Chapter 8 Exam A

Name___________________________________

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

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

1) 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.

A) 3.05 B) -3.05 C) -2.88 D) 2.88

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.

2) A cereal company claims that the mean weight of the cereal in its packets is 14 oz. The weights (in ounces) of the cereal in a random sample of 8 of its cereal packets are listed below.

14.6 13.8 14.1 13.7 14.0 14.4 13.6 14.2

Test the claim at the 0.01 significance level.

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

3) 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 \( \sigma \) 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.

Use the traditional method to test the given hypothesis. Assume that the population is normally distributed and that the sample has been randomly selected.

4) A manufacturer uses a new production method to produce steel rods. A random sample of 17 steel rods resulted in lengths with a standard deviation of 4.7 cm. At the 0.10 significance level, test the claim that the new production method has lengths with a standard deviation different from 3.5 cm, which was the standard deviation for the old method.

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.

5) 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.

<table>
<thead>
<tr>
<th>995</th>
<th>590</th>
<th>510</th>
<th>539</th>
<th>739</th>
<th>917</th>
<th>571</th>
<th>555</th>
</tr>
</thead>
<tbody>
<tr>
<td>916</td>
<td>728</td>
<td>664</td>
<td>693</td>
<td>708</td>
<td>887</td>
<td>849</td>
<td></td>
</tr>
</tbody>
</table>

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.
Provide an appropriate response.

6) Tim believes that a coin is coming up tails less than 50% of the time. He tests the claim \( p < 0.5 \). In 100 tosses, the coin comes up tails 57 times. What is the value of the sample proportion? Do you think the \( P \)-value will be small or large and what should Tim conclude about the claim \( p < 0.5 \)?

7) Sam wanted to test a claim about the mean of a population whose standard deviation was unknown. He picked a simple random sample of size 20 from the population. Lou wanted to test a claim about a mean of a different population whose standard deviation was known. He picked a simple random sample of size 22 from that population. George said that Sam would need to determine whether his sample was from a normally distributed population because the population standard deviation was unknown. He said that Lou would not need to do this since for his test the population standard deviation was known. Is George right?

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

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).

8) With \( H_1: p \neq 3/5 \), the test statistic is \( z = 0.78 \).
   A) 0.2177; reject the null hypothesis  
   B) 0.4354; reject the null hypothesis  
   C) 0.4354; fail to reject the null hypothesis  
   D) 0.2177 fail to reject the null hypothesis

Solve the problem.

9) For large numbers of degrees of freedom, the critical \( \chi^2 \) values can be approximated as follows:

\[
\chi^2 = \frac{1}{2} (z + \sqrt{2k - 1})^2,
\]

where \( k \) is the number of degrees of freedom and \( z \) is the critical value. To find the lower critical value, the negative \( z \)-value is used, to find the upper critical value, the positive \( z \)-value is used. Use this approximation to estimate the critical value of \( \chi^2 \) in a two-tailed hypothesis test with \( n = 104 \) and \( \alpha = 0.10 \).

A) \( \chi^2 \approx 85.903 \) and \( \chi^2 \approx 122.735 \)  
   B) \( \chi^2 \approx 81.186 \) and \( \chi^2 \approx 128.520 \)  
   C) \( \chi^2 \approx 80.300 \) and \( \chi^2 \approx 127.406 \)  
   D) \( \chi^2 \approx 84.992 \) and \( \chi^2 \approx 121.646 \)

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

10) What do you conclude about the claim below? Do not use formal procedures or exact calculations. Use only the rare event rule and make a subjective estimate to determine whether the event is likely.

Claim: A die is fair and in 100 rolls there are 63 sixes.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

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

11) The principal of a middle school claims that test scores of the seventh-graders at his school vary less than the test scores of the seventh-graders at a neighboring school, which have variation described by \( \sigma = 14.7 \). 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.

A) There is sufficient evidence to support the claim that the standard deviation is greater than 14.7.
B) There is sufficient evidence to support the claim that the standard deviation is less than 14.7.
C) There is not sufficient evidence to support the claim that the standard deviation is greater than 14.7.
D) There is not sufficient evidence to support the claim that the standard deviation is less than 14.7.

