Practice Problems for Exam 3

Provide an appropriate response.
1) The mean age of bus drivers in Chicago is 48.5 years. Write the null and alternative hypotheses.
2) The mean IQ of statistics teachers is greater than 110. Write the null and alternative hypotheses.
3) The mean score for all NBA games during a particular season was less than 101 points per game. Write the null and alternative hypotheses.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.
4) Given $H_0: p \geq 80\%$ and $H_a: p < 80\%$, determine whether the hypothesis test is left-tailed, right-tailed, or two-tailed.
   A) two-tailed  
   B) right-tailed  
   C) left-tailed
5) Given $H_0: \mu \leq 25$ and $H_a: \mu > 25$, determine whether the hypothesis test is left-tailed, right-tailed, or two-tailed.
   A) two-tailed  
   B) left-tailed  
   C) right-tailed
6) A researcher claims that 62% of voters favor gun control. Determine whether the hypothesis test for this claim is left-tailed, right-tailed, or two-tailed.
   A) right-tailed  
   B) two-tailed  
   C) left-tailed
7) The mean age of bus drivers in Chicago is 50.2 years. If a hypothesis test is performed, how should you interpret a decision that rejects the null hypothesis?
   A) There is not sufficient evidence to support the claim $\mu = 50.2$.
   B) There is sufficient evidence to reject the claim $\mu = 50.2$.
   C) There is not sufficient evidence to reject the claim $\mu = 50.2$.
   D) There is sufficient evidence to support the claim $\mu = 50.2$.
8) The mean age of bus drivers in Chicago is greater than 57.8 years. If a hypothesis test is performed, how should you interpret a decision that rejects the null hypothesis?
   A) There is sufficient evidence to support the claim $\mu > 57.8$.
   B) There is not sufficient evidence to reject the claim $\mu > 57.8$.
   C) There is sufficient evidence to reject the claim $\mu > 57.8$.
   D) There is not sufficient evidence to support the claim $\mu > 57.8$.
9) The mean age of bus drivers in Chicago is greater than 47.6 years. If a hypothesis test is performed, how should you interpret a decision that fails to reject the null hypothesis?
   A) There is sufficient evidence to support the claim $\mu > 47.6$.
   B) There is sufficient evidence to reject the claim $\mu > 47.6$.
   C) There is not sufficient evidence to reject the claim $\mu > 47.6$.
   D) There is not sufficient evidence to support the claim $\mu > 47.6$. 
10) A candidate for governor of a certain state claims to be favored by at least half of the voters. If a hypothesis test is performed, how should you interpret a decision that fails to reject the null hypothesis?
   A) There is sufficient evidence to support the claim \( \rho \geq 0.5 \).
   B) There is not sufficient evidence to reject the claim \( \rho \geq 0.5 \).
   C) There is sufficient evidence to reject the claim \( \rho \geq 0.5 \).
   D) There is not sufficient evidence to support the claim \( \rho \geq 0.5 \).

11) Suppose you are using \( \alpha = 0.05 \) to test the claim that \( \mu > 14 \) using a P-value. You are given the sample statistics \( n = 50, \bar{x} = 14.3 \), and \( s = 1.2 \). Find the P-value.
   A) 0.0012  B) 0.0128  C) 0.0384  D) 0.1321

12) Given \( H_0: \mu = 25, H_a: \mu \neq 25 \), and \( P = 0.034 \). Do you reject or fail to reject \( H_0 \) at the 0.01 level of significance?
   A) not sufficient information to decide
   B) fail to reject \( H_0 \)
   C) reject \( H_0 \)

13) Find the critical value for a right-tailed test with \( \alpha = 0.01 \) and \( n = 75 \).
   A) 2.33  B) 1.96  C) 2.575  D) 1.645

14) Find the critical value for a two-tailed test with \( \alpha = 0.01 \) and \( n = 30 \).
   A) \( \pm 2.575 \)  B) \( \pm 1.645 \)  C) \( \pm 2.33 \)  D) \( \pm 1.96 \)

15) Find the critical value for a left-tailed test with \( \alpha = 0.05 \) and \( n = 48 \).
   A) -2.575  B) -2.33  C) -1.645  D) -1.96

16) Test the claim that \( \mu > 19 \), given that \( \alpha = 0.05 \) and the sample statistics are \( n = 50, \bar{x} = 19.3, \) and \( s = 1.2 \).

