

STA2023
Test # 4 Study guide

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Express the null hypothesis and the alternative hypothesis in symbolic form. Use the correct symbol (μ , p , σ) for the indicated parameter.

1) An entomologist writes an article in a scientific journal which claims that fewer than 16 in ten thousand male fireflies are unable to produce light due to a genetic mutation. Use the parameter p , the true proportion of fireflies unable to produce light. 1) _____

- A) $H_0: p = 0.0016$ B) $H_0: p < 0.0016$ C) $H_0: p > 0.0016$ D) $H_0: p = 0.0016$
H₁: $p < 0.0016$ H₁: $p \geq 0.0016$ H₁: $p \leq 0.0016$ H₁: $p > 0.0016$

2) Carter Motor Company claims that its new sedan, the Libra, will average better than 23 miles per gallon in the city. Use μ , the true average mileage of the Libra. 2) _____

- A) $H_0: \mu = 23$ B) $H_0: \mu > 23$ C) $H_0: \mu = 23$ D) $H_0: \mu < 23$
H₁: $\mu < 23$ H₁: $\mu \leq 23$ H₁: $\mu > 23$ H₁: $\mu \geq 23$

3) The manufacturer of a refrigerator system for beer kegs produces refrigerators that are supposed to maintain a true mean temperature, μ , of 48°F, ideal for a certain type of German pilsner. The owner of the brewery does not agree with the refrigerator manufacturer, and claims he can prove that the true mean temperature is incorrect. 3) _____

- A) $H_0: \mu \geq 48^\circ$ B) $H_0: \mu \neq 48^\circ$ C) $H_0: \mu \leq 48^\circ$ D) $H_0: \mu = 48^\circ$
H₁: $\mu < 48^\circ$ H₁: $\mu = 48^\circ$ H₁: $\mu > 48^\circ$ H₁: $\mu \neq 48^\circ$

Assume that the data has a normal distribution and the number of observations is greater than fifty. Find the critical z value used to test a null hypothesis.

4) $\alpha = 0.05$ for a two-tailed test. 4) _____

- A) ± 1.645 B) ± 1.96 C) ± 1.764 D) ± 2.575

5) $\alpha = 0.09$ for a right-tailed test. 5) _____

- A) 1.34 B) ± 1.96 C) ± 1.34 D) 1.96

6) $\alpha = 0.05$ for a left-tailed test. 6) _____

- A) ± 1.645 B) -1.96 C) -1.645 D) ± 1.96

Find the value of the test statistic z using $z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$.

7) A claim is made that the proportion of children who play sports is less than 0.5, and the sample statistics include $n = 1320$ subjects with 30% saying that they play a sport. 7) _____

- A) 14.53 B) -14.53 C) 29.66 D) -29.66

- 8) The claim is that the proportion of drowning deaths of children attributable to beaches is more than 0.25, and the sample statistics include $n = 696$ drowning deaths of children with 30% of them attributable to beaches. 8) _____
- A) -3.05 B) -2.88 C) 2.88 D) 3.05

Use the given information to find the P-value. Also, use a 0.05 significance level and state the conclusion about the null hypothesis (reject the null hypothesis or fail to reject the null hypothesis).

- 9) The test statistic in a right-tailed test is $z = 0.52$. 9) _____
- A) 0.0195; reject the null hypothesis B) 0.3015; reject the null hypothesis
 C) 0.6030; fail to reject the null hypothesis D) 0.3015; fail to reject the null hypothesis

- 10) The test statistic in a right-tailed test is $z = 1.43$. 10) _____
- A) 0.1528; fail to reject the null hypothesis B) 0.0764; fail to reject the null hypothesis
 C) 0.1528; reject the null hypothesis D) 0.0764; reject the null hypothesis

- 11) The test statistic in a left-tailed test is $z = -2.05$. 11) _____
- A) 0.4798; fail to reject the null hypothesis B) 0.0453 fail to reject the null hypothesis
 C) 0.0404; reject the null hypothesis D) 0.0202; reject the null hypothesis

- 12) With $H_1: p \neq 0.377$, the test statistic is $z = 3.06$. 12) _____
- A) 0.0011; reject the null hypothesis B) 0.0022; fail to reject the null hypothesis
 C) 0.0022; reject the null hypothesis D) 0.0011; fail to reject the null hypothesis

