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

Identify the null hypothesis $H_0$ and the alternative hypothesis $H_1$. Use $\mu$ for a claim about a mean, $p$ for a claim about a proportion, and $\sigma$ for a claim about variation.

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.

A) $H_0: p \leq 0.0016$ \hspace{1cm} B) $H_0: p > 0.0016$ \hspace{1cm} C) $H_0: p \geq 0.0016$ \hspace{1cm} D) $H_0: p < 0.0016$

$H_1: p > 0.0016$ \hspace{1cm} $H_1: p \leq 0.0016$ \hspace{1cm} $H_1: p < 0.0016$ \hspace{1cm} $H_1: p \geq 0.0016$

2) Carter Motor Company claims that its new sedan, the Libra, will average better than 32 miles per gallon in the city. Use $\mu$, the true average mileage of the Libra.

A) $H_0: \mu > 32$ \hspace{1cm} B) $H_0: \mu < 32$ \hspace{1cm} C) $H_0: \mu \geq 32$ \hspace{1cm} D) $H_0: \mu \leq 32$

$H_1: \mu < 32$ \hspace{1cm} $H_1: \mu \geq 32$ \hspace{1cm} $H_1: \mu > 32$

3) A researcher claims that the amounts of acetaminophen in a certain brand of cold tablets have a standard deviation different from the $\sigma = 3.3$ mg claimed by the manufacturer.

A) $H_0: \sigma = 3.3$ mg \hspace{1cm} B) $H_0: \sigma \leq 3.3$ mg \hspace{1cm} C) $H_0: \sigma \geq 3.3$ mg \hspace{1cm} D) $H_0: \sigma \neq 3.3$ mg

$H_1: \sigma > 3.3$ mg \hspace{1cm} $H_1: \sigma < 3.3$ mg \hspace{1cm} $H_1: \sigma = 3.3$ mg

Assume that the data has a normal distribution and that the population standard deviation is known. Find the critical $z$ value used to test a null hypothesis.

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

A) $\pm 2.575$ \hspace{1cm} B) $\pm 1.764$ \hspace{1cm} C) $\pm 1.96$ \hspace{1cm} D) $\pm 1.645$

5) $\alpha = 0.1$ for a right-tailed test.

A) +1.96 \hspace{1cm} B) $\pm 1.96$ \hspace{1cm} C) $\pm 1.282$ \hspace{1cm} D) +1.282

6) $\alpha = 0.05$; $H_0: \mu \leq 0.815$

A) $-1.645$ \hspace{1cm} B) 1.96 \hspace{1cm} C) $\pm 1.96$ \hspace{1cm} D) 1.645

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

7) An entomologist writes an article in a scientific journal which claims that fewer than 7 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.

A) There is sufficient evidence to support the claim that the true proportion is less than 7 in ten thousand.

B) There is not sufficient evidence to support the claim that the true proportion is greater than 7 in ten thousand.

C) There is sufficient evidence to support the claim that the true proportion is greater than 7 in ten thousand.

D) There is not sufficient evidence to support the claim that the true proportion is less than 7 in ten thousand.
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

8) The Maine Department of Natural Resources reported that the mean weight of lobsters trapped in the state is 1.7 pounds. Carl Lewis is a lobster trapper off the coast of Maine. Carl suspects that this figure is too high so he records the weights of a random sample of 45 lobsters that he trapped and finds that the mean weight is 1.5 pounds. He knows that the population standard deviation is 0.6 pounds, use a 1 percent level of significance to test the state’s figure of 1.7 pounds.

9) A brochure claims that the average maximum height a certain type of plant is 0.7 m. A gardener suspects that this estimate is not accurate locally due to soil conditions. A random sample of 42 mature plants is taken. The mean height of the plants in the sample is 0.65 m and the population standard deviation is known to be 0.2 m. Test the claim made in the brochure at the 1 percent level of significance.

Test the given claim using the traditional method of hypothesis testing. Assume that the sample has been randomly selected from a population with a normal distribution.

