AP Stats
Chapter 9 Review IC

1) Twenty-six randomly selected packages of multicolored candies were opened and the number of blue candies is recorded. The sample mean number of blue candies was 7, and the standard deviation was 1. Which of the following is a 90% confidence interval for the mean number of blue candies per package?
A) \[7 \pm 1.706 \left( \frac{1}{\sqrt{46}} \right)\]  
B) \[7 \pm 1.708 \left( \frac{1}{\sqrt{46}} \right)\]  
C) \[7 \pm 1.708 \left( \frac{1}{\sqrt{28}} \right)\]  
D) \[7 \pm 2.060 \left( \frac{1}{\sqrt{28}} \right)\]  
E) \[7 \pm 2.060 \left( \frac{1}{\sqrt{28}} \right)\]

2) A media research firm regularly takes random samples of television viewers to determine their viewing habits. Data from last season indicate that the mean amount of time viewers spent watching network programming was 17 hours per week. The research firm wants to determine if the time viewers spend each week watching network programming has changed significantly from last season. It collects data for the first 3 weeks of the current season from a large sample of viewers. The 95% confidence interval for this season's mean weekly watching time \(\mu\) (in hours) is (16.55, 17.05). Which of the following statements is valid?
A) Since more of the interval is below 17 hours than above it, the mean watching time has changed.
B) A test of \(H_0: \mu = 17\) vs. \(H_a: \mu \neq 17\) would be significant at the \(\alpha = 0.01\) level, but not at the \(\alpha = 0.05\) level.
C) It is likely that the sample mean viewing time is less than 15 minutes difference from the true mean viewing time.
D) An interval with a higher confidence level than 95% may indicate a change in mean viewing time.
E) There is a 95% chance that mean viewing time has not changed significantly.

3) A team of biologists has collected data for an experiment on caloric intake of 28 lab rats. They used a one-sample \(t\)-test with \(\alpha = 0.05\) and chose to run a two-sided test. Which of the following is the smallest possible test statistic that would reject the null hypothesis in favor of the alternative hypothesis?
A) 1.253  
B) 1.701  
C) 1.703  
D) 2.012  
E) 2.301

4) An agricultural agency is studying ground squirrels and their effects on rangeland where cattle feed. The agency wants to know the mean number of squirrels per acre in a large area of rangeland. Several one-acre plots are randomly selected and the number of squirrels on each plot is determined through a variety of methods. A 95% confidence interval for the mean number of squirrels per acre is computed to be (3, 6). Which of the following is the correct interpretation of the interval?
A) In repeated sampling, 95% of the intervals constructed will capture the true mean number of squirrels per acre of rangeland.
B) The agency is 95% confident that there is between 3 and 6 squirrels on each acre of rangeland.
C) The agency is 95% confident that the mean number of squirrels per acre of rangeland is between 3 and 6.
D) There is a 95% chance that the agency will find between 3 and 6 squirrels on any particular acre of rangeland.
E) The agency is 95% confident that the mean number of squirrels per acre of rangeland in their sample is between 3 and 6.

5) A random sample has been drawn from a population and confidence interval computed for the population mean. All other things being equal, which of the following will increase the width of the interval? 
I) Increase sample size.  
II) Increasing the confidence level  
III) Using a \(t\)-critical value in place of a \(z\)-critical value
A) II only  
B) I and II only  
C) I and III only  
D) II and III only  
E) I, II, and III
6) Child psychologists claim that babies who play with toys decorated with geometric patterns of black, white, and red developed cognitive abilities faster than those who do not. A study compared the mental skill of 72 randomly selected babies, half of whom routinely played with the special toys and half of whom do not. The summary statistics of the babies’ mental scores are given in the table below.

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample Size</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special toys (S)</td>
<td>36</td>
<td>115</td>
<td>13</td>
</tr>
<tr>
<td>No special toys (N)</td>
<td>36</td>
<td>110</td>
<td>14</td>
</tr>
</tbody>
</table>

The researchers will use a hypothesis test to determine if there exists evidence that the mean mental score of babies using the special toys is significantly different than the mean mental score of babies not using the special toys. Which of the following is the correct set of hypotheses for the test?

A) $H_0: \mu_S = \mu_N$
B) $H_0: \bar{x}_S = \bar{x}_N$
C) $H_0: \mu_S = \mu_N$
D) $H_0: \mu_S = \mu_N$
E) $H_0: \mu_S = \mu_N$

7) A significance test of $H_0: \mu = \mu_0$ vs. $H_a: \mu \neq \mu_0$ is to be performed with a significance level of $\alpha$. The data will have sample size $n$. Which of the following will have the greatest effect on increasing the power of the test?

A) Decrease $\alpha$, decrease $n$
B) Decrease $\alpha$, increase $n$
C) Increase $\alpha$, decrease $n$
D) Increase $\alpha$, increase $n$
E) Increase $n$ only. Changing $\alpha$ has no effect on power.

