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

1) Find the critical value for the following values of the significance level $\alpha$, sample size $n$, and alternate hypothesis $H_1$.

$\alpha = 0.10$, $n = 4$, $H_1: \mu < \mu_0$

A) -2.354  
B) -1.533  
C) -1.282  
D) -1.638

2) Determine whether the outcome is a Type I error, a Type II error, or a correct decision.

A test is made of $H_0: \mu = 14$ versus $H_1: \mu \neq 14$. The true value of $\mu$ is 13 and $H_0$ is rejected.

A) Correct decision  
B) Type I error  
C) Type II error

3) A truck company wants on-time delivery for 98% of the parts they order from a metal manufacturing plant. They have been ordering from Hudson Manufacturing but will switch to a new, cheaper manufacturer (Steel-R-Us) unless there is evidence that this new manufacturer cannot meet the 98% on-time goal. As a test the truck company purchases a random sample of metal parts from Steel-R-Us, and then determines if these parts were delivered on-time. Which hypotheses should they test?

A) $H_0: p = 0.98$  
$H_A: p \neq 0.98$ 
B) $H_0: p < 0.98$  
$H_A: p = 0.98$ 
C) $H_0: p = 0.98$  
$H_A: p < 0.98$ 
D) $H_0: p = 0.98$  
$H_A: p > 0.98$ 
E) $H_0: p < 0.98$  
$H_A: p > 0.98$

4) The weights of soy patties sold by Veggie Burgers Delight are normally distributed. A random sample of 15 patties yields a mean weight of 3.8 ounces with a sample standard deviation of 0.5 ounces. At the 0.05 level of significance, perform a hypothesis test to see if the true mean weight is less than 4 ounces. The correct null and alternative hypotheses are

A) $H_0: \mu = 4; H_A: \mu \neq 4$ 
B) $H_0: \mu > 4; H_A: \mu = 4$ 
C) $H_0: \mu < 4; H_A: \mu = 4$ 
D) $H_0: \mu = 4; H_A: \mu > 4$ 
E) $H_0: \mu = 4; H_A: \mu < 4$
5) A type II error is committed when
   A) we don’t reject a null hypothesis that is true.
   B) we reject a null hypothesis that is true.
   C) we don’t reject a null hypothesis that is false.
   D) none of these
   E) we reject a null hypothesis that is false.

6) A real estate agency, located in a metropolitan area in the northeastern U.S., kept data on the various types of properties purchased in the area. Historically, 15% of purchases were for condominiums, 30% were for townhouses, 40% for single family homes, 10% for commercial properties and 5% for land. With changing demographics, the agency wondered if the current distribution matches the historical distribution. Recent data showed the following:

<table>
<thead>
<tr>
<th>Type of Property</th>
<th>Condos</th>
<th>Townhouses</th>
<th>Homes</th>
<th>Commercial</th>
<th>Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>89</td>
<td>121</td>
<td>78</td>
<td>25</td>
<td>12</td>
</tr>
</tbody>
</table>

Which Chi-square test is most appropriate for this situation?
   A) None of these
   B) Independence
   C) Homogeneity
   D) Goodness of Fit
   E) Proportional

7) Here is the five number summary for salaries of U.S. marketing managers.

<table>
<thead>
<tr>
<th>Min</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>46360</td>
<td>69693</td>
<td>77020</td>
<td>91750</td>
<td>129420</td>
</tr>
</tbody>
</table>

The IQR is
   A) $14,566.
   B) $83,060.
   C) $69,693.
   D) $77,020.
   E) $22,057.
8) The following boxplots show monthly sales revenue figures ($ thousands) for a discount office supply company with locations in three different regions of the U.S. (Northeast, Southeast, and West). Which of the following statements is true?

A) The West has the lowest mean sales revenue.
B) The West has the lowest median sales revenue.
C) None of these.
D) The Southeast has the lowest median sales revenue.
E) The Northeast has the lowest mean sales revenue.
9) Below is a histogram of salaries (in $) for a sample of U.S. marketing managers. The shape of this distribution is

A) bimodal.
B) left skewed.
C) normal.
D) right skewed.
E) symmetric.

10) A new organic pest control formula is being tested on potato plants to see whether it can reduce the level of potato beetle infestation. The mean number of beetles per untreated plant is 5. It is hoped that the new formula may reduce this infestation rate. State the appropriate null and alternate hypotheses.

A) \( H_0: \mu = 5, H_1: \mu < 5 \)  
B) \( H_0: \mu < 5, H_1: \mu > 5 \)  
C) \( H_0: \mu = 5, H_1: \mu \neq 5 \)  
D) \( H_0: \mu < 5, H_1: \mu = 5 \)

11) A garden supplier claims that its new variety of giant tomato produces fruit with an mean weight of 45 ounces. A test is made of \( H_0: \mu = 45 \) versus \( H_1: \mu \neq 45 \). The null hypothesis is rejected. State the appropriate conclusion.

