The two treatments are traditional surgery and a new method that does not require surgery. The records described many patients whose doctors had chosen each method. This is an example of:
  - a. an experiment
  - b. an observational study
  - c. a randomized design

**Answer** an observational study.
2. In Wisconsin 85% of cats and dogs are neutered. In a sample of 350 cats and dogs from throughout the state, only 212 were neutered for a percentage of 60.6%. The value 60.6% is a
  - a. Parameter
  - b. Statistic
  - c. Variable
  - d. Factor

**Answer** Statistic
3. There are 975 faculty employed at a college. The dean of this college wishes to conduct a survey to obtain faculty input on a new teaching method being proposed. The dean constructs a list of the 60 departments in the college. She plans to take a simple random sample of six departments. Her sample will consist of all faculty in those six departments. Each faculty member belongs to only one department. What sampling method was used here?
  - a. Stratified sampling
  - b. Cluster sampling
  - c. Simple random sampling
  - d. Convenience sampling
  - e. Systematic sampling

**Answer** Cluster Sampling
4. In a recent poll, 62% responded yes when asked if they favored an amendment protecting the life of an unborn child. However, when asked whether they favored an amendment prohibiting abortions, only 39% said yes. What type of bias is being observed?
  - a. Response
  - b. Non-response
  - c. Selection

**Answer** Response
5. In an effort to survey the attitudes of former university graduate students, the registrar randomly samples 100 names from each of the four past graduating classes. What sampling method is described here?
  - a. Stratified sampling
  - b. Cluster sampling
  - c. Simple random sampling
  - d. Systematic sampling

**Answer** Stratified sampling
6. A food products company is preparing a new pizza-crust mix for marketing. It is important that the taste of the pizza crust not change with small variations in baking time or temperature. An experiment is done in

which batches of pizza-crust dough are baked at 410°F, 425°F, or 440°F for 20 minutes or 30 minutes. Six batches of pizza-crust dough will be assigned to each treatment. How many experimental units are needed for this experiment?

- a. 2
- b. 6
- c. 36
- d. 42

**Answer**  $3 \times 2 \times 6 = 36$

7. In a simple random sample of 200 items from a large population of items, five items were defective. It can be concluded that (select one)
- a. the percent of defective items in the population is 2.5%.
  - b. out of every 200 items, there will be five defective items.
  - c. the percent of defective items in the sample is 2.5%.
  - d. none of the above

**Answer** the percent of defective items in the sample is 2.5%

## Chapter 5

1. Calculate the median for the following numbers: 1, 3, 7, 8, 10.
- 3
  - 7
  - 4
  - 5

**Answer** 7

2. Jessica is a 12 old and has an IQ score of 121.04. The mean IQ score for 12-year olds is 90, and the standard deviation is 16. What is Jessica's standardized score?
- 90
  - 31
  - 1.28
  - 1.94
  - 1.28

**Answer**  $Z = \frac{(121.04-90)}{16} = 1.94$

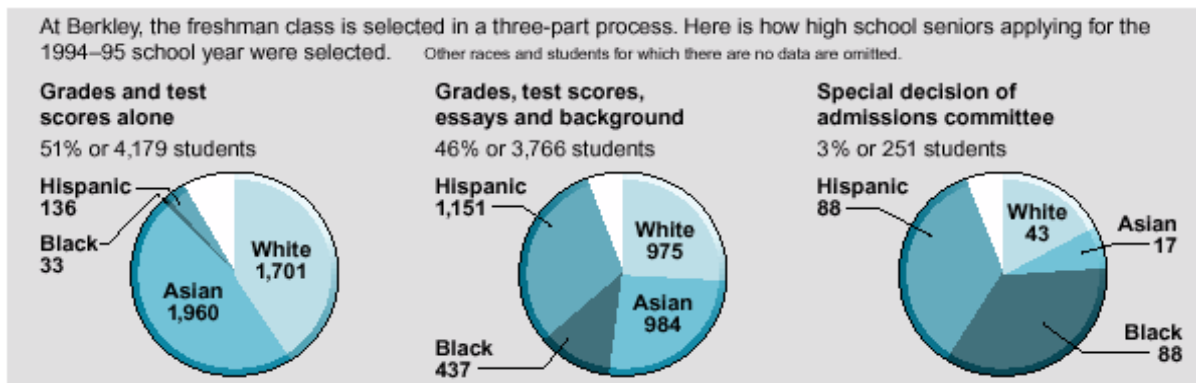
3. Calculate the Interquartile Range (IQR) for the following numbers: 1, 3, 7, 8, 10.
- 3
  - 7
  - 4
  - 5