8) A random sample of the cost of milk (per gallon) is taken at 30 grocery stores nationwide. The sample produced a mean price of $3.39 per gallon and a standard deviation of $0.38 per gallon. Which of the following is the correct 90% confidence interval for the mean cost of a gallon of milk nationwide?

A) $3.39 \pm 1.645 \times 0.38 \sqrt{\frac{1}{30}}$
B) $3.39 \pm 1.697 \times 0.38 \sqrt{\frac{1}{29}}$
C) $3.39 \pm 1.697 \times 0.38 \sqrt{\frac{1}{30}}$
D) $3.39 \pm 1.699 \times 0.38 \sqrt{\frac{1}{29}}$
E) $3.39 \pm 1.699 \times 0.38 \sqrt{\frac{1}{30}}$

9) An occupational safety administrator is interested in reducing repetitive motion injuries for office workers who use computers. The administrator divides 48 volunteers at random into two groups. The first group will use a standard keyboard for 12 months. The second group will use a new keyboard design for the same period of time. At the end of the study the frequencies of volunteers experiencing repetitive motion injuries with their respective keyboards will be compared. What would be the appropriate method of inference in this situation?

A) One-sample $t$-test
B) Paired $t$-test
C) Two-sample $t$-test
D) One-proportion $z$-test
E) Two-proportion $z$-test

10) A hypothesis test is conducted with respect to the mean weight (in ounces) of potato chip bags from a certain manufacturer. The test’s hypotheses are $H_0: \mu = 0.8$ and $H_a: \mu \neq 0.8$. Which confidence interval below would support the conclusion that there is insufficient evidence to reject the null hypothesis at the $\alpha = 0.03$ level of significance?

A) The 97% confidence interval for the mean weight in ounces of potato chips is (0.765, 0.823).
B) The 94% confidence interval for the mean weight in ounces of potato chips is (0.765, 0.823).
C) The 97% confidence interval for the mean weight in ounces of potato chips is (0.725, 0.873).
D) The 94% confidence interval for the mean weight in ounces of potato chips is (0.725, 0.873).
E) We cannot conclude anything with a confidence interval unless we have the actual data set to construct the interval.

11) A tire manufacturer is testing a new tread design for its light-truck tires. The previous design had a mean tread life of 47,500 miles. Tires with the new design are manufactured and tested on a variety of light trucks. Which of the following is the correct pair of hypotheses to test the assertion that the new tread design has a longer life than the older design?

A) $H_0: \mu = 47,500, H_a: \mu = 47,500$
B) $H_0: \mu = 47,500, H_a: \mu \neq 47,500$
C) $H_0: \mu = 47,500, H_a: \mu < 47,500$
D) $H_0: \mu = 47,500, H_a: \mu > 47,500$
E) $H_0: \mu > 47,500, H_a: \mu < 47,500$
12) A significance test was performed with hypotheses of $H_0: \mu = 15$ and $H_a: \mu < 15$. The $P$-value for the test was 0.026. Which of the following conclusions is most appropriate for this test?
A) 2.6% of the time the mean will be exactly 15.
B) 97.4% of the time the mean will be less than 15.
C) There is a 2.6% chance of making a Type II error.
D) There is reason to believe that the mean $\mu$ is less than 15.
E) The true mean is approximately 2.6% of 15.

13) A light bulb manufacturer wishes to estimate the mean lifetime (in hours) of its new "long-life" bulb. Thirty bulbs were tested and the lifetime was recorded for each. The mean of the sample was 1,450 hours and the standard deviation of the sample was 150 hours. Assuming all conditions for interference are satisfied, what is the 99% confidence interval for $\mu$, the mean lifetime of the new "long-life" bulb?
A) $1450 \pm 2.750$ 
B) $1450 \pm 2.756$ 
C) $1450 \pm 2.750$ 
D) $1450 \pm 2.756$ 
E) $1450 \pm 0.8389$

14) USA Today reported that speed skater Bonnie Blair had "won the USA's heart," according to a USA Today/CNN/Gallup poll conducted on the final Thursday of the 1994 Winter Olympics. When asked who was the hero of the Olympics, 65 percent of the respondents chose Blair, who won five gold medals. The poll of 615 adults, done by telephone, had a margin of error of 4 percent. Which of the following statements best describes what is meant by the 4 percent margin of error?
A) About 4% of adults were expect to change their mind between the time of the poll and its publication in USA Today.
B) About 4% of adults did not have telephones.
C) About 4% of the 615 adults polled refused to answer.
D) Not all of the 615 adults knew anything about the Olympics.
E) The difference between the sample percentage and the population percentage is likely to be less than 4%.