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

17) Find the standardized test statistic \( t \) for a sample with \( n = 12, \bar{x} = 22.2, s = 2.2, \) and \( \alpha = 0.01 \) if \( H_0: \mu = 21 \). Round your answer to three decimal places.
   A) 1.991  B) 2.001  C) 1.890  D) 2.132

18) Use a t-test to test the claim \( \mu \geq 10.2 \) at \( \alpha = 0.05 \), given the sample statistics \( n = 10, \bar{x} = 9.3 \), and \( s = 1.3 \).

19) A manufacturer claims that the mean lifetime of its fluorescent bulbs is 1000 hours. A homeowner selects 25 bulbs and finds the mean lifetime to be 980 hours with a standard deviation of 80 hours. If \( \alpha = 0.05 \), test the manufacturer's claim using P-values.

20) Test the claim about the population proportion \( p \neq 0.325 \) given \( n = 42 \) and \( \hat{p} = 0.247 \). Use \( \alpha = 0.05 \).
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

21) Classify the two given samples as independent or dependent.
Sample 1: Pre-training weights of 19 people
Sample 2: Post-training weights of 19 people
A) dependent       B) independent

22) Classify the two given samples as independent or dependent.
Sample 1: The weights in pounds of 26 newborn females
Sample 2: The weights in pounds of 26 newborn males
A) dependent       B) independent

23) A study was conducted to determine if the salaries of elementary school teachers from two neighboring states were equal. A sample of 100 teachers from each state was randomly selected. The mean from the first state was $28,700 with a standard deviation of $2300. The mean from the second state was $30,100 with a standard deviation of $2100. Test the claim that the salaries from both states are equal. Use $\alpha = 0.05$.

24) At a local college, 65 female students were randomly selected and it was found that their mean monthly income was $609 with a standard deviation of $121.50. Seventy-five male students were also randomly selected and their mean monthly income was found to be $651 with a standard deviation of $168.70. Test the claim that male students have a higher monthly income than female students. Use $\alpha = 0.01$.

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

25) Find the critical value, $t_0$, to test the claim $\mu_1 < \mu_2$. Two samples are randomly selected and come from populations that are normal. The sample statistics are given below. Assume that $\sigma^2_1 = \sigma^2_2$. Use $\alpha = 0.05$.

\[
\begin{align*}
n_1 &= 15 \\
\bar{x}_1 &= 25.59 \\
s_1 &= 2.9
\end{align*}
\]  \[
\begin{align*}
n_2 &= 15 \\
\bar{x}_2 &= 28.14 \\
s_2 &= 2.8
\end{align*}
\]
A) -1.701       B) -1.313       C) 2.467       D) 0.683

26) Test the claim that $\mu_1 \neq \mu_2$. Two samples are randomly selected from normal populations. The sample statistics are given below. Assume that $\sigma^2_1 \neq \sigma^2_2$. Use $\alpha = 0.02$.

\[
\begin{align*}
n_1 &= 11 \\
\bar{x}_1 &= 8.7 \\
s_1 &= 0.76
\end{align*}\]  \[
\begin{align*}
n_2 &= 18 \\
\bar{x}_2 &= 9.1 \\
s_2 &= 0.51
\end{align*}\]
27) Test the claim that \( \mu_d < 0 \) using the sample statistics below. Assume that the populations are normally distributed. Use \( \alpha = 0.10 \).

Sample statistics: \( n = 18, \bar{d} = -3.3, s_d = 0.4 \)

28) Nine students took the SAT. Their scores are listed below. Later on, they took a test preparation course and retook the SAT. Their new scores are listed below. Test the claim that the test preparation had no effect on their scores. Use \( \alpha = 0.05 \). Assume that the distribution is normally distributed.

<table>
<thead>
<tr>
<th>Student</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores before course</td>
<td>720</td>
<td>860</td>
<td>850</td>
<td>880</td>
<td>860</td>
<td>710</td>
<td>850</td>
<td>1200</td>
<td>950</td>
</tr>
<tr>
<td>Scores after course</td>
<td>740</td>
<td>860</td>
<td>840</td>
<td>920</td>
<td>890</td>
<td>720</td>
<td>840</td>
<td>1240</td>
<td>970</td>
</tr>
</tbody>
</table>

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

29) Find the weighted estimate, \( \bar{p} \) to test the claim that \( p_1 = p_2 \). Use \( \alpha = 0.05 \). The sample statistics listed below are from independent samples.

Sample statistics: \( n_1 = 50, x_1 = 35, \) and \( n_2 = 60, x_2 = 40 \)

A) 0.328  
B) 0.238  
C) 1.367  
D) 0.682

30) Find the weighted estimate, \( \bar{p} \) to test the claim that \( p_1 > p_2 \). Use \( \alpha = 0.01 \). The sample statistics listed below are from independent samples.