	Number	Percentage	
	1	0-20	
<b>Answer</b>	3	20-40	IQR=75%-25%=8-3=5
	7	40-60	
	8	60-80	
	10	80-100	

4. For a recent exam given in your statistics class, the average score for the 170 students in the class was  $\bar{X} = 18$ , with a standard deviation of  $s_X = 4$ . If the professor makes the following correction to the score:  $Y = 1 - 7X$ , then what is the standard deviation of the random variable Y?
- 127
  - 28
  - 28
  - 1

**Answer**  $S_Y = |-7|S_X = 7 \times 4 = 28$

5. Pie charts are often used to summarize qualitative data. The accompanying picture shows three pie charts for race, one chart for each of the three possible ways a student may be selected for admission.

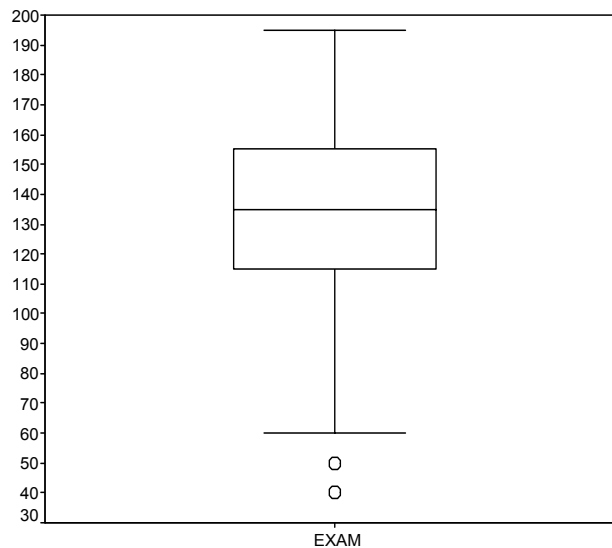


How many students were selected in all?

- a. 4179
- b. 3766
- c. 251
- d. 8196

**Answer** 8196

- a. Answer the next **three** questions based on the attached box plot that shows the distribution of Exam scores for a class of  $n = 276$  students taking a Fundamentals of Business Statistics course.



- 6. What percentile does a score of 155 represent?

- a. 25
- b. 75
- c. 50
- d. 0
- e. 100

**Answer** 75

- 7. Approximately how many students got a score of 60 or more (choose the answer that is most appropriate)?

- a. 25
- b. 75
- c. 100

d. 274

e. 276

**Answer** 274

8. What is the interquartile range of scores for this class?

a. 155

b. 115

c. 40

d. 65

e. 80

**Answer**  $155 - 115 = 40$

## Chapter 6

1. If  $Z \sim N(0,1)$ , then what is the z value corresponding to the 25th percentile?
- 0.0
  - 0.674
  - 1.645
  - 0.674
  - 1.645

**Answer** From Table III, the answer is -0.674

2. The distribution of scores for a particular exam follows a normal distribution with  $X \sim N(70, 36)$ . If you got a 70 in this class, at what percentile is your score?
- 0.9525
  - 0.9995
  - 0.50
  - 0.0475

**Answer**  $P(X < 70) = P(Z < \frac{(70-70)}{\sqrt{36}} = 0)$ . The answer is 0.50.

3. Jessica is a 12 old and has an IQ score of 110.5. The mean IQ score for 12-year olds is 90, and the standard deviation is 16. What is Jessica's standardized score?
- 90
  - 31
  - 1.28
  - 1.94
  - 1.28

**Answer**  $Z = \frac{(110.5-90)}{16} = 1.28$

4. If  $Z \sim N(0,1)$ , then what is the z value corresponding to the 95th percentile?
- 0.0
  - 0.674
  - 1.645
  - 0.674
  - 1.645

**Answer** Look up Table III for 0.95, and you will see 1.645.

5. The distribution of scores for a particular exam follows a normal distribution with  $X \sim N(70, 36)$ . If you got an 80 in this class, at what percentile (given as a proportion) is your score?
- 0.9525
  - 0.9995
  - 0.50
  - 0.0475

**Answer**  $P(X < 80) = P(Z < \frac{(80-70)}{\sqrt{36}} = \frac{5}{3} = 1.67)$ . Look Up Table II for the answer of 0.9525.