- 13) With $H_1: p < 2/3$, the test statistic is $z = -1.89$. 13) _____
- A) 0.9706; fail to reject the null hypothesis B) 0.0294; fail to reject the null hypothesis
 C) 0.0588; fail to reject the null hypothesis D) 0.0294; reject the null hypothesis

- 14) With $H_1: p > 0.554$, the test statistic is $z = 1.34$. 14) _____
- A) 0.1802; reject the null hypothesis B) 0.9099; fail to reject the null hypothesis
 C) 0.0901; fail to reject the null hypothesis D) 0.0901; reject the null hypothesis

Formulate the indicated conclusion in nontechnical terms. Be sure to address the original claim.

- 15) An entomologist writes an article in a scientific journal which claims that fewer than 3 in ten thousand male fireflies are unable to produce light due to a genetic mutation. Assuming that a hypothesis test of the claim has been conducted and that the conclusion is to reject the null hypothesis, state the conclusion in nontechnical terms. 15) _____
- A) There is not sufficient evidence to support the claim that the true proportion is greater than 3 in ten thousand.
 B) There is not sufficient evidence to support the claim that the true proportion is less than 3 in ten thousand.
 C) There is sufficient evidence to support the claim that the true proportion is greater than 3 in ten thousand.
 D) There is sufficient evidence to support the claim that the true proportion is less than 3 in ten thousand.

- 16) The owner of a football team claims that the average attendance at games is over 523, and he is therefore justified in moving the team to a city with a larger stadium. Assuming that a hypothesis test of the claim has been conducted and that the conclusion is failure to reject the null hypothesis, state the conclusion in nontechnical terms. 16) _____
- A) There is not sufficient evidence to support the claim that the mean attendance is less than 523.
- B) There is not sufficient evidence to support the claim that the mean attendance is greater than 523.
- C) There is sufficient evidence to support the claim that the mean attendance is less than 523.
- D) There is sufficient evidence to support the claim that the mean attendance is greater than 523.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Identify the null hypothesis, alternative hypothesis, test statistic, P-value, conclusion about the null hypothesis, and final conclusion that addresses the original claim.

- 17) A manufacturer considers his production process to be out of control when defects exceed 3%. In a random sample of 85 items, the defect rate is 5.9% but the manager claims that this is only a sample fluctuation and production is not really out of control. At the 0.01 level of significance, test the manager's claim. 17) _____
- 18) According to a recent poll 53% of Americans would vote for the incumbent president. If a random sample of 100 people results in 45% who would vote for the incumbent, test the claim that the actual percentage is 53%. Use a 0.10 significance level. 18) _____
- 19) An article in a journal reports that 34% of American fathers take no responsibility for child care. A researcher claims that the figure is higher for fathers in the town of Littleton. A random sample of 234 fathers from Littleton yielded 96 who did not help with child care. Test the researcher's claim at the 0.05 significance level. 19) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Find the P-value for the indicated hypothesis test.

- 20) A medical school claims that more than 28% of its students plan to go into general practice. It is found that among a random sample of 130 of the school's students, 32% of them plan to go into general practice. Find the P-value for a test of the school's claim. 20) _____
- A) 0.3078 B) 0.1539 C) 0.1635 D) 0.3461
- 21) In a sample of 88 children selected randomly from one town, it is found that 8 of them suffer from asthma. Find the P-value for a test of the claim that the proportion of all children in the town who suffer from asthma is equal to 11%. 21) _____
- A) -0.2843 B) 0.2157 C) 0.5686 D) 0.2843
- 22) A manufacturer claims that fewer than 6% of its fax machines are defective. In a random sample of 97 such fax machines, 5% are defective. Find the P-value for a test of the manufacturer's claim. 22) _____
- A) 0.3409 B) 0.3264 C) 0.1736 D) 0.1591

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Assume that a simple random sample has been selected from a normally distributed population and test the given claim. Use either the traditional method or P-value method as indicated. Identify the null and alternative hypotheses, test statistic, critical value(s) or P-value (or range of P-values) as appropriate, and state the final conclusion that addresses the original claim.

