CHAPTER 10 TEST
FORM A

For the given data, solve the following problems.

Taltson Lake is in the Canadian Northwest Territories. This lake has many Northern Pike. The following data was obtained by two fishermen visiting the lake. Let \( x \) = length of a Northern Pike in inches and let \( y \) = weight in pounds.

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
x \text{ (inches)} & 20 & 24 & 36 & 41 & 46 \\
\hline
y \text{ (pounds)} & 2 & 4 & 12 & 15 & 20 \\
\hline
\end{array}
\]

1. Draw a scatter diagram. Using the scatter diagram (no calculations) would you estimate the linear correlation coefficient to be positive, close to zero, or negative? Explain your answer.

2. For the given data compute each of the following.
   \( (a) \quad \bar{x} \text{ and } \bar{y} \)
   \( (b) \quad \sum x, \sum y, \sum x^2, \sum y^2, \sum xy \)
   \( (c) \text{ The slope } b \text{ and } y \text{ intercept } a \text{ of the least squares line; write out the equation for the least squares line.} \)
   \( (d) \text{ Graph the least squares line on your scatter plot of problem 1.} \)

3. Compute the sample correlation coefficient \( r \). Compute the coefficient of determination. Give a brief explanation of the meaning of the coefficient of determination in the context of this problem.

4. Compute the standard error of estimate \( S_e \).

5. If a 32 inch Northern Pike is caught, what is the weight in pounds as predicted by the least squares line?

6. Find a 90% confidence interval for your prediction of Problem 5.

7. Using the sample correlation coefficient \( r \) computed in Problem 3, test whether or not the population correlation coefficient \( \rho \) is different from zero. Use \( \alpha = 0.01 \). Is \( r \) significant in this problem? Explain.
CHAPTER 10, FORM A, PAGE 2

For the given data, solve the following problems.

A marketing analyst is studying the relationship between $x =$ amount spent on television advertising and $y =$ increase in sales. The following data represents a random sample from the study.

<table>
<thead>
<tr>
<th>$x$ (thousands)</th>
<th>15</th>
<th>28</th>
<th>19</th>
<th>47</th>
<th>10</th>
<th>92</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$ (thousands)</td>
<td>340</td>
<td>260</td>
<td>152</td>
<td>413</td>
<td>130</td>
<td>855</td>
</tr>
</tbody>
</table>

8. Draw a scatter diagram. Using the scatter diagram (no calculations) would you estimate the linear correlation coefficient to be positive, close to zero, or negative? Explain your answer.

9. For the given data compute each of the following.

(a) $\bar{x}$ and $\bar{y}$

(b) $\sum x$, $\sum y$, $\sum x^2$, $\sum y^2$, $\sum xy$

(c) The slope $b$ and $y$ intercept $a$ of the least squares line; write out the equation for the least squares line.

(d) Graph the least squares line on your scatter plot of problem 8.

10. Compute the sample correlation coefficient $r$. Compute the coefficient of determination. Give a brief explanation of the meaning of the correlation coefficient and the coefficient of determination in the context of this problem.

11. Compute the standard error of estimate $S_e$.

12. Suppose that the amount spent on advertising is $37,000. What does the least-squares line predict for the increase in sales?

13. Test the claim that the slope $\beta$ of the population least-squares line is positive at the $\alpha = 0.05$ level of significance.

14. Find a 95% confidence interval for $\beta$ and interpret its meaning.
CHAPTER 10 TEST
FORM B

For the given data, solve the following problems.

Do higher paid chief executive officers (CEO’s) control bigger companies? Let us study \( x \) = annual CEO salary ($ millions) and \( y \) = annual company revenue ($ billions). The following data are based on information from Forbes magazine and represents a sample of top US executives.

<table>
<thead>
<tr>
<th>( x ) ($ millions)</th>
<th>0.8</th>
<th>1.0</th>
<th>1.1</th>
<th>1.7</th>
<th>2.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y ) ($ billions)</td>
<td>14</td>
<td>11</td>
<td>19</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

1. Draw a scatter diagram. Using the scatter diagram (no calculations) would you estimate the linear correlation coefficient to be positive, close to zero, or negative? Explain your answer.

