

*Key*

The number of persons in households with children in high school was used to estimate the number of vehicles that the family had insured. The bivariate data recorded below are number of persons in the household (X) and number of insured vehicles (Y). Use this data to answer the next five questions.

X	6	3	4	7	5	$\Sigma X = 25$
Y	3	2	3	4	2	$\Sigma Y = 14$
$X^2$	36	9	16	49	25	$\Sigma X^2 = 135$
$Y^2$	9	4	9	16	4	$\Sigma Y^2 = 42$
$XY$	18	6	12	28	10	$\Sigma XY = 74$

1. What is the sum of squares for the x-variable?

$$\Sigma X^2 = 135$$

2. What is the sum of squares for the y-variable?

$$\Sigma Y^2 = 42$$

3. What is the sum of the cross-product?

$$\Sigma XY = 74$$

4. What is the corrected sum of squares for the x-variable?

$$SS_X = \Sigma X^2 - \frac{(\Sigma X)^2}{n} = 135 - \frac{25^2}{5} = 10$$

5. What is the corrected sum of squares for the y-variable?

$$SS_Y = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n} = 42 - \frac{14^2}{5} = 2.8$$

6. What is the corrected sum of squares for the cross product?

$$SS_{XY} = \Sigma XY - \frac{\Sigma X (\Sigma Y)}{n} = 74 - \frac{25(14)}{5} = 4.$$

Lesson 18.1 exercise, page 2

7. What is the least squares estimate of the slope in the linear regression equation to estimate the number of insured vehicles from the number of persons in the household?

$$\hat{\beta}_1 = \frac{SS_{xy}}{SS_x} = \frac{4}{10} = .4$$

8. What is the least squares estimate of the y-intercept in the linear regression equation to estimate the number of insured vehicles from the number of persons in the household?

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} = \frac{14}{5} - .4 \left( \frac{25}{5} \right) = .8$$

9. Write the estimated regression equation to estimate the number of insured vehicles from the number of persons in the household.

$$\hat{y} = .8 + .4x$$

10. Use the estimated regression equation to estimate the average number of insured vehicles if there are 5 people living in the household.

$$\hat{y}_{x=5} = .8 + .4(5) = 2.8$$

11. Use the estimated regression equation to estimate the average number of insured vehicles if there are 7 people living in the household.

$$\hat{y}_{x=7} = .8 + .4(7) = 3.6$$