23) Use a significance level of $\alpha = 0.05$ to test the claim that $\mu = 32.6$. The sample data consist of 15 scores for which $\bar{x} = 42.5$ and $s = 5.9$. Use the traditional method of testing hypotheses. 23) _____

24) A test of sobriety involves measuring the subject's motor skills. Twenty randomly selected sober subjects take the test and produce a mean score of 41.0 with a standard deviation of 3.7. At the 0.01 level of significance, test the claim that the true mean score for all sober subjects is equal to 35.0. Use the traditional method of testing hypotheses. 24) _____

25) In tests of a computer component, it is found that the mean time between failures is 520 hours. A modification is made which is supposed to increase the time between failures. Tests on a random sample of 10 modified components resulted in the following times (in hours) between failures. 25) _____
518 548 561 523 536
499 538 557 528 563
At the 0.05 significance level, test the claim that for the modified components, the mean time between failures is greater than 520 hours. Use the P-value method of testing hypotheses.

26) A light-bulb manufacturer advertises that the average life for its light bulbs is 900 hours. A random sample of 15 of its light bulbs resulted in the following lives in hours. 26) _____
995 590 510 539 739 917 571 555
916 728 664 693 708 887 849
At the 10% significance level, test the claim that the sample is from a population with a mean life of 900 hours. Use the P-value method of testing hypotheses.

Assume that a simple random sample has been selected from a normally distributed population. Find the test statistic, P-value, critical value(s), and state the final conclusion.

27) Test the claim that for the population of female college students, the mean weight is given by $\mu = 132$ lb. Sample data are summarized as $n = 20$, $\bar{x} = 137$ lb, and $s = 14.2$ lb. Use a significance level of $\alpha = 0.1$. 27) _____

28) Test the claim that the mean lifetime of car engines of a particular type is greater than 220,000 miles. Sample data are summarized as $n = 23$, $\bar{x} = 226,450$ miles, and $s = 11,500$ miles. Use a significance level of $\alpha = 0.01$. 28) _____

Identify the null hypothesis, alternative hypothesis, test statistic, P-value, conclusion about the null hypothesis, and final conclusion that addresses the original claim.

29) Various temperature measurements are recorded at different times for a particular city. The mean of 20°C is obtained for 60 temperatures on 60 different days. Assuming that $\sigma = 1.5^\circ\text{C}$, test the claim that the population mean is 22°C. Use a 0.05 significance level. 29) _____

- 30) The health of employees is monitored by periodically weighing them in. A sample of 54 employees has a mean weight of 183.9 lb. Assuming that σ is known to be 121.2 lb, use a 0.10 significance level to test the claim that the population mean of all such employees weights is less than 200 lb. 30) _____

Test the given claim. Use the P-value method or the traditional method as indicated. Identify the null hypothesis, alternative hypothesis, test statistic, critical value(s) or P-value, conclusion about the null hypothesis, and final conclusion that addresses the original claim.

- 31) A simple random sample of 15-year old boys from one city is obtained and their weights (in pounds) are listed below. Use a 0.01 significance level to test the claim that these sample weights come from a population with a mean equal to 147 lb. Assume that the standard deviation of the weights of all 15-year old boys in the city is known to be 16.7 lb. Use the traditional method of testing hypotheses. 31) _____

146 140 160 151 134 189 157 144 175 127 164

- 32) The mean resting pulse rate for men is 72 beats per minute. A simple random sample of men who regularly work out at Mitch's Gym is obtained and their resting pulse rates (in beats per minute) are listed below. Use a 0.05 significance level to test the claim that these sample pulse rates come from a population with a mean less than 72 beats per minute. Assume that the standard deviation of the resting pulse rates of all men who work out at Mitch's Gym is known to be 6.6 beats per minute. Use the traditional method of testing hypotheses. 32) _____

54 59 69 84 74 64 69
70 66 80 59 71 76 63

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Given the linear correlation coefficient r and the sample size n , determine the critical values of r and use your finding to state whether or not the given r represents a significant linear correlation. Use a significance level of 0.05.