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

Use the traditional method to test the given hypothesis. Assume that the population is normally distributed and that the sample has been randomly selected.

12) Heights of men aged 25 to 34 have a standard deviation of 2.9. Use a 0.05 significance level to test the claim that the heights of women aged 25 to 34 have a different standard deviation. The heights (in inches) of 16 randomly selected women aged 25 to 34 are listed below. Round the sample standard deviation to five decimal places.

62.13  65.09  64.18  66.72  63.09  61.15  67.50  64.65
63.80  64.21  60.17  68.28  66.49  62.10  65.73  64.72

12) ________________

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

Solve the problem.

13) A hypothesis test is performed to test the claim that a population proportion is greater than 0.7. Find the probability of a type II error, \( \beta \), given that the true value of the population proportion is 0.72. The sample size is 50 and the significance level is 0.05.

A) 0.4129  
B) 0.5754  
C) 0.7123  
D) 0.9706

13) ________________

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

14) A psychologist claims that more than 5.8 percent of the population suffers from professional problems due to extreme shyness. Use \( p \), the true percentage of the population that suffers from extreme shyness.

A) \( H_0: p = 5.8\% \)  
B) \( H_0: p > 5.8\% \)  
C) \( H_0: p = 5.8\% \)  
D) \( H_0: p < 5.8\% \)

\[ H_1: p < 5.8\% \]  
\[ H_1: p \leq 5.8\% \]  
\[ H_1: p > 5.8\% \]  
\[ H_1: p \geq 5.8\% \]

14) ________________

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).

15) The test statistic in a right-tailed test is \( z = 0.52 \).

A) 0.6030; fail to reject the null hypothesis  
B) 0.3015; reject the null hypothesis  
C) 0.0195; reject the null hypothesis  
D) 0.3015; fail to reject the null hypothesis

15) ________________
Find the critical value or values of $\chi^2$ based on the given information.

16) $H_1: \sigma < 0.629$

- $n = 19$
- $\alpha = 0.025$

A) 8.231 B) 31.526 C) 7.015 D) 8.907

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

Solve the problem.

17) What do you conclude about the claim below? Do not use formal procedures or exact calculations. Use only the rare event rule and make a subjective estimate to determine whether the event is likely.

Claim: A roulette wheel is fair and in 40 consecutive spins of the wheel, black shows up 23 times. (A roulette wheel has 38 equally likely slots of which 18 are black).

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

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).

18) With $H_1: p > 0.554$, the test statistic is $z = 1.34$.

A) 0.9099; fail to reject the null hypothesis
B) 0.0901; reject the null hypothesis
C) 0.0901; fail to reject the null hypothesis
D) 0.1802; reject the null hypothesis

Express the null hypothesis and the alternative hypothesis in symbolic form. Use the correct symbol ($\mu$, $p$, $\sigma$) for the indicated parameter.

19) 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.

A) $H_0: p = 0.0016$  B) $H_0: p = 0.0016$
C) $H_0: p > 0.0016$  D) $H_0: p < 0.0016$

$H_1: p < 0.0016$  $H_1: p > 0.0016$  $H_1: p \leq 0.0016$  $H_1: p \geq 0.0016$

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.

20) 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.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

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

21) Carter Motor Company claims that its new sedan, the Libra, will average better than 32 miles per gallon in the city. 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.

A) There is sufficient evidence to support the claim that the mean is greater than 32 miles per gallon.
B) There is not sufficient evidence to support the claim that the mean is greater than 32 miles per gallon.
C) There is not sufficient evidence to support the claim that the mean is less than 32 miles per gallon.
D) There is sufficient evidence to support the claim that the mean is less than 32 miles per gallon.

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

Use the traditional method to test the given hypothesis. Assume that the population is normally distributed and that the sample has been randomly selected.