2. For the given data compute each of the following.
   (a) \( \bar{x} \) and \( \bar{y} \)
   (b) \( \sum x, \sum y, \sum x^2, \sum y^2, \sum xy \)
   (c) The slope \( b \) and \( y \) intercept \( a \) of the least squares line; write out the equation for the least squares line.
   (d) Graph the least squares line on your scatter plot of problem 1.

3. Compute the sample correlation coefficient \( r \). Compute the coefficient of determination. Give a brief explanation of the meaning of the coefficient of determination in the context of this problem.

4. Compute the standard error of estimate \( S_e \).

5. If a CEO has an annual salary of 1.5 million, what is his or her annual company revenue as predicted by the least squares line?

6. Find a 90% confidence interval for your prediction of Problem 5.

7. Using the sample correlation coefficient \( r \) computed in Problem 3, test whether or not the population correlation coefficient \( \rho \) is different from zero. Use \( \alpha = 0.01 \). Is \( r \) significant in this problem? Explain.
CHAPTER 10, FORM B, PAGE 2

For the given data, solve the following problems.

An accountant for a small manufacturing plant collected the following random sample to study the relationship between $x =$ the cost to make a particular item and $y =$ the selling price.

<table>
<thead>
<tr>
<th>$x$ ($)</th>
<th>26</th>
<th>50</th>
<th>47</th>
<th>23</th>
<th>52</th>
<th>71</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$ ($)</td>
<td>78</td>
<td>132</td>
<td>128</td>
<td>70</td>
<td>152</td>
<td>198</td>
</tr>
</tbody>
</table>

8. Draw a scatter diagram. Using the scatter diagram (no calculations) would you estimate the linear correlation coefficient to be positive, close to zero, or negative? Explain your answer.

9. For the given data compute each of the following.
   (a) $\bar{x}$ and $\bar{y}$
   (b) $\sum x, \sum y, \sum x^2, \sum y^2, \sum xy$
   (c) The slope $b$ and $y$ intercept $a$ of the least squares line; write out the equation for the least squares line.
   (d) Graph the least squares line on your scatter plot of problem 8.

10. Compute the sample correlation coefficient $r$. Compute the coefficient of determination. Give a brief explanation of the meaning of the correlation coefficient and the coefficient of determination in the context of this problem.

11. Compute the standard error of estimate $S_e$.

12. Suppose that the cost to make a particular item is $35. What does the least-squares line predict for the selling price?

13. Test the claim that the slope $\beta$ of the population least-squares line is positive at the $\alpha = 0.05$ level of significance.

14. Find a 95% confidence interval for $\beta$ and interpret its meaning.
CHAPTER 10 TEST
FORM C

Write the letter of the response that best answers each problem.

Does the weight of a vehicle affect the gas mileage? The following random sample was collected where \( x = \) weight of a vehicle in hundreds of pounds and \( y = \) miles per gallon.

<table>
<thead>
<tr>
<th>( x ) (lb hundreds)</th>
<th>26</th>
<th>35</th>
<th>29</th>
<th>39</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y ) (mpg)</td>
<td>22.0</td>
<td>16.1</td>
<td>18.8</td>
<td>15.7</td>
<td>23.4</td>
</tr>
</tbody>
</table>

1. Based on a scatter diagram, would you estimate the linear correlation coefficient to be \[ \text{________} \]
   (a) close to \(-1\)   (b) closer to 0 and negative
   (c) close to 1        (d) closer to 0 and positive   (e) Cannot determine

2. What is the equation for the least squares line? \[ \text{________} \]
   (a) \( y = -32.55x + 0.448 \)   (b) \( y = -32.55x - 0.448 \)
   (c) \( y = -32.55x + 0.448 \)   (d) \( y = -0.448x + 32.55 \)
   (e) \( y = 0.448x - 32.55 \)

