A random sample of 11 students provided the following age data:

25 19 20 21 19 23 22 19 33 21 24

Find the z-score for data value 23. (Round your answer to three decimal places.)

(a) 0.156
(b) 0.636
(c) 1.723
(d) 2.091
(e) 0.000

In order to be accepted into a top-level university, applicants must score within the top 10% on an entrance exam. Given that scores on the exam have an approximate normal distribution with a mean of 73 and a standard deviation of 9, what is the lowest possible score (rounded to the closest integer) a student needs in order to qualify for acceptance into this university?

(a) 80
(b) 83
(c) 85
(d) 87
(e) 89

In hypothesis testing, if the \( p \)-value is greater than the level of significance \( \alpha \), then . . .

(a) we have committed a Type I error.
(b) we have committed a Type II error.
(c) we have sufficient evidence to reject \( H_0 \).
(d) we do not have sufficient evidence to reject \( H_0 \).
(e) we have increased the power of the test.

An observation that is extremely small or extremely large relative to the rest of the data in a data set is called . . .

(a) A standard deviate
(b) A standard score
(c) An outlier
(d) A percentile
(e) An interquartile range observation
5. A random sample of the ACT scores of 100 students at Big State University provided a sample mean score of 21.8 with a sample standard deviation of 5.632. Find the 99% confidence interval for the mean score of all Big State students who had taken the ACT.

(a) (20.7, 22.9)  
(b) (18.7, 24.9)  
(c) (20.9, 22.7)  
(d) (20.3, 23.3)  
(e) (21.1, 22.5)

6. The birth weights of babies born at City General Hospital have a normal distribution with mean weight 7.5 pounds and standard deviation 1.0 pound. Approximately 68% of the babies will weigh between

(a) 5.5 and 9.5 pounds  
(b) 6.0 and 9.0 pounds  
(c) 6.5 and 8.5 pounds  
(d) 7.0 and 8.0 pounds  
(e) 7.3 and 7.7 pounds

7. A data set has a mean of 80 and a standard deviation of 5. Use Chebyshev’s inequality to find the least percentage of the data that will fall in the interval (65, 95).

(a) 50.00 %  
(b) 68.27 %  
(c) 75.00 %  
(d) 88.9 %  
(e) 95.4 %

8. A random sample of 300 Big State University students provided the data in the contingency table below.

<table>
<thead>
<tr>
<th></th>
<th>Smoke</th>
<th>Don't Smoke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>60</td>
<td>85</td>
</tr>
<tr>
<td>Women</td>
<td>55</td>
<td>100</td>
</tr>
</tbody>
</table>

If smoking were independent of gender, what is the expected count for the table cell “men who smoke”?

(a) 64.706  
(b) 55.583  
(c) 95.583  
(d) 89.417  
(e) 57.500
9. Given the following stem and leaf plot of 31 test scores, find the 5-number summary.

<table>
<thead>
<tr>
<th>4</th>
<th>4 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1 3 9</td>
</tr>
<tr>
<td>6</td>
<td>1 4 5 6</td>
</tr>
<tr>
<td>7</td>
<td>0 2 2 4 7 7 9 9</td>
</tr>
<tr>
<td>8</td>
<td>1 1 3 5 5 6 6 8</td>
</tr>
<tr>
<td>9</td>
<td>0 2 4 4 6 8</td>
</tr>
</tbody>
</table>

(a) min = 44, Q1 = 65, median=78, Q3=88, max=98
(b) min = 44, Q1 = 64, median=78, Q3=90, max=98
(c) min = 44, Q1 = 66, median=78, Q3=77, max=98
(d) min = 44, Q1 = 65, median=79, Q3=86, max=98
(e) min = 44, Q1 = 64, median=79, Q3=88, max=98

10. A shipment of 20 televisions contains 5 defective televisions. If a random sample (without replacement) of 3 televisions is taken from the shipment, what is the probability that the sample will contain no defective televisions? (Round to 3 decimal places.)

(a) 0.750
(b) 0.563
(c) 0.739
(d) 0.633
(e) 0.399

11. A student randomly and independently guesses at 10 multiple-choice questions. Each question has 5 possible choices. What is the probability that the student gets exactly 2 correct answers?

(a) 0.0222
(b) 0.0400
(c) 0.3020
(d) 0.5000
(e) 0.6778

12. A machine that fills beer bottles is supposed to have a mean amount of beer equal to 12 ounces. An inspector suspects that the true mean is less than 12 ounces. If a statistical hypothesis test is to be performed, how should the hypotheses be stated? Let $\mu$ represent the true mean amount of beer.