6. If  $Z \sim N(0,1)$ , then what is the z value corresponding to the 5th percentile?
- 0.674
  - 1.645
  - 0.674

d. -1.645

**Answer** -1.645 (Table III)

7. If  $X \sim N(10, 4)$ , then find the proportion of value less than  $X = 6$ . That is, what is  $P(X < 6)$ ?

a. 0.1587

b. 0.0228

c. 0.9772

d. 0.8413

**Answer**  $P(X < 6) = P\left(Z < \frac{(6-10)}{\sqrt{4}}\right) = P(Z < -2) = .0228$

8. If  $X \sim N(10, 4)$ , find the proportion of values between  $X = 8$  and  $X = 12$ . That is, what is  $P(8 \leq X \leq 12)$ ?

a. 0.1587

b. 0.8413

c. 0.7984

d. 0.6826

**Answer**  $P(8 \leq X \leq 12) = P\left(\frac{(8-10)}{\sqrt{4}} \leq Z \leq \frac{(12-10)}{\sqrt{4}}\right) = P(-1 \leq Z \leq 1) = 0.8413 - 0.1587 = 0.6826$

9. The distribution of scores for a particular exam follows a normal distribution with  $X \sim N(70, 16)$ . Assuming that the top 10% of students get an A, the next 10% a B, and so on. If you got an 80 in this class, what grade did you get?

a. A

b. B

c. C

d. D

e. F

**Answer**  $P(X < 80) = P\left(Z < \frac{(80-70)}{\sqrt{16}}\right) = P(Z < 2.5) = 0.9938$ . Therefore, you got an A.



## Chapter 7

1. Answer the next **two** questions based on the following linear regression output of WEIGHT ( $y$ ) = average weight in pounds for American females between 30 and 39 years, on EXERCISE ( $x$ ) = hours per week:

Model	Coefficients	Significance
(Constant)	126.91	0.012
EXERCISE	-4.34	0.064

2. What will be the predicted weight for a female who exercises 5 hours / week?
- 126.91
  - 120.54
  - 110.78
  - 113.89
  - 105.21

**Answer**  $\text{WEIGHT} = 126.91 + (-4.34) \times 5 = 105.21$

3. Is there a significant (non-zero) relationship between EXERCISE and WEIGHT at the  $\alpha = 0.10$  significance level?
- Yes
  - No
  - Cannot tell

**Answer** Yes, because  $p\text{-value of } 0.064$  is less than  $\alpha = 0.05$ .

Answer the next **four** questions based on the following output: Your instructor was interested in determining the relationship between in-class exam scores ( $y$ ) and online quiz scores ( $x$ ) for the students in his Fundamental of Business Statistics course in Spring 2001. The following output shows the result of running a linear regression on EXAM ( $y$ ) and QUIZ ( $x$ ):

Dependent Variable: EXAM		
Model	Coefficients	Sig.
(Constant)	75.394	.000
QUIZ	.793	.000
$R^2 = .244$		

4. What is the linear correlation between QUIZ and EXAM scores?
- 0.244
  - 0.244
  - 0.494
  - 0.494

**Answer**  $r = \sqrt{r^2} = \sqrt{0.244} = 0.494$ . The sign will be positive as the slope is positive.

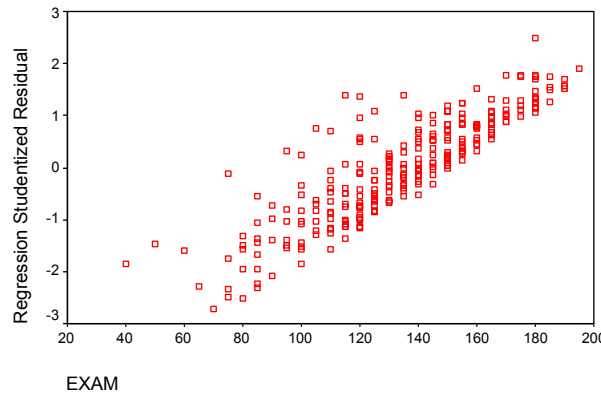
5. What will be the predicted EXAM score for a student who gets an 89 QUIZ score?
- 89.00
  - 124.23
  - 189.45
  - 145.97
  - 75.34