A) The mean weight is not equal to 45 ounces.
B) The mean weight is equal to 45 ounces.
C) There is not enough evidence to conclude that the mean weight differs from 45 ounces.
D) There is not enough evidence to conclude that the mean weight is 45 ounces.
12) A test is made of $H_0: \mu = 70$ versus $H_1: \mu \neq 70$. A sample of size $n = 65$ is drawn, and $ar{x} = 76$. The population standard deviation is $\sigma = 29$. Compute the value of the test statistic $z$ and determine if $H_0$ is rejected at the $\alpha = 0.05$ level.

A) 0.21, $H_0$ not rejected  
B) 1.67, $H_0$ rejected  
C) 1.67, $H_0$ not rejected  
D) 0.21, $H_0$ rejected

13) A test of $H_0: \mu = 44$ versus $H_1: \mu < 44$ is performed using a significance level of $\alpha = 0.01$. The value of the test statistic is $z = -2.19$.

If the true value of $\mu$ is 44, does the conclusion result in a Type I error, a Type II error, or a correct decision?

A) Type II error  
B) Type I error  
C) Correct decision

14) A test of $H_0: \mu = 42$ versus $H_1: \mu \neq 42$ is performed using a significance level of $\alpha = 0.01$. The value of the test statistic is $z = -2.71$. Is $H_0$ rejected?

A) It cannot be determined.  
B) Yes  
C) No

15) The following display from a TI-84 Plus calculator presents the results of a hypothesis test.

```
Z-Test
μ ≠ 37
z = 1.947543
p = 0.051470
\bar{x} = 38.80
n = 45
```

What is the value of the test statistic?

A) 38.80  
B) 37  
C) 0.051470  
D) 1.947543
16) A sample of 40 students enroll in a program that claims to improve scores on the quantitative reasoning portion of the Graduate Record Examination (GRE). The participants take a mock GRE test before the program begins and again at the end to measure their improvement.

The mean number of points improved was \( \bar{x} = 17 \). Assume the standard deviation is \( \sigma = 65 \) and let \( \mu \) be the population mean number of points improved. To determine whether the program is effective, a test is made of the hypotheses \( H_0: \mu = 0 \) versus \( H_1: \mu > 0 \).

Compute the \( P \)-value.

A) 0.0123  
B) 0.0246  
C) 0.0491  
D) 1.6541

17) The mean annual tuition and fees for a sample of 9 private colleges was $30,100 with a standard deviation of $5500. A dotplot shows that it is reasonable to assume that the population is approximately normal. You wish to test whether the mean tuition and fees for private colleges is different from $33,000.

Compute the value of the test statistic and state the number of degrees of freedom.

A) -0.527; 9 degrees of freedom  
B) -1.582; 8 degrees of freedom  
C) -0.527; 8 degrees of freedom  
D) -1.582; 9 degrees of freedom

18) The following display from a TI-84 Plus calculator presents the results of a hypothesis test for a population mean \( \mu \).

```
T-Test
\mu < 40
\mu > 40
\mu \neq 40
\mu \leq 40
\mu \geq 40
\mu = 40
\mu \neq 40

\bar{x} = 39.92
Sx = 2.01779
n = 51
p = 0.389120
t = -0.283139
```

What is the value of \( \bar{x} \)?

A) -0.283139  
B) 39.92  
C) 40  
D) 0.389120
19) Scores on an IQ test are normally distributed. A sample of 19 IQ scores had standard deviation \( s = 9 \). The developer of the test claims that the population standard deviation is \( \sigma = 15 \). Do these data provide sufficient evidence to contradict this claim? Use the \( \alpha = 0.05 \) level of significance.

A) Reject \( H_0 \).
   The population standard deviation appears to differ from 15.
B) Do not reject \( H_0 \).
   There is insufficient evidence to conclude that the population standard deviation differs from 15.

20) In a survey of 618 cigarette smokers, 41 of them reported that they have tried hypnosis therapy to try to quit smoking. Can you conclude that less than one-tenth of smokers have tried hypnosis therapy? Use the \( \alpha = 0.01 \) level of significance.

A) No conclusion is possible.
B) Yes
C) No

21) A test was made of \( H_0: \mu_1 = \mu_2 \) versus \( H_1: \mu_1 < \mu_2 \). The sample means were \( \bar{x}_1 = 13 \) and \( \bar{x}_2 = 11 \), the sample standard deviations were \( s_1 = 5 \) and \( s_2 = 6 \), and the sample sizes were \( n_1 = 15 \) and \( n_2 = 18 \).