22) For randomly selected adults, IQ scores are normally distributed with a standard deviation of 15. The scores of 14 randomly selected college students are listed below. Use a 0.10 significance level to test the claim that the standard deviation of IQ scores of college students is less than 15. Round the sample standard deviation to three decimal places.

115 128 107 109 116 124 135
127 115 104 118 126 129 133

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.

23) Test the claim that for the adult population of one town, the mean annual salary is given by $\mu = 30,000$. Sample data are summarized as $n = 17$, $x = 22,298$, and $s = 14,200$. Use a significance level of $\alpha = 0.05$.

Provide an appropriate response.

24) Complete the following table on hypothesis testing.

<table>
<thead>
<tr>
<th>Test about</th>
<th>Distribution</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td></td>
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<tr>
<td>Mean</td>
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<tr>
<td>Proportion</td>
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<tr>
<td>Variance</td>
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</table>

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

Find the critical value or values of $\chi^2$ based on the given information.

25) $H_1: \sigma < 0.14$

- $n = 23$
- $\alpha = 0.10$

A) 14.848  B) 30.813  C) $-30.813$  D) 14.042
Answer Key
Testname: CHAPTER 8 EXAM A

1) A
2) H\(_0\): \(\mu = 14\) oz. H\(_1\): \(\mu \neq 14\) oz. Test statistic: \(t = 0.408\). Critical values: \(t = \pm 3.499\). Fail to reject H\(_0\). There is not sufficient evidence to warrant rejection of the claim that the mean weight is 14 ounces.
3) 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.
4) Test statistic: \(\chi^2 = 28.852\). Critical values: \(\chi^2 = 7.962, 26.296\). Reject H\(_0\). There is sufficient evidence to support the claim that the standard deviation is different from 3.5.
5) 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.
6) \(p = 0.57\); The P-value will be large. Tim should conclude that there is not sufficient evidence to support the claim \(p < 0.5\).
7) No. Both Sam and Lou need to determine whether their samples are from normally distributed populations since in both cases the sample sizes are smaller than 30. Whether or not to test for normality does not depend on whether the population standard deviation is known.
8) C
9) C

10) If the die were fair, the probability of obtaining 63 6’s in 100 rolls would be extremely small. Therefore, by the rare event rule, we conclude that the claim that the die is fair is probably not correct.
11) B
12) Test statistic: \(\chi^2 = 9.2597\). Critical values: \(\chi^2 = 6.262, 27.488\). Fail to reject H\(_0\). There is not sufficient evidence to support the claim that heights of women aged 25 to 34 have a standard deviation different from 2.9 in.
13) D
14) C
15) D
16) A
17) If the roulette wheel were fair, one could easily obtain 23 blacks in 40 spins by chance—this is not improbable. Therefore, by the rare event rule, we have no reason to reject the claim that the roulette wheel is fair.
18) C
19) A
20) 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%.
21) A
22) Test statistic: \(\chi^2 = 5.571\). Critical value: \(\chi^2 = 7.042\). Reject H\(_0\). There is sufficient evidence to support the claim that IQ scores of college students have a standard deviation smaller than 15.
23) \(\alpha = 0.05\)
   Test statistic: \(t = -2.236\)
   P-value: \(p = 0.0399\)
   Critical values: \(t = \pm 2.120\)
   Because the test statistic, \(t < -2.120\), we reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that \(\mu = 30,000\).
24) **Test about Distribution | Assumptions**

<table>
<thead>
<tr>
<th>Test about</th>
<th>Distribution</th>
<th>Assumptions</th>
</tr>
</thead>
</table>
| Mean       | z distribution | \(n > 30\) or
\(n \leq 30\) and \(\sigma\) is known,
the parent population is
essentially normal. |
| Mean       | t distribution | \(n \leq 30\) and \(\sigma\) is not known,
the parent population is
essentially normal. |
| Proportion | z distribution | All the conditions for a
binomial experiment are met
\textbf{and} \(np > 5\) and \(nq > 5\). |
| Variance   | \(x^2\) distribution | The population is
normally distributed. |

25) D