1. Suppose we are testing the difference between two proportions at the 0.05 level of significance. If the computed \( z \) is \(-1.07\), what is our decision?
A. Reject the null hypothesis
B. Do not reject the null hypothesis
C. Take a larger sample
D. Reserve judgment

2. The net weights (in grams) of a sample of bottles filled by a machine manufactured by Edne, and the net weights of a sample filled by a similar machine manufactured by Orno, Inc., are:
   Edne: 5, 8, 7, 6, 9 and 7
   Orno: 8, 10, 7, 11, 9, 12, 14 and 9
Testing the claim at the 0.05 level that the mean weight of the bottles filled by the Orno machine is greater than the mean weight of the bottles filled by the Edne machine, what is the critical value? Assume equal standard deviations for both samples.
A. 2.179
B. 2.145
C. 1.782
D. 1.761

3. When is it appropriate to use the paired difference \( t \)-test?
A. Four samples are compared at once
B. Any two samples are compared
C. Two independent samples are compared
D. Two dependent samples are compared

4. Administering the same test to a group of 15 students and a second group of 15 students to see which group scores higher is an example of
A. a one sample test of means.
B. a two sample test of means.
C. a paired \( t \)-test.
D. a test of proportions.

5. 20 randomly selected statistics students were given 15 multiple-choice questions and 15 open-ended questions – all on the same material. The professor was interested in determining which type of questions the students scored higher. This experiment is an example of
A. a one sample test of means.
B. a two sample test of means.
C. a paired \( t \)-test.
D. a test of proportions.

**USE the following situation for Questions 6 and 7:** Of 250 adults who were administered the J2P2 anti-virus 187 did not show symptoms of the disease that it guarded against; of 100 children who were administered the anti-virus, 66 did not show symptoms of the disease.
6. Using the 0.1 significance level and the alternate hypothesis $\pi_1 \neq \pi_2$, what is the null hypothesis?
A. $\pi_1 > \pi_2$
B. $\pi_1 < \pi_2$
C. $\pi_1 = \pi_2$
D. None of these

7. What test statistic should we use?
A. $z$-statistic
B. Right one-tailed test
C. Left one-tailed test
D. Two-tailed test

Use the following situation for Questions 8 – 15: A national manufacturer of ball bearings is experimenting with two different processes for producing precision ball bearings. It is important that the diameters be as close as possible to an industry standard. The output from each process is sampled and the average error from the industry standard is calculated. The results are presented below.

<table>
<thead>
<tr>
<th></th>
<th>Process A</th>
<th>Process B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.002mm</td>
<td>0.0026mm</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.0001mm</td>
<td>0.00012mm</td>
</tr>
<tr>
<td>Sample Size</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>

The researcher is interested in determining whether there is evidence that the two processes yield different average errors. Assume that the population standard deviations are equal.

8. What is the null hypothesis? $\mu_A$ $\mu_B$
A. $\mu_A = \mu_B$
B. $\mu_A \neq \mu_B$
C. $\mu_A \leq \mu_B$
D. $\mu_A > \mu_B$

9. What is the alternate hypothesis?
A. $\mu_A = \mu_B$
B. $\mu_A \neq \mu_B$
C. $\mu_A \leq \mu_B$
D. $\mu_A > \mu_B$.

10. What is the degrees of freedom?
A. 10
B. 13
C. 26
D. 24

11. What is the critical $t$ value at the 1% level of significance?
A. +2.779
B. −2.492
C. ±1.711
D. ±2.797
12. What is the computed value of \( t \)?
   A. +2.797
   B. -2.797
   C. -13.70
   D. +13.70

13. What is the decision at the 1% level of significance?
   A. Reject the null hypothesis and conclude the means are different.
   B. Reject the null hypothesis and conclude the means are the same.
   C. Fail to reject the null hypothesis and conclude the means are the same.
   D. Fail to reject the null hypothesis and conclude the means are different.

14. If the calculated value of \( t \) is +2.70, what would be the decision using the 0.01 level of significance?
   A. Reject the null hypothesis and conclude the means are different.
   B. Reject the null hypothesis and conclude the means are the same.
   C. Fail to reject the null hypothesis and conclude the means are the same.
   D. Fail to reject the null hypothesis and conclude the means are different.

15. This example is what type of test?
   A. One sample test of means.
   B. Two sample test of means.
   C. Paired \( t \)-test.
   D. Test of proportions.