**Answer**  $EXAM = 75.394 + (0.793) \times 89 = 145.97$

6. Is there a significant linear (non zero) relationship at the 10% level between EXAM and QUIZ scores?
- yes
  - no
  - cannot be determined

**Answer** yes

7. The residual plot for the above model is given below. Based on this plot, are the assumptions of linear regression satisfied?



- yes
- no
- cannot be determined

**Answer** no, because there is a trend in the residual plot.

Answer the next **three** questions based on the following linear regression output of WEIGHT (y) = average weight in pounds for American females between 30 and 39 years, on EXERCISE (x) = hours per week:

Model	Coefficients	Significance
(Constant)	126.91	0.012
EXERCISE	-4.34	0.064

$R^2 = 0.934$

8. What is the linear correlation between WEIGHT and EXERCISE?
- 0.934
  - 0.934
  - 0.966
  - 0.966

**Answer**  $r = \sqrt{r^2} = \sqrt{0.934} = -0.966$  (the answer will be negative as the slope -4.34 is negative).

9. What will be the predicted weight for a female who exercises 3 hours / week?
- 126.91
  - 120.54
  - 101.23
  - 113.89
  - 98.78

**Answer**  $WEIGHT = 126.91 + (-4.34) \times 3 = 113.89$

10. Is there a significant (non-zero) relationship between EXERCISE and WEIGHT at the  $\alpha = 0.05$

- a. Yes
- b. No
- c. Cannot tell

**Answer** No, because *p-value of 0.064* is greater than  $\alpha = 0.05$ .

## Chapter 10

- Answer the next **three** questions based on the following: A 90% confidence interval for the mean tread wear of tires from a certain manufacturer happens to be (0.134, 0.854).
- In testing the hypotheses  $H_0 : \mu = 0.87$  vs  $H_1 : \mu \neq 0.87$ , which hypothesis would you conclude at the  $\alpha = 0.05$  level?
  - Accept the null
  - Accept the alternative
  - Cannot be determined

**Answer** Cannot be determined
- What is the WIDTH of the interval?
  - 0.134
  - 0.350
  - 0.494
  - 0.720

**Answer**  $W = 0.854 - 0.134 = 0.72$
- If the sample size was now increased, what do you think will most probably happen to the 90% confidence interval?
  - The interval width will increase
  - The interval width will decrease
  - There will be no change to the interval width.

**Answer** The interval width will decrease
- The ASPA wants to estimate the mean yearly sugar consumption. A sample of 16 people reveals  $\bar{X} = 60$  pounds. It is known that the standard deviation of the sample mean is  $s_{\bar{X}} = 5$ . If the consumption of sugar follows a normal distribution, then construct a 95% one-sided, lower-bound confidence interval for  $\mu$ .
  - $\mu \geq 59.80$
  - $\mu \geq 53.59$
  - $\mu \geq 58.23$
  - $\mu \geq 51.24$

**Answer**  $\mu \geq \bar{X} - t_{(n-1;1-\alpha)} \times s_{\bar{X}} = 60 - t_{(15;0.95)} \times 5 = 60 - 1.753 \times 5 = 51.24$
- If  $X \sim t_{(25)}$ , then what is the T value corresponding to the 20th percentile?
  - .842
  - .842
  - .856
  - .856

**Answer** -.856
- Will you assist the college registrar in determining how many transcripts to study? The registrar wants to estimate the mean GPA of all graduating seniors during the last 10 years. The mean GPA is to be estimated within plus or minus 0.10 (i.e., the half width is 0.10). The standard deviation is  $\sigma = 0.279$ . Assume that the distribution of scores is normally distributed, and that we require a 95% confidence interval.
  - 15
  - 30
  - 6

d. 183

$$\text{Answer } H = \frac{Z_{(1-\alpha/2)} \times \sigma}{\sqrt{n}} \Rightarrow \sqrt{n} = \frac{Z_{(1-\alpha/2)} \times \sigma}{H} = \frac{Z_{(.975)} \times 0.279}{.10} = \frac{1.96 \times 0.279}{0.10} = 5.4684. \text{ Therefore,}$$

$$n = 5.4684^2 = 29.903 \approx 30$$

8. Many statistical computing packages automatically report the p-value for a two-sided test. Suppose the reported two-sided p-value was 0.20. If the observed test statistic  $Z$  is negative, and the alternative hypothesis is one-sided, right-tailed, then, what will the p-value be?