Compute the value of the test statistic.
A) 2.449  B) 1.044  C) 1.471  D) 0.256

22) The following display from a TI-84 Plus calculator presents the results of a hypothesis test for the difference between two means. The sample sizes are \( n_1 = 12 \) and \( n_2 = 15 \).

![TI-84 display]

Can you reject \( H_0 \) rejected at the \( \alpha = 0.01 \) level?
A) Yes  B) No
23) For a particular diamond mine, 75% of the diamonds fail to qualify as "gemstone grade". A random sample of 110 diamonds is analysed. Find the probability that less than 81% of the sample diamonds fail to qualify as gemstone grade.
   A) 0.0548  B) 0.0735  C) 0.9265  D) 0.9452

24) In a survey of 615 cigarette smokers, 50 of them reported that they have tried hypnosis therapy to try to quit smoking. Can you conclude that less than one-tenth of smokers have tried hypnosis therapy? Use the $\alpha = 0.05$ level of significance.
   A) No conclusion is possible.  B) Yes  C) No

25) A paint manufacturer discovers that the mean volume of paint in a gallon-sized pail is 1 gallon with a standard deviation of 0.05 gallons. The paint volumes are approximately bell-shaped. Estimate the percent of pails with volumes between 0.90 gallons and 1.10 gallons.
   A) 95%  B) 5%  C) almost all (greater than 95%)  D) 68%

26) A student has an average of 88 on seven chapter tests. If the student's scores on six of the tests are 91, 91, 92, 82, 91, and 70, what was the score on the remaining test?
   A) 81  B) 88  C) 86  D) 99

27) The Australian sheep dog is a breed renowned for its intelligence and work ethic. It is estimated that 45% of adult Australian sheep dogs weigh 65 pounds or more. A sample of 14 adult dogs is studied. What is the standard deviation of the number of dogs who weigh 65 lb or more?
   A) 1.8615  B) 3.465  C) 14  D) 6.3

28) For a particular diamond mine, 79% of the diamonds fail to qualify as "gemstone grade". A random sample of 96 diamonds is analysed. Find the probability that more than 82% of the sample diamonds fail to qualify as gemstone grade.
   A) 0.7642  B) 0.7995  C) 0.2358  D) 0.2005

29) A normal population has a mean $\mu = 30$ and standard deviation $\sigma = 9$. What is the 25th percentile of the population?
   A) 28.76  B) 23.97  C) 19.18  D) 26.37

30) A student takes a true-false test that has 15 questions and guesses randomly at each answer. Let $X$ be the number of questions answered correctly. Find $P$(Fewer than 4)
   A) 0.0592  B) 0.9408  C) 0.0176  D) 0.0037
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

31) The following table presents the numbers of customers who - after 2 weeks of use - were satisfied or dissatisfied with their newly-purchased computers.

<table>
<thead>
<tr>
<th></th>
<th>Brand A</th>
<th>Brand B</th>
<th>Brand C</th>
<th>Brand D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied</td>
<td>28</td>
<td>22</td>
<td>37</td>
<td>47</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>9</td>
<td>16</td>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>

Can you conclude that the satisfaction rate is related to the brand of computer? Use the $\alpha = 0.05$ level of significance.
32) Are low-fat diets or low-carb diets more effective for weight loss? A sample of 80 subjects went on a low-carbohydrate diet for six months. At the end of that time, the sample mean weight loss was 11.5 pounds with a sample standard deviation of 7.17 pounds. A second sample of 75 subjects went on a low-fat diet. Their sample mean weight loss was 17.9 with a standard deviation of 6.75. Can you conclude that the mean weight loss differed between the two diets? Use the $\alpha = 0.05$ level.

i). State the appropriate null and alternate hypotheses.
ii). Compute the test statistic.
iii). How many degrees of freedom are there, using the simple method?
iv). Do you reject $H_0$? State a conclusion.
In an experiment to determine whether there is a systematic difference between the weights obtained with two different mass balances, six specimens were weighed, in grams, on each balance. The following data were obtained:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.40</td>
<td>6.40</td>
</tr>
<tr>
<td>2</td>
<td>7.92</td>
<td>7.92</td>
</tr>
<tr>
<td>3</td>
<td>8.35</td>
<td>8.35</td>
</tr>
<tr>
<td>4</td>
<td>6.03</td>
<td>6.00</td>
</tr>
<tr>
<td>5</td>
<td>9.31</td>
<td>9.30</td>
</tr>
<tr>
<td>6</td>
<td>5.80</td>
<td>5.81</td>
</tr>
</tbody>
</table>

Can you conclude that the mean weight differs between the two balances?

i). State the null and alternative hypotheses.

ii). Compute the test statistic.

iii). State a conclusion using the $\alpha = 0.02$ level of significance.