- 33) $r = 0.543$, $n = 25$ 33) _____
 A) Critical values: $r = \pm 0.396$, significant linear correlation
 B) Critical values: $r = \pm 0.487$, significant linear correlation
 C) Critical values: $r = \pm 0.487$, no significant linear correlation
 D) Critical values: $r = \pm 0.396$, no significant linear correlation

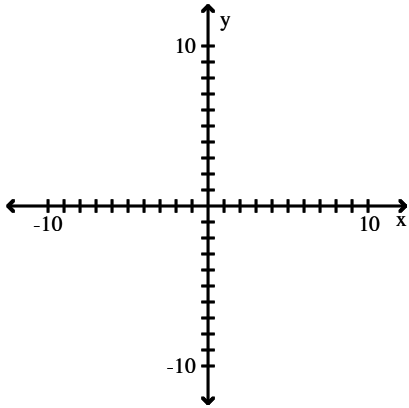
- 34) $r = 0.353$, $n = 15$ 34) _____
 A) Critical values: $r = \pm 0.514$, no significant linear correlation
 B) Critical values: $r = \pm 0.532$, no significant linear correlation
 C) Critical values: $r = \pm 0.514$, significant linear correlation
 D) Critical values: $r = 0.514$, no significant linear correlation

- 35) $r = -0.802$, $n = 5$ 35) _____
 A) Critical values: $r = \pm 0.950$, no significant linear correlation
 B) Critical values: $r = \pm 0.878$, no significant linear correlation
 C) Critical values: $r = 0.950$, significant linear correlation
 D) Critical values: $r = \pm 0.878$, significant linear correlation

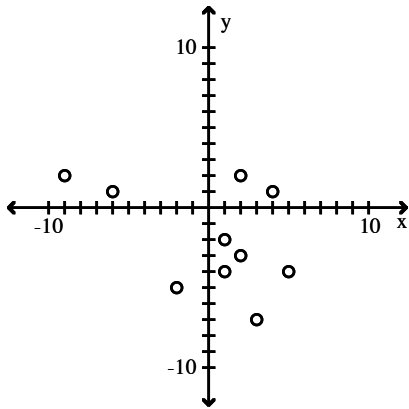
Construct a scatterplot for the given data.

36)
$$\begin{array}{c|c|c|c|c|c|c|c|c|c|c} x & -3 & -2 & -1 & -4 & -2 & 6 & 2 & 9 & -5 & -1 \\ \hline y & -7 & -3 & -2 & 1 & 2 & 1 & -5 & 2 & -4 & -4 \end{array}$$

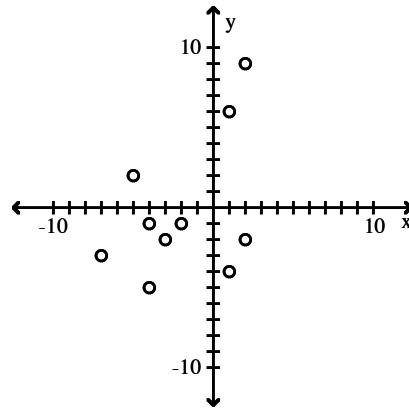
36) _____



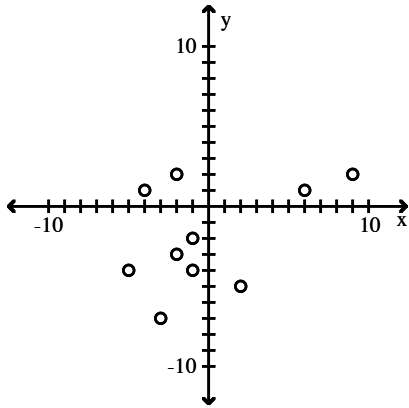
A)



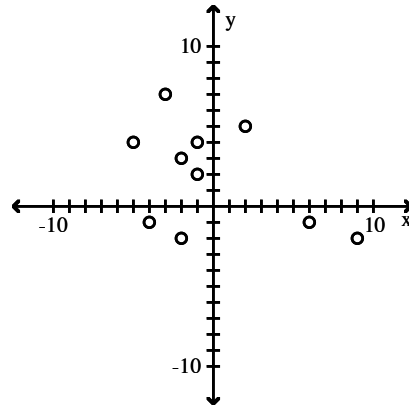
B)



C)



D)

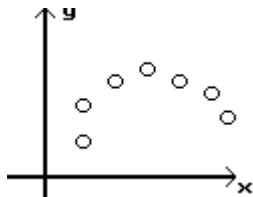


Determine which scatterplot shows the strongest linear correlation.

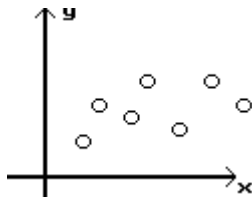
37) Which shows the strongest linear correlation?