(a) $H_0: \mu < 12$ vs. $H_1: \mu = 12$
(b) $H_0: \mu > 12$ vs. $H_1: \mu \leq 12$
(c) $H_0: \mu = 12$ vs. $H_1: \mu < 12$
(d) $H_0: \mu = 12$ vs. $H_1: \mu > 12$
(e) $H_0: \mu \neq 12$ vs. $H_1: \mu = 12$
A political candidate wants to estimate her chances of winning the coming election for mayor. Out of a random sample of 500 voters, 200 voters stated they supported the candidate. Find the 90% confidence interval for $p$, the true proportion of supporters.

(a) (.36, .44)  
(b) (.34, .46)  
(c) (.38, .42)  
(d) (.31, .49)  
(e) (.39, .41)

For the probability distribution given in the table below, find the mean.

<table>
<thead>
<tr>
<th>$x$</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P(x)$</td>
<td>1/2</td>
<td>1/6</td>
<td>1/3</td>
</tr>
</tbody>
</table>

(a) $\mu = 3/2$  
(b) $\mu = 9/6$  
(c) $\mu = 11/6$  
(d) $\mu = 5/3$  
(e) $\mu = 2$

The Academy of Orthopedic Surgeons states that the proportion of women who wear shoes that are too small for their feet is .60. An independent researcher wants to construct a 90% confidence interval for the true proportion $p$. What sample size is needed so that the researcher's estimate has an approximate margin of error of .03? (Use .60 as a preliminary estimate of $p$.)

(a) 358  
(b) 722  
(c) 817  
(d) 1025  
(e) 1770

A random sample of 300 Big State University students provided the data in the contingency table below.

<table>
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<tr>
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<tbody>
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<td>85</td>
</tr>
<tr>
<td>Women</td>
<td>55</td>
<td>100</td>
</tr>
</tbody>
</table>

If a chi-square test for independence is performed using $\alpha = .10$, what is the test statistic value and the test conclusion?

(a) The test statistic value is 1.10; we conclude smoking could be independent of gender.  
(b) The test statistic value is 1.10; we conclude smoking is very likely related to gender.  
(c) The test statistic value is 2.83; we conclude smoking could be independent of gender.  
(d) The test statistic value is 2.83; we conclude smoking is very likely related to gender.  
(e) The test statistic value is 1.83; we conclude smoking is very likely related to gender.
17. Which of the following events is more likely?
   \( A = \) getting 8 heads when tossing a fair coin 20 times
   \( B = \) getting 4 heads when tossing a coin 10 times
   \( C = \) getting 2 heads when tossing a coin 5 times

   (a) event \( A \)
   (b) event \( B \)
   (c) event \( C \)
   (d) The events above are equally likely.
   (e) There is not enough information to determine.

18. Randall runs a carnival game in which he charges $2 for a player to randomly select 3 cards from a 52 card deck. If the player gets 3 cards of the same color, the player is handed a $5.00 bill. What is Randall's expected profit per play? (Round to the nearest cent.)
   (a) $0.71
   (b) $0.82
   (c) $1.13
   (d) $1.46
   (e) $1.88

19. A student randomly and independently guesses at 40 multiple-choice questions. Each question has 5 possible choices. What is the mean and the standard deviation for the number of questions the student answers correctly?
   (a) The mean is 8 and the standard deviation is \( \sqrt{1.6} \).
   (b) The mean is 8 and the standard deviation is 1.6.
   (c) The mean is 20 and the standard deviation is \( \sqrt{10} \).
   (d) The mean is 20 and the standard deviation is 10.
   (e) None of the above.

20. Consider the following four statements concerning hypothesis tests.
I. We can decrease the probability of a Type I error by increasing the sample size.
II. We can decrease the probability of a Type I error by decreasing the sample size.
III. We can decrease the probability of a Type I error by increasing the level of significance.
IV. We can decrease the probability of a Type I error by decreasing the level of significance.

Which of the above statements are true?

   (a) I only.
   (b) II only.
   (c) II and III only.
   (d) I and IV only.
   (e) None of the statements are true.
A manufacturer claims that no more than .05 of the widgets it ships out to wholesalers are “defective”. A wholesaler finds 60 defective widgets in a random sample of 1000 widgets from the last shipment of 100,000 widgets. Using $\alpha = .05$, is there sufficient evidence to conclude that more than .05 of the widget shipment is defective? Give the proper conclusion.