16. If we are testing for the difference between two population means, it is assumed that the sample observations from one population are independent of sample observations from the other population.
   True    False

17. A hospital administrator wishes to estimate the number of days that people who received a hip replacement spent in the ICU. How many records should be examined to have a 95% confidence that the estimate is not more than .6 day from the mean? Previous records suggest that \( \sigma = 1.5 \).
   A. n = 40
   B. n = 35
   C. n = 60
   D. n = 68

18. A medical researcher wants to compare the effects of a new process for treating defected cells after a first treatment and a second treatment. This is an example of paired or dependent observations.
   True    False

Use the following situation for Questions 19 – 23: A nationwide survey of medical complaints indicated that 66 out of 150 people in the Southwestern US and 58 out of 160 people in the National Capital Region caught the common cold in 2008. Is this a chance difference? Is the data consistent with the hypothesis that geography plays a role? Test at \( \alpha = .05 \)
19. Select the appropriate null and alternative hypothesis:
A. $H_0: \pi_1 - \pi_2 \geq 0 ; H_1: \pi_1 - \pi_2 < 0$
B. $H_0: \pi_1 - \pi_2 \neq 0 ; H_1: \pi_1 - \pi_2 = 0$
C. $H_0: \pi_1 = \pi_2 ; H_1: \pi_1 \neq \pi_2$
D. $H_0: \pi_1 < \pi_2 ; H_1: \pi_1 \geq \pi_2$

20. Identify the following: $\alpha = 0.05$, $p_1 = 0.44$, $p_2 = 0.3625$, $p' = \frac{0.4}{\text{other value}}$, $\text{SE}(p_1 - p_2) = 0.05568$

21. Compute the test statistic value. $z = ______$
A. 0.464
B. 1.392
C. 1.385
D. 3.210

22. What is the critical value?
A. 1.96
B. 1.64
C. 2.33
D. 2.57

23. What is the decision and the conclusion?
A. Reject $H_0$ and conclude that there is a difference in the regions
B. Reject $H_0$ and conclude that there is no difference in the regions
C. Fail to reject $H_0$ and conclude that there is a difference in the regions
D. Fail to reject $H_0$ and conclude that there is no difference in the regions

24. Analysis of variance is used to
A. compare nominal data.
B. compute $t$ test.
C. compare population proportion.
D. simultaneously compare several population means.

**Use the following situation for Questions 25 and 26:** In an effort to determine the most effective way to teach laboratory safety principles to a group of laboratory technicians, four different methods were tried. Some technicians were given programmed instruction booklets and worked through the course at their own pace. Other technicians attended lectures. A third group of technicians watched a television presentation, and a fourth group was divided into small discussion groups. A high of 10 was possible. A sample of five tests was selected from each group. The test grade results were:

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Programmed Instructions</th>
<th>Lectures</th>
<th>TV</th>
<th>Group Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
25. At the 0.01 level, what is the critical value (cutoff value for the critical region)?
A. 1.00
B. 1.96
C. 3.24
D. 5.29

26. How many treatments are there?
A. 3
B. 4
C. 12
D. 0

27. If an ANOVA test is conducted and the null hypothesis is rejected, what does this indicate?
A. Too many degrees of freedom
B. No difference between the population means
C. A difference between at least one pair of population means
D. None of these

28. In ANOVA analysis, when the null hypothesis is rejected, we can find which means are different by
A. perform a post hoc analysis
B. adding another treatment.
C. doing an additional ANOVA.
D. doing a t test.

Use the following situation for Questions 29 – 33: Given the following One Way Analysis of Variance table for three groups each with six observations each.

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F Ratio</th>
<th>Critical F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1116</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td>1068</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2184</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

29. What are the degrees of freedom for the numerator and denominator?
A. 3 and 18
B. 2 and 17
C. 3 and 15
D. 2 and 15

30. What is the critical value of $F$ at the 5% level of significance?
A. 19.43
B. 3.68
C. 6.36
D. 99.43

31. What is the mean square between groups?
A. 71.2
B. 71.4
C. 558
D. 534
32. What is the computed value of $F$?
   A. 7.48
   B. 7.84
   C. 8.84
   D. 8.48

33. What is the decision?
   A. Reject H0 – there is a difference in the groups means
   B. Fail to reject H0 – there is a difference in the groups means
   C. Reject H0 – there is a difference in errors
   D. Fail to reject H0 – there is a difference in errors

34. The test statistic used in ANOVA is *Student’s t*.
   True   False

35. What is our decision regarding the differences between the observed and expected frequencies if the critical value of chi-square is 9.488 and the computed value is 6.079?
   A. The difference is probably due to sampling error; do not reject the null hypothesis
   B. Not due to chance; reject the null hypothesis
   C. Not due to chance; do not reject the alternate hypothesis
   D. Too close; reserve judgment

36. The chi-square distribution can assume
   A. only positive values.
   B. only negative values.
   C. negative and positive values or zero.
   D. only zero.