- a. 0.80
- b. 0.90
- c. 0.20
- d. 0.10

**Answer** As the  $Z$  value is negative, then the area to the left of the  $Z$  value is 0.10 ( $0.20/2$ ), and the area to the right will be 0.90. As the question is asking for the p-value of a one-sided, right-tailed test, we want the area to the right, which is 0.90.

The next **three** questions are based on the following: To test the amount of bacteria in raw milk, a dairy takes a simple random sample of 36 1-mL samples from the next shipment, resulting in  $\bar{X} = 4994$  bacteria / mL. Assume that bacteria count is normally distributed, and  $\sigma = 16$ .

**Answer** Using the flow chart in Chapter 10, we will use the  $Z \sim N(0, 1)$  distribution. Also,

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{16}{6} = 2.67$$

9. If the hypothesis being tested is  $H_0 : \mu \leq 5000$  vs  $H_1 : \mu > 5000$ , then what is the approximate p-value?
- a. 0.05
  - b. 0.0244
  - c. 0.0122
  - d. 0.9878
  - e. 0.0175

**Answer** P-Value =  $P(\bar{X} > 4994 | H_0) = P\left(Z > \frac{(4994 - 5000)}{2.67}\right) = P(Z > -2.25) = 0.9878$  from Table II.

10. If the hypothesis being tested is  $H_0 : \mu = 5000$  vs  $H_1 : \mu \neq 5000$ , then what is the approximate p-value?
- a. 0.05
  - b. 0.0244
  - c. 0.0122
  - d. 0.9878
  - e. 0.0175

**Answer** This is a two-sided test. The test statistic is the same as the previous question. Therefore, in this case, the p-value =  $2 \times \text{Min}(A, B) =$

$$2 \times \text{Min}(P(Z < -2.25), P(Z > -2.25)) = 2 \times \text{Min}(.0122, .9878) = 2 \times 0.0122 = 0.0244$$

11. To test the amount of bacteria in raw milk, a dairy takes a simple random sample of 61 1-mL samples from the next shipment, resulting in  $\bar{X} = 5003$ . Calculate a one-sided, upper-bound 99% confidence interval for  $\mu$  the mean bacteria count. Assume that bacteria count is normally distributed, and  $\sigma = 16$ .

- a.  $\mu \leq 5007.77$
- b.  $\mu \leq 4999.07$
- c.  $\mu \leq 5003.49$
- d.  $\mu \leq 5010.43$

**Answer**  $\mu \leq \bar{X} + Z_{(1-\alpha)} \frac{\sigma}{\sqrt{n}} = 5003 + Z_{(0.99)} \frac{16}{\sqrt{61}} = 5003 + 2.326 \times \frac{16}{\sqrt{61}} = 5007.77$

12. A psychologist wishes to test the hypotheses  $H_0 : \mu \leq 110$  vs  $H_1 : \mu > 110$  about the average IQ scores at a particular school. A random sample of nine girls gives a sample mean IQ score of  $\bar{X} = 114$ , and  $s = 15$ . Assume that IQ scores follow a normal distribution. Calculate the approximate p-value.

- a. 0.05
- b. 0.40
- c. 0.80
- d. 0.20

**Answer** One sided, upper-tailed test. Therefore, direction of extreme is to the right. p-value  
 $= P\left(t > \frac{(114-110)}{(15/\sqrt{9})} = 0.8\right) \simeq 1 - 0.8 = 0.2$

13. A tire manufacturer wishes to investigate the tread life of its tires. A sample of 10 tires driven 50,000 miles revealed a sample mean of  $\bar{X} = 0.32$  inch of tread remaining, and  $s^2 = 0.0081$ . Assume that the distribution of tread wear is normally distributed. Construct a 95% confidence interval for  $\mu$ , the population mean tread wear.

