Quiz 4

Please show your work in all the problems to get full credit.

**Problem 1:** The following data set is available:

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>8</td>
<td>2</td>
<td>6</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

(1) [1 points] Draw a scatterplot of this data set.

(2) [2 points] Calculate the linear correlation coefficient. $\Sigma x = 24$, $\Sigma y = 37$, $\Sigma x^2 = 194$, $\Sigma y^2 = 329$, $\Sigma xy = 219$

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}} = \frac{219}{\sqrt{194 \times 329}} \approx 0.6277225$$

(3) [1 points] Set the hypothesis with the correct symbols for testing whether there is a significant linear correlation between the two variables.

$$H_0 : \rho = 0 \text{ Non-significant correlation}$$

$$H_1 : \rho \neq 0 \text{ Significant correlation}$$

(4) [2 points] Use a formal test statistic with a level of significance $\alpha = 0.05$ to determine whether there is a significant linear correlation between $x$ and $y$. $t = 1.396705$.

Critical value $t_{\alpha/2}$ with 3 d.f. = 3.18. Since $|t| < 3.18 \rightarrow$ Fail to reject $H_0$.

**Problem 2:** MULTIPLE CHOICE. For the next two questions, identify the choice that contains a conclusion with a common correlation error.
Problem 3: Use the following sample data to answer the next three questions. The paired data consist of the cost of regionally advertising (in thousands of dollars) a certain pharmaceutical drug and the number of new prescriptions written (in thousands).

<table>
<thead>
<tr>
<th>Cost</th>
<th>9</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>2</th>
<th>5</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>85</td>
<td>52</td>
<td>55</td>
<td>68</td>
<td>67</td>
<td>86</td>
<td>83</td>
<td>73</td>
</tr>
</tbody>
</table>

Use: $\Sigma x = 44$, $\Sigma y = 569$, $\Sigma x^2 = 320$, $\Sigma y^2 = 41681$, $\Sigma x y = 3347$

(1) [2 points] Find the equation of the regression line, letting Cost be the independent ($x$) variable. $b_0 = 55.788$, $b_1 = 2.788$, $\hat{y} = 55.788 + 2.788 x$

(2) [1.5 points] Find the predicted value of the number of new prescriptions written if $5000$ is spent in regional advertising. $\hat{y} = 55.788 + 2.788 \times 5 = 69.728$

(3) [1.5 points] Find the standard error of estimate $Se = 10.04$

Equations

Linear correlation coefficient: $r = \frac{n(\Sigma x y) - (\Sigma x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2}\sqrt{n(\Sigma y^2) - (\Sigma y)^2}}$

t-test for correlation: $t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$ with $n - 2$ degrees of freedom

Linear regression equation: $\hat{y} = b_0 + b_1 x$ where $b_1 = \frac{n(\Sigma x y) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2}$ and $b_0 = \hat{y} - b_1 \bar{x}$

Standard error of estimate: $Se = \sqrt{\frac{\Sigma y^2 - b_0 \Sigma y - b_1 \Sigma x y}{n-2}}$