3. Compute the coefficient of determination. \[ \text{________} \]
   (a) \(-0.941\)    (b) 0.941
   (c) \(-0.970\)    (d) 0.970    (e) 0.965

4. Compute the standard error of estimate \( S_e \). \[ \text{________} \]
   (a) 0.965    (b) \(-0.970\)
   (c) 0.941    (d) 1.975    (e) 0.065

5. If a vehicle weighs 2200 pounds, what does the least-squares line predict for the miles per gallon? \[ \text{________} \]
   (a) 22.7    (b) 66.0
   (c) 42.4    (d) 22.0    (e) Cannot determine

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6. Find a 90% confidence interval for your prediction of Problem 5.

(a) 21.1 mpg ≤ y ≤ 24.3 mpg    (b) 19.5 mpg ≤ y ≤ 25.9 mpg
(c) 19.9 mpg ≤ y ≤ 25.5 mpg    (d) 19.0 mpg ≤ y ≤ 26.4 mpg
(e) 20.6 mpg ≤ y ≤ 24.8 mpg

7. Using the sample correlation coefficient \( r \), test whether or not the population correlation coefficient \( \rho \) is different from zero. Use \( \alpha = 0.01 \). Is \( r \) significant in this problem?

(a) Do not reject \( H_0; r \) is not significant  (b) Reject \( H_0; r \) is significant
(c) Do not reject \( H_0; r \) is significant  (d) Reject \( H_0; r \) is not significant
(e) Cannot determine

Write the letter of the response that best answers each problem.

A graduate school committee is studying the relationship between \( x \) = an applicant's undergraduate grade point average and \( y \) = the applicants' score on the graduate entrance exam. The following random sample was collected to study this relationship.

<table>
<thead>
<tr>
<th>( x ) (GPA)</th>
<th>3.2</th>
<th>3.9</th>
<th>4.0</th>
<th>3.4</th>
<th>3.7</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y ) (score)</td>
<td>725</td>
<td>788</td>
<td>775</td>
<td>647</td>
<td>800</td>
<td>672</td>
</tr>
</tbody>
</table>

8. Based on a scatter diagram, would you estimate the linear correlation coefficient to be

(a) close to \(-1\)    (b) closer to 0 and negative
(c) close to 1        (d) closer to 0 and positive    (e) Cannot determine

9. What is the equation for the least squares line?

(a) \( \hat{y} = -123.03x + 299.8 \)    (b) \( \hat{y} = 123.03x - 299.8 \)
(c) \( \hat{y} = 299.8x + 123.03 \)    (d) \( \hat{y} = -299.8x + 123.03 \)    (e) \( \hat{y} = 123.03x + 299.8 \)
10. Compute the sample correlation coefficient.
   (a) 0.587  (b) −0.766  
   (c) 0.875  (d) 0.766  (e) −0.586

11. Compute the standard error of estimate $s_e$.
   (a) 45.93  (b) 0.766  
   (c) 183.2  (d) 51.6  (e) 0.587

12. If a student has a grade point average of 3.5, what does the least-squares line predict for the score on the graduate entrance exam?
   (a) 926.3  (b) 3.5  
   (c) 730.4  (d) 130.8  (e) 1172.3

13. Test the claim that the slope $\beta$ of the population least-squares line is positive at the $\alpha = 0.05$ level of significance.
   (a) Do not reject $H_0$; slope is positive  (b) Do not reject $H_0$; cannot determine that slope is positive  
   (c) Reject $H_0$; slope is positive  (d) Reject $H_0$; cannot determine that slope is positive  
   (e) Cannot determine

14. Find an 80% confidence interval for $\beta$.
   (a) $220.75 < \beta < 378.85$  (b) $654.3 < \beta < 806.5$  
   (c) $0 < \beta < 266.18$  (d) $592.6 < \beta < 868.2$  
   (e) $43.98 < \beta < 202.08$