Sample statistics: \( n_1 = 100, x_1 = 38, \) and \( n_2 = 140, x_2 = 50 \)

A) 0.367  
B) 0.633  
C) 0.523  
D) 0.179

31) The data below are the ages and systolic blood pressures (measured in millimeters of mercury) of 9 randomly selected adults. Construct a scatter plot for the data.

<table>
<thead>
<tr>
<th>Age, x</th>
<th>38</th>
<th>41</th>
<th>45</th>
<th>48</th>
<th>51</th>
<th>53</th>
<th>57</th>
<th>61</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure, y</td>
<td>116</td>
<td>120</td>
<td>123</td>
<td>131</td>
<td>142</td>
<td>145</td>
<td>148</td>
<td>150</td>
<td>152</td>
</tr>
</tbody>
</table>

32) The data below are the average monthly temperatures, in \( ^\circ F \), and the monthly natural gas consumption, in ccf, for a household in northwestern Pennsylvania. Test the significance of the correlation coefficient using \( \alpha = 0.05 \) and the claim \( \rho < 0 \).

<table>
<thead>
<tr>
<th>Temperature</th>
<th>47</th>
<th>35</th>
<th>21</th>
<th>27</th>
<th>39</th>
<th>48</th>
<th>61</th>
<th>65</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>34</td>
<td>169</td>
<td>248</td>
<td>134</td>
<td>137</td>
<td>100</td>
<td>19</td>
<td>34</td>
<td>12</td>
</tr>
</tbody>
</table>
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

33) The data below are the final exam scores of 10 randomly selected statistics students and the number of hours they studied for the exam. Find the equation of the regression line for the given data.

<table>
<thead>
<tr>
<th>Hours, x</th>
<th>Scores, y</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>65</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>88</td>
</tr>
<tr>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>4</td>
<td>78</td>
</tr>
<tr>
<td>4</td>
<td>85</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>71</td>
</tr>
</tbody>
</table>

A) \( \hat{y} = 5.044x + 56.113 \)
B) \( \hat{y} = 56.113x - 5.044 \)
C) \( \hat{y} = -5.044x + 56.113 \)
D) \( \hat{y} = -56.113x - 5.044 \)
1) $H_0: \mu = 48.5, H_a: \mu \neq 48.5$
2) $H_0: \mu \leq 110, H_a: \mu > 110$
3) $H_0: \mu \geq 101, H_a: \mu < 101$
4) C
5) C
6) B
7) B
8) A
9) D
10) B
11) C
12) B
13) A
14) A
15) C
16) standardized test statistic $\approx 1.77$; critical value $= 1.645$; reject $H_0$; There is enough evidence to support the claim.
17) C
18) $t_0 = -1.833$, standardized test statistic $\approx -2.189$, reject $H_0$; There is sufficient evidence to reject the claim.
19) Standardized test statistic $\approx -1.25$; Therefore, at a degree of freedom of 24, $P$ must be between 0.10 and 0.25. $P > \alpha$, fail to reject $H_0$; There is not sufficient evidence to reject the manufacturer’s claim.
20) critical value $z_0 = \pm 1.96$; standardized test statistic $\approx -1.08$; fail to reject $H_0$; There is not sufficient evidence to support the claim.
21) A
22) B
23) critical values $z_0 = \pm 1.96$; standardized test statistic $z = -4.50$, reject $H_0$; There is sufficient evidence to reject the claim.
24) critical value $z_0 = 2.33$; standardized test statistic $\approx 1.71$; fail to reject $H_0$; There is not sufficient evidence to support the claim.
25) A
26) critical value $t_0 = \pm 2.764$; standardized test statistic $\approx -1.546$; fail to reject $H_0$; There is not sufficient evidence to support the claim.
27) critical value $t_0 = -1.333$; standardized test statistic $t \approx -35.002$; reject $H_0$; There is sufficient evidence to support the claim.
28) claim: $\mu_d = 0$; critical values $t_0 = \pm 2.306$; standardized test statistic $t \approx -2.401$; reject $H_0$; There is sufficient evidence to reject the claim.
29) D
30) A
31) 

![Blood Pressure vs Age graph](image)

32) standardized test statistic $t \approx -5.770$; critical value $t_0 = -1.895$; reject $H_0$; There is sufficient evidence to conclude that a significant negative correlation exists.

33) A