

QUANTITATIVE METHODS

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Quiz 8

Solutions

Question 1 (15 points)

Some students claim they can tell the cost of a textbook just by looking at its thickness. To test this claim they picked 4 hardbound books of the same height and width at random. The cost and thickness for each book was

x (Thickness in cm)	y (Cost in \$)	x^2	xy	y^2
1.3	72	1.69	93.6	5184
3.5	88	12.25	308	7744
2.6	65	6.76	169	4225
4.1	105	16.81	430.5	11025
$\sum x = 11.5$	$\sum y = 330$	$\sum x^2 = 37.51$	$\sum xy = 1001.1$	$\sum y^2 = 28178$

$$SS_x = \sum x^2 - \frac{(\sum x)^2}{n} = 37.51 - \frac{1001.1^2}{4} = 4.448$$

$$\bar{x} = \frac{\sum x}{n} = \frac{11.5}{4} = 2.875$$

$$SS_y = \sum y^2 - \frac{(\sum y)^2}{n} = 28178 - \frac{330^2}{4} = 953$$

$$\bar{y} = \frac{\sum y}{n} = \frac{330}{4} = 82.5$$

$$S_{xy} = \sum xy - \frac{\sum x \sum y}{n} = 1001.1 - \frac{11.5 \cdot 330}{4} = 52.35$$

- a) Find the equation of the least-squares line.

$$\text{Slope : } b = \frac{SS_{xy}}{SS_x} = \frac{52.35}{4.448} = 11.8$$

$$y\text{-intercept : } a = \bar{y} - b\bar{x} = 82.5 - 11.8(2.875) = 48.7$$

Thus the least-squares line is given by $y = 48.7 + 11.8x$

- b) Draw a scatter diagram that includes the least-squares line.
c) If a book has a thickness of 2.2 cm, what is the predicted cost of the book?

$$\hat{y} = 48.7 + 11.8(2.2) = \$74.66$$

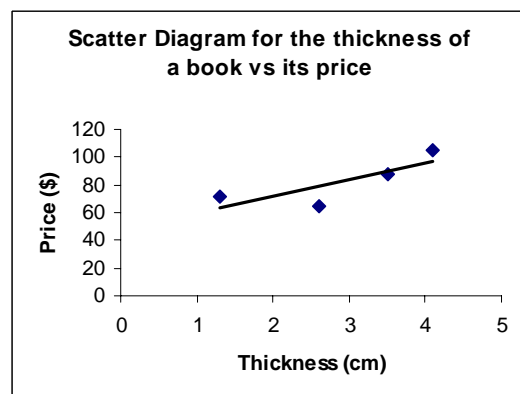
- d) Find the coefficient of correlation.

$$r = \frac{SS_{xy}}{\sqrt{SS_x SS_y}} = \frac{52.35}{\sqrt{4.448 \cdot 953}} = 0.804$$

- e) Find the coefficient of determination.

$$r^2 = 0.804^2 = 0.647 = 64.7\%$$

- f) Is the correlation positive or negative? Perfect, high, moderate or low?



Positive and High