- a. (0.194, 0.432)
- b. (0.256, 0.384)
- c. (0.273, 0.367)
- d. (0.264, 0.376)

**Answer**  $\bar{X} \pm t_{(1-n;1-\alpha/2)} \frac{s}{\sqrt{n}} = 0.32 \pm t_{(1-10;1-0.05/2)} \frac{0.09}{\sqrt{10}} = 0.32 \pm t_{(9;0.975)} \times 0.0285 = 0.32 \pm 2.262 \times 0.$

The next **two** questions are based on the following: To test the amount of bacteria in raw milk, a dairy takes a simple random sample of 36 1-mL samples from the next shipment, resulting in  $\bar{X} = 4994$  bacteria / mL, and  $s^2 = 256$ . Assume that bacteria count is normally distributed.

**Answer** Using the flow chart in Chapter 10, we will use the  $t$  distribution with  $(36 - 1) = 35$  degrees of freedom. Also,  $S_{\bar{X}} = \frac{s}{\sqrt{n}} = \frac{16}{6} = 2.67$

14. If the hypothesis being tested is  $H_0 : \mu \geq 5000$  vs  $H_1 : \mu < 5000$ , then what is the approximate p-value?
- a. 0.05
  - b. 0.035
  - c. 0.9342
  - d. 0.9825
  - e. 0.0175

**Answer** This is a one-sided, lower-tailed test. Direction of extreme is to the left. Therefore p-value  
 $= P\left(T < \frac{(4994-5000)}{2.67}\right) = P(T < -2.25) \simeq .075$  (As there is no 35 df in the table, look at either 30 or 40. You will see that 2.25 is between 2.04 and 2.45 for 30 df. There, an approximate answer is between 0.01 and 0.025 - at the bottom of the table).

15. If the hypothesis being tested is  $H_0 : \mu = 5000$  vs  $H_1 : \mu \neq 5000$ , then what is the approximate p-value?
- a. 0.05
  - b. 0.035
  - c. 0.9342
  - d. 0.9825
  - e. 0.0175

**Answer** This is a two-sided test. The test statistic is the same as the previous question. Therefore, in this case, the p-value =  $2 \times \text{Min}(A, B) =$   
 $2 \times \text{Min}(P(T < -2.25), P(T > -2.25)) = 2 \times \text{Min}(0.0175, 0.925) = 2 \times 0.0175 = 0.035$

16. To test the amount of bacteria in raw milk, a dairy takes a simple random sample of **61** 1-mL samples from

the next shipment, resulting in  $\bar{X} = 5003$ , and  $s^2 = 256$ . Calculate a one-sided, upper-bound 99% confidence interval for  $\mu$  the mean bacteria count. Assume that bacteria count is normally distributed.

- a.  $\mu \leq 5007.90$
- b.  $\mu \leq 4998.07$
- c.  $\mu \leq 5003.00$
- d.  $\mu \leq 5010.43$

**Answer**  $\mu \leq \bar{X} + t_{(n-1;1-\alpha)} \frac{s}{\sqrt{n}} = 5003 + t_{(60;.99)} \frac{16}{\sqrt{61}} = 5003 + 2.39 \times \frac{16}{\sqrt{61}} = 5007.9$

17. A psychologist wishes to test the hypotheses  $H_0 : \mu \leq 110$  vs  $H_1 : \mu > 110$  about the average IQ scores at a particular school. A random sample of nine girls gives a sample mean IQ score of  $\bar{X} = 114$ . Assume that IQ scores follow a normal distribution with  $\sigma = 15$ . Calculate the p-value.
- a. 0.05
  - b. 0.1392
  - c. 0.4238
  - d. 0.7881
  - e. 0.2119

**Answer** One sided, upper-tailed test. Therefore, direction of extreme is to the right. p-value  
 $= P\left(Z > \frac{(114-110)}{(15/\sqrt{9})} = 0.8\right) = 1 - .7881 = 0.2119$

If a 90% confidence interval for the mean tread wear of tires from a certain manufacturer happens to be (0.134, 0.854), then answer the following **two** questions:

18. What is the value of the sample mean  $\bar{X}$ ?
- a. 0.134
  - b. 0.854
  - c. 0.494
  - d. Cannot be determined

**Answer**  $\bar{X} = \frac{.134+.854}{2} = 0.494$

19. In testing the hypotheses  $H_0 : \mu = 0.80$  vs  $H_1 : \mu \neq 0.80$ , which hypothesis would you conclude at the  $\alpha = 0.05$  level?
- a. Accept the null
  - b. Accept the alternative
  - c. Cannot be determined

**Answer** First,  $\mu = 0.80$  lies in the above 90% CI. If we change the level of confidence to 95% (as requested), the interval becomes wider, and  $\mu = 0.80$  continues to lie in it. Therefore, accept the null.