(a) There is sufficient evidence at the .05 level of significance to conclude that $p > .05$.
(b) There is sufficient evidence at the .05 level of significance to conclude that $p \leq .05$.
(c) There is not sufficient evidence at the .05 level of significance to conclude that $p > .05$.
(d) There is not sufficient evidence at the .05 level of significance to conclude that $p \leq .05$.
(e) There is not sufficient information to perform a hypothesis test.

A statistician took a random sample of 10 newborn babies at City General Hospital. The sample provided the following weight data (in lb):

6.5 7.5 6.8 8.4 5.9 7.4 6.7 8.1 7.5 9.3

Construct a 95% confidence interval for the mean weight (in lb.) of all babies born at City General Hospital in recent times. (Assume the population of baby weights has a normal distribution. Note that the sample size is considered small.)

(a) (5.45, 9.37)
(b) (6.69, 8.13)
(c) (6.79, 8.03)
(d) (6.82, 8.00)
(e) (7.21, 7.61)

A random sample of 300 females from a large population provided the following sample statistics:

sample mean body temperature: $\bar{x} = 98.29^\circ$

sample standard deviation of body temperatures: $s = .76^\circ$

Find the margin of error $E$ for a 95% confidence interval for the mean body temperature of all females in the population that was sampled.

(a) 0.030
(b) 0.086
(c) 0.115
(d) 0.141
(e) 1.490
24. If random variable $Z$ has standard normal distribution, then find $P(-1 < Z < 2)$.

(a) 0.68  (b) 0.75  (c) 0.82  (d) 0.95  (e) 0.99

25. Suppose a 95% confidence interval for the mean heart rate (beats/min) of a particular population was (69.7, 74.5). Which one of the following statements is correct?

(a) Ninety-five percent of the population has a heart rate somewhere between 69.7 and 74.5.
(b) Ninety-five percent of the time each person's heart has a rate somewhere between 69.7 and 74.5.
(c) Ninety-five percent of the population has an average heart rate and five percent does not.
(d) We are 95% certain that average heart rate of the population is between 69.7 and 74.5.
(e) Five percent of the population has a heart rate outside the range 69.7 to 74.5.

26. Suppose a 95% confidence interval for the mean heart rate (beats/min) of a particular population was (69.7, 74.5). Find the margin of error.

(a) 1.2  (b) 2.4  (c) 3.8  (d) 4.8  (e) none of the above

27. A random sample of 10 students provided the following bivariate data, where $x$ denotes the number of hours a student studied for the final exam and $y$ the student's exam score.

<table>
<thead>
<tr>
<th>$x$</th>
<th>8</th>
<th>10</th>
<th>5</th>
<th>7</th>
<th>10</th>
<th>6</th>
<th>3</th>
<th>9</th>
<th>7</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>90</td>
<td>95</td>
<td>75</td>
<td>80</td>
<td>97</td>
<td>75</td>
<td>58</td>
<td>90</td>
<td>83</td>
<td>78</td>
</tr>
</tbody>
</table>

Find the sample correlation coefficient for $x$ and $y$.

(a) 0.68  (b) 0.77  (c) 0.83  (d) 0.92  (e) 0.98

28. A random sample of 10 students provided the following bivariate data, where $x$ denotes the number of hours a student studied for the final exam and $y$ the student's exam score.

<table>
<thead>
<tr>
<th>$x$</th>
<th>8</th>
<th>10</th>
<th>5</th>
<th>7</th>
<th>10</th>
<th>6</th>
<th>3</th>
<th>9</th>
<th>7</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>90</td>
<td>95</td>
<td>75</td>
<td>80</td>
<td>97</td>
<td>75</td>
<td>58</td>
<td>90</td>
<td>83</td>
<td>78</td>
</tr>
</tbody>
</table>

Use the least squares regression line to estimate the exam score for a student who studies 4 hours.

(a) 63  (b) 64  (c) 65  (d) 66  (e) 67
29. A fair coin is flipped 100,000 times. Find the approximate probability that heads occur more than 50,150 times.