10) A large software company gives job applicants a test of programming ability and the mean for that test has been 160 in the past. Twenty-five job applicants are randomly selected from one large university and they produce a mean score and standard deviation of 183 and 12, respectively. Use a 0.05 level of significance to test the claim that this sample comes from a population with a mean score greater than 160.

11) A public bus company official claims that the mean waiting time for bus number 14 during peak hours is less than 10 minutes. Karen took bus number 14 during peak hours on 18 different occasions. Her mean waiting time was 7.3 minutes with a standard deviation of 2.2 minutes. At the 0.01 significance level, test the claim that the mean is less than 10 minutes.

Use the traditional method to test the given hypothesis. Assume that all samples have been randomly selected.

12) A poll of 1,068 adult Americans reveals that 48% of the voters surveyed prefer the Democratic candidate for the presidency. At the 0.05 level of significance, test the claim that at least half of all voters prefer the Democrat.

13) In a sample of 81 adults selected randomly from one town, it is found that 8 of them have been exposed to a particular strain of the flu. At the 0.01 significance level, test the claim that the proportion of all adults in the town that have been exposed to this strain of the flu is 8%.

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

14) With individual lines at the checkouts, a store manager finds that the standard deviation for the waiting times on Monday mornings is 5.2 minutes. After switching to a single waiting line, he finds that for a random sample of 29 customers, the waiting times have a standard deviation of 5.9 minutes. Use a 0.025 significance level to test the claim that with a single line, waiting times vary less than with individual lines.

15) The standard deviation of math test scores at one high school is 16.1. A teacher claims that the standard deviation of the girls’ test scores is smaller than 16.1. A random sample of 22 girls results in scores with a standard deviation of 15.4. Use a significance level of 0.01 to test the teacher’s claim.
Answer Key
Testname: CH7REV

1) C
2) D
3) A
4) C
5) D
6) D
7) A
8) Test statistic: \( z = -2.24 \).
   Critical value: \( z = -2.33 \). Fail to reject \( H_0 \): \( \mu \geq 1.7 \) pounds. There is not sufficient evidence to support the claim that the mean is lower than 1.7 pounds.
9) Test statistic: \( z = -1.62 \).
   Critical values: \( z = \pm 2.575 \). Fail to reject \( H_0 \): \( \mu = 0.7 \) m. There is not sufficient evidence to warrant rejection of the claim that the mean length is 0.7 m.
10) \( H_0: \mu \leq 160 \). \( H_1: \mu > 160 \).
    Test statistic: \( t = 9.583 \). Critical value: \( t = 1.711 \). Reject the null hypothesis. There is sufficient evidence to support the claim that the mean is greater than 160.
11) \( H_0: \mu \geq 10 \) minutes. \( H_1: \mu < 10 \) minutes.
    Test statistic: \( t = -5.21 \). Critical values: \( t = -2.567 \). Reject \( H_0 \). There is sufficient evidence to support the claim that the mean is less than 10 minutes.
12) \( H_0: p \geq 0.5 \). \( H_1: p < 0.5 \). Test statistic: \( z = -1.31 \).
    Critical value: \( z = -1.645 \). Fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that at least half of all voters prefer the Democrat.
13) Test statistic: \( z = 0.62 \). Critical values: \( z = \pm 2.575 \).
    Fail to reject \( H_0 \): \( p = 0.08 \). There is not sufficient evidence to warrant rejection of the claim that the proportion of all adults in the town that have been exposed to this strain of the flu is 8%.
14) \( H_0: \sigma \geq 5.2 \) minutes. \( H_1: \sigma < 5.2 \) minutes.
    Test statistic: \( X^2 = 36.046 \). Critical value: \( X^2 = 15.308 \). Fail to reject \( H_0 \). There is not sufficient evidence to support the claim that with a single line waiting times have a smaller standard deviation.
15) \( H_0: \sigma \geq 16.1 \). \( H_1: \sigma < 16.1 \).
    Test statistic: \( X^2 = 19.214 \). Critical value: \( X^2 = 8.897 \). Fail to reject \( H_0 \). There is not sufficient evidence to support the claim that the standard deviation of the girls' test scores is smaller than 16.1.