20. A tire manufacturer wishes to investigate the tread life of its tires. A sample of 10 tires driven 50,000 miles revealed a sample mean of  $\bar{X} = 0.32$  inch of tread remaining. Assume that the distribution of tread wear is normally distributed, and  $\sigma = 0.09$ . Construct a 95% confidence interval for  $\mu$ , the population mean tread wear.
- a. (0.194, 0.432)
  - b. (0.246, 0.384)
  - c. (0.273, 0.367)
  - d. (0.264, 0.376)

**Answer**  $\bar{X} \pm Z_{(1-\alpha/2)} \frac{\sigma}{\sqrt{n}} = 0.32 \pm Z_{(1-0.05/2)} \frac{0.09}{\sqrt{10}} = 0.32 \pm 1.96 \times 0.0285 = 0.32 \pm 0.558 = (.264, .376)$

21. For a particular two-sided hypothesis test, the *p-value* was 0.04. If  $\alpha = 0.10$ , which hypothesis was

concluded?

- a. Null
- b. Alternative
- c. Cannot be determined without further information

**Answer** p-value is less than  $\alpha$ , therefore Alternative.

22. The American Sugar Producers Association wants to estimate the mean yearly sugar consumption. A sample of 16 people reveals  $\bar{X} = 60$  pounds. Assume that the consumption of sugar follows a normal distribution with  $\sigma = 20$ . Construct a 90% one-sided, lower-bound confidence interval for  $\mu$ .

- a.  $\mu \geq 69.80$
- b.  $\mu \geq 53.59$
- c.  $\mu \geq 68.23$
- d.  $\mu \geq 51.78$

**Answer**  $\mu \geq \bar{X} - Z_{(1-\alpha)} \frac{\sigma}{\sqrt{n}} = 60 - Z_{(1-.10)} \frac{20}{4} = 60 - Z_{(.90)} \times 5 = 60 - 1.282 \times 5 = 53.59$

23. Will you assist the college registrar in determining how many transcripts to study? The registrar wants to estimate the mean GPA of all graduating seniors during the last 10 years. The mean GPA is to be estimated within plus or minus 0.05 (i.e., the half width is 0.05). The standard deviation is  $\sigma = 0.279$ . Assume that the distribution of scores is normally distributed, and that we require a 99% confidence interval.

- a. 15
- b. 28
- c. 129
- d. 207

**Answer**  $H = \frac{Z_{(1-\alpha/2)} \times \sigma}{\sqrt{n}} \Rightarrow \sqrt{n} = \frac{Z_{(1-\alpha/2)} \times \sigma}{H} = \frac{Z_{(.995)} \times 0.279}{.05} = \frac{2.576 \times 0.279}{0.05} = 14.374$ . Therefore,  
 $n = 14.374^2 = 206.61 \approx 207$

24. Many statistical computing packages automatically report the p-value for a two-sided test. Suppose the reported two-sided p-value was 0.20. If the observed test statistic  $Z$  is positive, and the alternative hypothesis is one-sided, right-tailed, then, what will the p-value be?

- a. 0.80
- b. 0.90
- c. 0.20
- d. 0.10

**Answer** As the  $Z$  value is positive, then the area to the right of the  $Z$  value is 0.10 (0.20/2), and the area to the left will be 0.90. As the question is asking for the p-value of a one-sided, right-tailed test, we want the area to the right, which is 0.10.

25. If  $X \sim N(0, 1)$ , then what is the  $Z$  value corresponding to the 15th percentile?

- a. -1.751
- b. 1.751
- c. -1.036
- d. 1.036

**Answer** Look up Table III for 0.15, and you get -1.036