Multiple-Choice Test

Chapter 06.03
Linear Regression

1. Given \((x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)\), best fitting data to \(y = f(x)\) by least squares requires minimization of

(A) \(\sum_{i=1}^{n} [y_i - f(x_i)]\)

(B) \(\sum_{i=1}^{n} |y_i - f(x_i)|\)

(C) \(\sum_{i=1}^{n} (y_i - f(x_i))^2\)

(D) \(\sum_{i=1}^{n} [y_i - \bar{y}]^2, \quad \bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}\)

2. The following data

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>x</td>
<td>1</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>y</td>
<td>1</td>
<td>400</td>
<td>800</td>
</tr>
</tbody>
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is regressed with least squares regression to \(y = a_0 + a_1x\). The value of \(a_1\) most nearly is

(A) 27.480
(B) 28.956
(C) 32.625
(D) 40.000

3. The following data is regressed with least squares regression to \(y = a_0 + a_1x\). The value of \(a_1\) most nearly is

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(A) 27.480
(B) 28.956
(C) 32.625
(D) 40.000
4. An instructor gives the same \( y \) vs. \( x \) data as given below to four students and asks them to regress the data with least squares regression to \( y = a_0 + a_1 x \).

\[
\begin{array}{c|cccc}
   x & 1 & 10 & 20 & 30 & 40 \\
   \hline
   y & 100 & 400 & 600 & 1200 \\
\end{array}
\]

They each come up with four different answers for the straight-line regression model. Only one is correct. The correct model is

(A) \( y = 60x - 1200 \)

(B) \( y = 30x - 200 \)

(C) \( y = -139.43 + 29.684x \)

(D) \( y = 1 + 22.782x \)

5. A torsion spring of a mousetrap is twisted through an angle of \( 180^\circ \). The torque vs. angle data is given below.

<table>
<thead>
<tr>
<th>Torsion, ( T ) (N-m)</th>
<th>0.110</th>
<th>0.189</th>
<th>0.230</th>
<th>0.250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle, ( \theta ) (rad)</td>
<td>0.10</td>
<td>0.50</td>
<td>1.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

The relationship between the torque and the angle is \( T = a_0 + a_1 \theta \).

The amount of strain energy stored in the mousetrap spring in Joules is

(A) 0.29872

(B) 0.41740

(C) 0.84208

(D) 1561.8

6. A scientist finds that regressing the \( y \) vs. \( x \) data given below to \( y = a_0 + a_1 x \) results in the coefficient of determination for the straight-line model, \( r^2 \) being zero.

\[
\begin{array}{c|ccc}
   x & 1 & 3 & 11 & 17 \\
   \hline
   y & 2 & 6 & 22 & ? \\
\end{array}
\]

The missing value for \( y \) at \( x = 17 \) most nearly is

(A) \(-2.4444\)

(B) 2.000

(C) 6.889

(D) 34.00

For a complete solution, refer to the links at the end of the book.