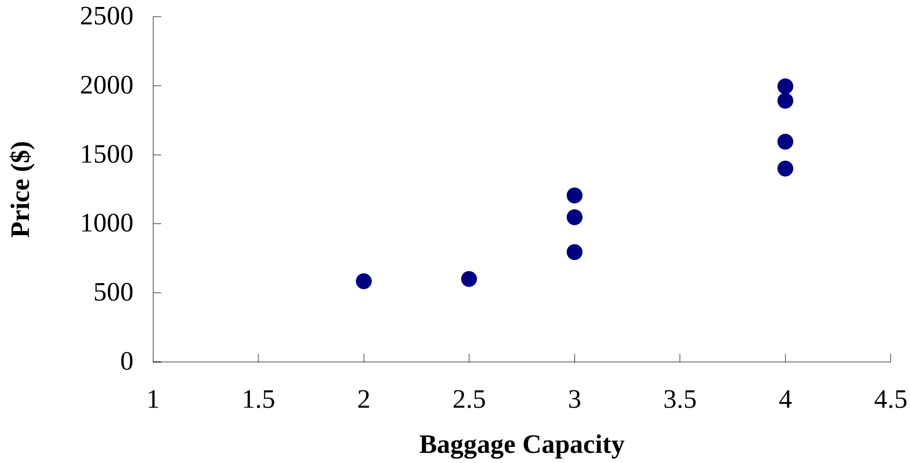
Problem Set 9-Solutions

Chapter 12

5. a.



b. Let x = baggage capacity and y = price ($).

There appears to be a linear relationship between x and y.

c. Many different straight lines can be drawn to provide a linear approximation of the relationship between x and y; in part (d) we will determine the equation of a straight line that “best” represents the relationship according to the least squares criterion.

d. Summations needed to compute the slope and y-intercept are:

$$\Sigma x_i = 29.5 \qquad \Sigma y_i = 11{,}110 \qquad \Sigma(x_i - \bar{x})(y_i - \bar{y}) = 2909.8889 \qquad \Sigma(x_i - \bar{x})^2 = 4.5556$$

$$b_1 = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\Sigma(x_i - \bar{x})^2} = \frac{2909.9889}{4.5556} = 638.7561$$

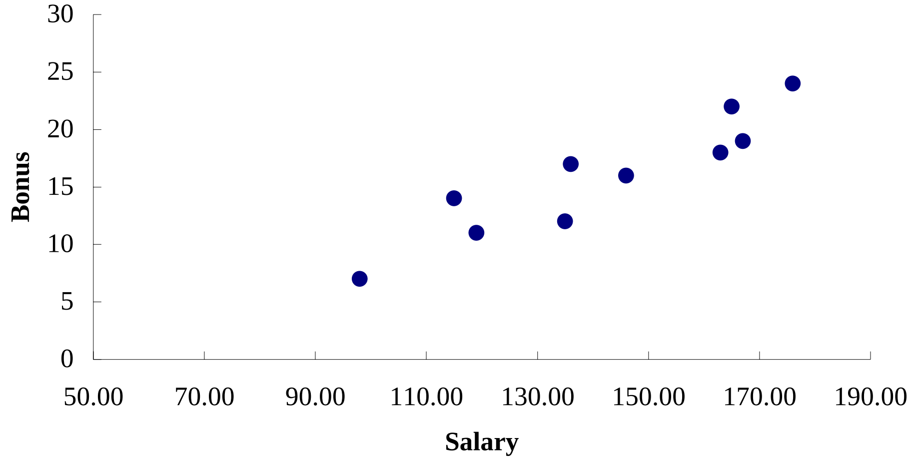
$$b_0 = \bar{y} - b_1\bar{x} = 1234.4444 - (638.7561)(3.2778) = -859.26$$

$$\hat{y} = -859.26 + 638.76x$$

e. A one point increase in the baggage capacity rating will increase the price by approximately $639.

f. $\hat{y} = -859.26 + 638.76x = -859.26 + 638.76(3) = \$1057$

6. a.



b. Let x = salary and y = bonus.

There appears to be a linear relationship between x and y.

c. Summations needed to compute the slope and y-intercept are:

$\Sigma x_i = 1420 \quad \Sigma y_i = 160 \quad \Sigma(x_i - \bar{x})(y_i - \bar{y}) = 1114 \quad \Sigma(x_i - \bar{x})^2 = 6046$

$$b_1 = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\Sigma(x_i - \bar{x})^2} = \frac{1114}{6046} = .18425$$

$$b_0 = \bar{y} - b_1\bar{x} = 16 - (.18425)(142) = -10.16$$

$$\hat{y} = -10.16 + .18x$$

d. \$1000 increase in salary will increase the bonus by \$180.

e $\hat{y} = -10.16 + .18x = -10.16 + .18(120) = 11.95$ or approximately \$12,000

15. a. The estimated regression equation and the mean for the dependent variable are:

$\hat{y}_i = 0.2 + 2.6x_i \qquad \bar{y} = 8$

The sum of squares due to error and the total sum of squares are

$\text{SSE} = \Sigma(y_i - \hat{y}_i)^2 = 12.40 \qquad \text{SST} = \Sigma(y_i - \bar{y})^2 = 80$

Thus, SSR = SST - SSE = 80 - 12.4 = 67.6

b. r^2 = SSR/SST = 67.6/80 = .845

The least squares line provided a very good fit; 84.5% of the variability in *y* has been explained by the least squares line.

c. $r = \sqrt{.845} = +.9192$

17. The estimated regression equation and the mean for the dependent variable are:

$$\hat{y}_i = .75 + .51x \qquad \bar{y} = 3.4$$

The sum of squares due to error and the total sum of squares are

$$\text{SSE} = \Sigma(y_i - \hat{y}_i)^2 = 5.3 \qquad \text{SST} = \Sigma(y_i - \bar{y})^2 = 11.2$$

Thus, SSR = SST - SSE = 11.2 - 5.3 = 5.9

r^2 = SSR/SST = 5.9/11.2 = .527

We see that 52.7% of the variability in *y* has been explained by the least squares line.

$$r = \sqrt{.527} = +.7259$$

18. a. The estimated regression equation and the mean for the dependent variable are:

$$\hat{y} = 1790.5 + 581.1x \qquad \bar{y} = 3650$$

The sum of squares due to error and the total sum of squares are

$$\text{SSE} = \Sigma(y_i - \hat{y}_i)^2 = 85{,}135.14 \qquad \text{SST} = \Sigma(y_i - \bar{y})^2 = 335{,}000$$

Thus, SSR = SST - SSE = 335,000 - 85,135.14 = 249,864.86

b. r^2 = SSR/SST = 249,864.86/335,000 = .746

We see that 74.6% of the variability in *y* has been explained by the least squares line.

c. $r = \sqrt{.746} = +.8637$

23. a. s^2 = MSE = SSE / (n - 2) = 12.4 / 3 = 4.133

b. $s = \sqrt{\text{MSE}} = \sqrt{4.133} = 2.033$

c. $\Sigma(x_i - \bar{x})^2 = 10$

$$s_{b_1} = \frac{s}{\sqrt{\Sigma(x_i - \overline{x})^2}} = \frac{2.033}{\sqrt{10}} = 0.643$$

d. $t = \frac{b_1}{s_{b_1}} = \frac{2.6}{.643} = 4.04$

Using t table (3 degrees of freedom), the test statistic t is greater than the critical value, $t_{0.025}$, we reject H_0: $\beta_1 = 0$