37) _____

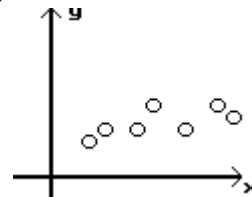
A)



B)



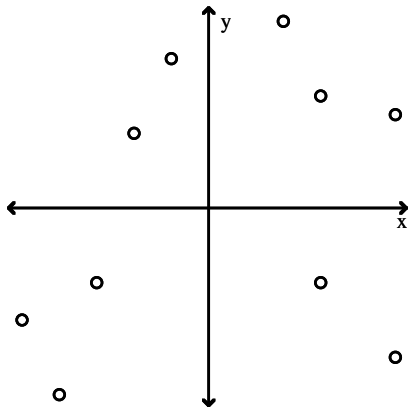
C)



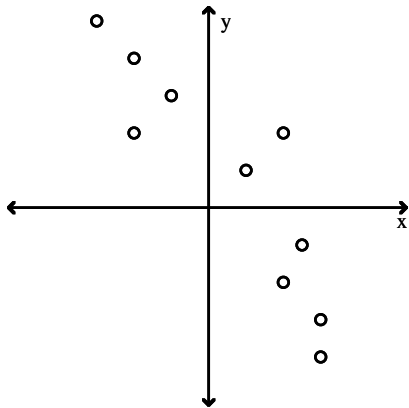
38) Which shows the strongest linear correlation?

38) _____

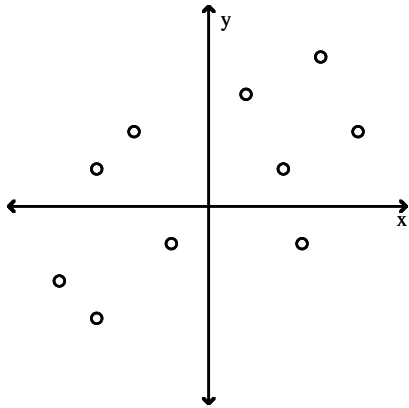
A)



B)



C)



Find the value of the linear correlation coefficient r .

39)

x	47.0	46.6	27.4	33.2	40.9
y	8	10	10	5	10

39) _____

A) 0

B) 0.175

C) -0.175

D) 0.156

40)

x	62	53	64	52	52	54	58
y	158	176	151	164	164	174	162

40) _____

A) 0.754

B) 0

C) -0.775

D) -0.081

Use the given data to find the best predicted value of the response variable.

- 41) Four pairs of data yield $r = 0.942$ and the regression equation $\hat{y} = 3x$. Also, $\bar{y} = 12.75$. What is the best predicted value of y for $x = 4.6$? 41) _____
 A) 2.826 B) 12.75 C) 0.942 D) 13.8

- 42) Six pairs of data yield $r = 0.444$ and the regression equation $\hat{y} = 5x + 2$. Also, $\bar{y} = 18.3$. What is the best predicted value of y for $x = 5$? 42) _____
 A) 4.22 B) 93.5 C) 18.3 D) 27

Use the given data to find the equation of the regression line. Round the final values to three significant digits, if necessary.

- 43)
$$\begin{array}{c|cccc} x & 0 & 3 & 4 & 5 & 12 \\ \hline y & 8 & 2 & 6 & 9 & 12 \end{array}$$
 43) _____
 A) $\hat{y} = 4.88 + 0.625x$ B) $\hat{y} = 4.88 + 0.525x$
 C) $\hat{y} = 4.98 + 0.425x$ D) $\hat{y} = 4.98 + 0.725x$

- 44)
$$\begin{array}{c|cccc} x & 3 & 5 & 7 & 15 & 16 \\ \hline y & 8 & 11 & 7 & 14 & 20 \end{array}$$
 44) _____
 A) $\hat{y} = 5.07 + 0.753x$ B) $\hat{y} = 5.07 + 0.850x$
 C) $\hat{y} = 4.07 + 0.753x$ D) $\hat{y} = 4.07 + 0.850x$

- 45) Two different tests are designed to measure employee productivity and dexterity. Several employees are randomly selected and tested with these results. 45) _____

Productivity	23	25	28	21	21	25	26	30	34	36
Dexterity	49	53	59	42	47	53	55	63	67	75

- A) $\hat{y} = 75.3 - 0.329x$ B) $\hat{y} = 5.05 + 1.91x$
 C) $\hat{y} = 10.7 + 1.53x$ D) $\hat{y} = 2.36 + 2.03x$