**Use the following situation for Question 37:** The following table classifies an individual in two ways—by gender and by educational choice.

<table>
<thead>
<tr>
<th>Gender</th>
<th>College Attended</th>
<th>None</th>
<th>Two Year</th>
<th>Four Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td>7</td>
<td>13</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>13</td>
<td>17</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

37. What is this two-way classification called?
   A. Goodness-of-fit test
   B. Frequency table
   C. ANOVA table
   D. Contingency table

**Use the following situation for Questions 38 – 42:** A personnel manager is concerned about absenteeism. She decides to sample the records to determine if absenteeism is distributed evenly throughout the six-day workweek. The null hypothesis to be tested is: Absenteeism is distributed evenly throughout the week.
   The 0.01 level is to be used. The sample results are:
<table>
<thead>
<tr>
<th>Day of Week</th>
<th>Number Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>12</td>
</tr>
<tr>
<td>Wednesday</td>
<td>9</td>
</tr>
<tr>
<td>Thursday</td>
<td>11</td>
</tr>
<tr>
<td>Friday</td>
<td>10</td>
</tr>
<tr>
<td>Saturday</td>
<td>9</td>
</tr>
</tbody>
</table>

38. What kind of frequencies are the numbers 12, 9, 11, 10, and 9 called?
A. Acceptance
B. Critical value
C. Expected
D. Observed

39. How many degrees of freedom are there?
A. 0
B. 3
C. 4
D. 5

40. What is the expected frequency?
A. 9
B. 10
C. 11
D. 12

41. What is the calculated value of chi-square?
A. 1.0
B. 0.5
C. 0.8
D. 8.0

42. What is the critical value of chi-square with $\alpha = 0.05$?
A. 11.070
B. 12.592
C. 13.388
D. 15.033
Use the following situation for Questions 43 - 49: A recent clinical behavior study of the relationship between social activity and education showed the following results.

<table>
<thead>
<tr>
<th>Social Activity</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>30</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>High School</td>
<td>20</td>
<td>40</td>
<td>90</td>
</tr>
<tr>
<td>Grade School</td>
<td>10</td>
<td>50</td>
<td>130</td>
</tr>
</tbody>
</table>

43. The appropriate test to analyze the relationship between social activity and education is:
   A. regression analysis
   B. Analysis of variance
   C. Contingency table analysis
   D. Goodness-of-fit

   **C. Contingency table analysis**

44. The appropriate test statistic for the analysis is a:
   A. F-statistic
   B. T-statistic
   C. Chi-square statistic
   D. Z-statistic

   **C. Chi-square statistic**

45. The null hypothesis for the analysis is:
   A. There is no relationship between social activity and education.
   B. The correlation between social activity and education is zero.
   C. As social activity increases, education increases.
   D. The mean of social activity equals the mean of education.

   **A. There is no relationship between social activity and education.**

46. The degrees of freedom for the analysis is:
   A. 1
   B. 2
   C. 3
   D. 4

   **D. 4**

47. Using 0.05 as the significance level, what is the critical value for the test statistic?
   A. 9.488
   B. 5.991
   C. 7.815
   D. 3.841

   **A. 9.488**

48. What is the value of the test statistic?
   A. 100
   B. 135.24
   C. 50
   D. 4.94

   **B. 135.24**

49. Based on the analysis, what can be concluded?
   A. Social activity and education are correlated.
   B. Social activity and education are not related.
   C. Social activity and education are related.
   D. No conclusion is possible.

   **C. Social activity and education are related.**
Use the following situation for Questions 50 - 54: Recently, students in a marketing research class were interested in the driving behavior of students. Specifically, the marketing students were interested if exceeding the speed limit was related to social activity. They collected the following responses from 100 randomly selected students:

<table>
<thead>
<tr>
<th></th>
<th>Speeds</th>
<th>Does Not Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Females</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>

50. The null hypothesis for the analysis is:
A. There is no relationship between gender and driving behavior.
B. The correlation between driving behavior and gender is zero.
C. As driving behavior increases, gender increases.
D. The mean of driving behavior equals the mean of gender.

51. The degrees of freedom for the analysis is:
A. 1
B. 2
C. 3
D. 4

52. Using 0.05 as the significance level, what is the critical value for the test statistic?
A. 9.488
B. 5.991
C. 7.815
D. 3.841

53. What is the value of the test statistic?
A. 83.67
B. 9.89
C. 50
D. 4.94

54. Based on the analysis, what can be concluded?
A. driving behavior and gender are correlated.
B. driving behavior and gender are not related.
C. driving behavior and gender are related.
D. No conclusion is possible.