(a) .104  
(b) .147  
(c) .171  
(d) .222  
(e) .259

30. Which confidence level below would give the smallest confidence interval for a population mean?

(a) 90%  
(b) 95%  
(c) 97%  
(d) 98%  
(e) 99%

31. In hypothesis testing, a Type II error occurs if . . .

(a) the null hypothesis is rejected when the null hypothesis is actually true.  
(b) the null hypothesis is not rejected when the null hypothesis is actually false.  
(c) the level of significance is set at a very high value.  
(d) the sample size is very large.  
(e) the test statistic is very large.

32. If a confidence interval (with confidence coefficient $1 - \alpha$) for a population mean $\mu$ does not contain the value 100, which of the following conclusions from a corresponding two-tailed hypothesis test (with significance level $\alpha$) is best?

(a) We have sufficient evidence to conclude that $\mu = 100$  
(b) We do not have sufficient evidence to conclude that $\mu \neq 100$.  
(c) We have sufficient evidence to conclude that $\mu \neq 100$.  
(d) We do not have sufficient evidence to conclude that $\mu = 100$.  
(e) All of the above.

33. Of 1459 subjects in a study, 734 were randomly chosen to take Viagra while the 725 other subjects were given a placebo. Of the 734 subjects taking Viagra, 117 experienced headaches. Of the 725 taking the placebo, 29 experienced headaches. Construct a 99% confidence interval for the difference $p_1 - p_2$, where $p_1$ denotes the probability of a headache for a Viagra user and $p_2$ denotes the probability of a headache for a placebo user.

(a) ( .06, .18)  
(b) ( .07, .17)  
(c) ( .08, .16)  
(d) ( .09, .15)  
(e) ( .10, .14)
Two methods of teaching reading to first graders are being compared. Independent random samples provided the following reading score data.

<table>
<thead>
<tr>
<th>Method 1</th>
<th>Method 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\overline{x}_1 = 69.4$</td>
<td>$\overline{x}_2 = 74.9$</td>
</tr>
<tr>
<td>$s_1 = 11.7$</td>
<td>$s_2 = 12.1$</td>
</tr>
<tr>
<td>$n_1 = 50$</td>
<td>$n_2 = 45$</td>
</tr>
</tbody>
</table>

Let $\mu_1 =$ method 1 population mean reading score and $\mu_2 =$ method 2 population mean reading score. In testing $H_0 : \mu_1 = \mu_2$ versus $H_1 : \mu_1 \neq \mu_2$, using level of significance $\alpha = .05$, which of the following statements is the best conclusion.

(a) There is sufficient evidence to conclude that $\mu_1 = \mu_2$.
(b) There is not sufficient evidence to conclude that $\mu_1 = \mu_2$.
(c) There is sufficient evidence to conclude that $\mu_1 \neq \mu_2$.
(d) There is not sufficient evidence to conclude that $\mu_1 \neq \mu_2$.
(e) The difference in means is not statistically significant.

If one obtains a random sample of size $n$ from a population with finite mean $\mu$ and finite standard deviation $\sigma$, which of the following statements best captures the essence of central limit theorem?

(a) The sample mean is an unbiased estimator of the population mean.
(b) The sample mean has an approximate normal distribution if the population has a normal distribution.
(c) The sample mean has a uniform distribution.
(d) The sample mean has an approximate normal distribution when $n$ is large.
(e) The sample mean has $t$ distribution with $n - 1$ degrees of freedom.

Releasing a guilty person for lack of evidence is analogous to

(a) Committing a Type I error.
(b) Committing a Type II error.
(c) Increasing the level of significance.
(d) Increasing the power of the test.
(e) Decreasing the level of significance.

In hypothesis testing, the maximum probability of a Type I error is called ...

(a) the $p$-value.
(b) the power of the test.
(c) the level of significance.
(d) the critical value.
(e) the decision rule.
38. Below is a histogram constructed from a random sample of size 28. Estimate the sample mean using the midpoint method.

(a) 35.00  (b) 35.25  (c) 32.50  (d) 33.75  (e) 37.50

39. If the weight of newborn babies at City General Hospital has a normal distribution with mean 7.25 lb and standard deviation 1.07 lb, find the probability that mean weight of 100 randomly selected babies from the hospital is greater than 7.36 lb.

(a) .459  (b) .376  (c) .223  (d) .152  (e) .007

40. Which of the following does not characterize a normal distribution?

(a) a symmetric density curve  
(b) its mean equals its median  
(c) a bell-shaped density curve  
(d) the approximate distribution of a sample mean from a large random sample  
(e) almost all of the probability is beyond 3 standard deviations of the mean