Answer Key

Testname: UNTITLED1

- 1) A
- 2) C
- 3) D
- 4) B
- 5) A
- 6) C
- 7) B
- 8) D
- 9) D
- 10) B
- 11) D
- 12) C
- 13) D
- 14) C
- 15) D
- 16) B
- 17) $H_0: p = 0.03$. $H_1: p > 0.03$. Test statistic: $z = 1.57$. P-value: $p = 0.0582$.
Critical value: $z = 2.33$. Fail to reject null hypothesis. There is not sufficient evidence to warrant rejection of the manager's claim that production is not really out of control.
- 18) $H_0: p = 0.53$. $H_1: p \neq 0.53$. Test statistic: $z = -1.60$. P-value: $p = 0.0548$.
Critical value: $z = \pm 1.645$. Fail to reject null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the actual percentage is 53%.
- 19) $H_0: p = 0.34$. $H_1: p > 0.34$. Test statistic: $z = 2.27$. P-value: $p = 0.0116$.
Critical value: $z = 1.645$. Reject null hypothesis. There is sufficient evidence to support the researcher's claim that the proportion for fathers in Littleton is higher than 34%.
- 20) B
- 21) C
- 22) A
- 23) $H_0: \mu = 32.6$. $H_1: \mu \neq 32.6$. Test statistic: $t = 6.50$. Critical values: $t = \pm 2.145$. Reject H_0 . There is sufficient evidence to warrant rejection of the claim that the mean is 32.6.
- 24) $H_0: \mu = 35.0$. $H_1: \mu \neq 35.0$. Test statistic: $t = 7.252$. Critical values: $t = -2.861, 2.861$. Reject H_0 . There is sufficient evidence to warrant rejection of the claim that the mean is equal to 35.0.
- 25) $H_0: \mu = 520$ hrs. $H_1: \mu > 520$ hrs. Test statistic: $t = 2.612$.
 $0.01 < P\text{-value} < 0.025$. Reject H_0 . There is sufficient evidence to support the claim that the mean is greater than 520 hours.
- 26) $H_0: \mu = 900$ hrs. $H_1: \mu \neq 900$ hrs. Test statistic: $t = -4.342$. P-value < 0.01 . Reject H_0 . There is sufficient evidence to warrant rejection of the claim that the sample is from a population with a mean life of 900 hours. The light bulbs do not appear to conform to the manufacturer's specifications.
- 27) $\alpha = 0.1$
Test statistic: $t = 1.57$
P-value: $p = 0.1318$
Critical values: $t = \pm 1.729$
Because the test statistic, $t < 1.729$, we fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that $\mu = 132$ lb.

Answer Key

Testname: UNTITLED1

28) $\alpha = 0.01$

Test statistic: $t = 2.6898$

P-value: $p = 0.0066$

Critical value: $t = 2.508$

Because the test statistic, $t > 2.508$, we reject the null hypothesis. There is sufficient evidence to accept the claim that $\mu > 220,000$ miles.

29) $H_0: \mu = 22$; $H_1: \mu \neq 22$. Test statistic: $z = -10.33$. P-value: 0.0002. Because the P-value is less than the significance level of $\alpha = 0.05$, we reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that the population mean temperature is 22°C .

30) $H_0: \mu = 200$; $H_1: \mu < 200$; Test statistic: $z = -0.98$. P-value: 0.1635. Fail to reject H_0 . There is not sufficient evidence to support the claim that the mean is less than 200 pounds.

31) $H_0: \mu = 147$ lb

$H_1: \mu \neq 147$ lb

Test statistic: $z = 1.26$

Critical-values: $z = \pm 2.575$

Do not reject H_0 ; At the 1% significance level, there is not sufficient evidence to warrant rejection of the claim that these sample weights come from a population with a mean equal to 147 lb.

32) $H_0: \mu = 72$ beats per minute

$H_1: \mu < 72$ beats per minute

Test statistic: $z = -2.02$

Critical-value: $z = -1.645$

Reject H_0 ; At the 5% significance level, there is sufficient evidence to support the claim that these sample pulse rates come from a population with a mean less than 72 beats per minute.

33) A

34) A

35) B

36) C

37) C

38) B

39) B

40) C

41) B

42) C

43) B

44) A

45) B