15) An automobile manufacturer claims that the average gas mileage of a new model is 35 miles per gallon (mpg). A consumer group is skeptical of this claim and thinks the manufacturer may be overstating the average gas mileage. If $\mu$ represents the true average gas mileage for this new model, which of the following gives the null and alternative hypotheses that the consumer group should test?
A) $H_0: \mu < 35$ mpg $H_a: \mu \geq 35$ mpg
B) $H_0: \mu \leq 35$ mpg $H_a: \mu > 35$ mpg
C) $H_0: \mu = 35$ mpg $H_a: \mu > 35$ mpg
D) $H_0: \mu < 35$ mpg $H_a: \mu = 35$ mpg
E) $H_0: \mu = 35$ mpg $H_a: \mu \neq 35$ mpg

Questions 16-21 refer to the following information:
Researchers at the University of Washington conducted a study that included the collection of a large amount of data on the water temperature of streams in the Pacific Northwest. The study found that the mean temperature for a random sample of 178 streams that were under a closed canopy of vegetation was 16.02°C with a sample standard deviation of 2.83°C. The data were approximately normally distributed.

16) Assuming all else remains the same, which of these would reduce the width of a confidence interval for the population mean temperature?
I) Increase the sample size
II) Have a smaller sample standard deviation
III) Increase the confidence level, $1 - \alpha$
A) I only B) II only C) III only
D) I and II only E) I, II, and III

17) If a good estimate of the population standard deviation is 3.0°C, then approximately what minimum sample size would you need in a simple random sample if you wanted a 95% confidence interval for the mean to have a margin of error of 0.5°C or less?
A) 164 B) 139 C) 98 D) 35
E) The answer cannot be determined from the information given.
18) If you construct a confidence interval for the mean stream temperature based on the $t$-distribution, then, in practice, what condition must be satisfied?
A) The sample must be random and the population must be approximately normal.
B) The sample must be random, but because the sample size is large (178), the population does not have to be approximately normal.
C) The sample doesn’t need to be random and the population doesn’t have to be approximately normal because the sample size is so large (178).
D) The type of canopy must have been randomly assigned to the streams.
E) The sample must be random and $np > 10$ and $n(1 - p) > 10$.

19) Which of these is the best interpretation of the 95% confidence interval for the mean stream temperature, $16.02^\circ\pm0.42^\circ$, or $(15.60^\circ, 16.44^\circ)$?
A) Of all the stream temperatures in the population, 95% are between $15.60^\circ$ and $16.44^\circ$.
B) Of the stream temperatures in the sample, 95% are between $15.60^\circ$ and $16.44^\circ$.
C) Any value of the population mean in the interval $(15.60^\circ, 16.44^\circ)$ could have produced the observed sample mean as a reasonably likely outcome.
D) The probability that this confidence interval contains the population mean is 95%.
E) The probability that this confidence interval contains the sample mean is 95%.

20) What conclusion would you draw if the researchers were testing the null hypothesis that the true mean stream temperature under a closed canopy of vegetation is $15.5^\circ$ using 0.05 level of significance $(H_0: \mu = 15.5^\circ$ and $H_a: \mu \neq 15.5^\circ$)?
A) The null hypothesis is not rejected because the 95% confidence interval for the population mean contains $15.5^\circ$.
B) The null hypothesis is not rejected because the 95% confidence interval for the population mean does not contain $15.5^\circ$.
C) The null hypothesis is not rejected because the $P$-value is less than 0.05.
D) The null hypothesis is rejected because the 95% confidence interval for the population mean contains $15.5^\circ$.
E) The null hypothesis is rejected because the 95% confidence interval for the population mean does not contain $15.5^\circ$.

21) The researchers at the University of Washington also collected data on temperatures of streams under open sky with no shielding vegetation. They randomly sampled 67 streams and found a mean temperature of $17.48^\circ$C with a sample standard deviation of $3.70^\circ$. Is there statistically significant evidence that streams with shielding vegetation are significantly cooler than streams without shielding vegetation? (2 pts.)
A) Yes, because the $P$-value is 0.002
B) Yes, because the $P$-value is 0.004
C) No, because the $P$-value is 0.996
D) No, because the $P$-value is 0.998
E) Cannot be determined because the two sample sizes are significantly different

22) The process of producing pain-reliever tablets yields tablets with varying amounts of the active ingredient. It is claimed that the average amount of active ingredient per tablet is at least 200 milligrams. The Consumer Watchdog Bureau tests a random sample of 70 tablets. The mean content of the active ingredient for this sample is 194.3 milligrams, while the standard deviation is 21 milligrams. What is the approximate $p$-value for the appropriate test?
A) 0.012
B) 0.024
C) 0.050
D) 0.100
E) 0.488
ANSWERS:
1) C
2) C
3) E
4) C
5) D
6) A
7) D
8) E
9) E
10) A
11) D
12) D
13) B
14) E
15) D
16) D
17) B
18) B
19) D
20) E
21) A
22) A