Holistic Numerical Methods Institute
committed to bringing numerical methods to undergraduates

Multiple-Choice Test  Take this multiple-choice test on linear regression online

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

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

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

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

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

2. The following data

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>1</td>
<td>400</td>
<td>800</td>
<td>1300</td>
</tr>
</tbody>
</table>

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

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

3. The following data

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
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<tbody>
<tr>
<td>y</td>
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</table>

   is regressed with least squares regression to \(y = a_1 x\). The value of \(a_1\) most nearly is

   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.

<table>
<thead>
<tr>
<th>$x$</th>
<th>1</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>1</td>
<td>100</td>
<td>400</td>
<td>600</td>
<td>1200</td>
</tr>
</tbody>
</table>

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

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

A) 0.2987
B) 0.4174
C) 0.8420
D) 1562

6. A scientist finds that regressing the $y$ vs $x$ data given below to straight-line $y = a_0 + a_1x$ results in the coefficient of determination for the straight-line model, $r^2$ to be zero.

<table>
<thead>
<tr>
<th>$x$</th>
<th>1</th>
<th>3</th>
<th>11</th>
<th>17</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>2</td>
<td>6</td>
<td>22</td>
<td>?</td>
</tr>
</tbody>
</table>

The missing value for $y$ at $x = 17$ most nearly is

A) -2.444
B) 2.000
C) 6.889
D) 34.00