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Exercises

1. The following measurements of the specific heat of a certain chemical were made in order to investigate the variation in specific heat with temperature.

Temperature °C	0	10	20	30	40
Specific heat	0·51	0·55	0·57	0·59	0·63

Plot the points on a scatter diagram and verify that the relationship is approximately linear. Estimate the regression line of specific heat on temperature, and hence estimate the value of the specific heat when the temperature is 25°C.

2. When the values of the controlled variable are equally spaced, the calculation of the regression line can be considerably simplified by coding the data in integers symmetrically about zero. When the values of the controlled variable sum to zero, the estimates of the regression coefficients are given by

$$\hat{a}_0 = \bar{y}, \qquad \hat{a}_1 = \frac{\sum x_i y_i}{\sum x_i^2}.$$

For example, with five equally spaced values of the controlled variable the coded values could be $2, -1, 0, -1, -2$, with six values the coded measurements could be $-5, -3, -1, -1, 3, 5$.

Use this technique to find the regression line in the following case.

Output (1000 tons)	11·1	12·3	13·7	14·6	15·6
Year	1960	1961	1962	1963	1964

Estimate the output of the company in 1965.

3. The following are the measurements of the height and weight of ten men.

Height (inches)	63	71	72	68	75	66	68	76	71	70
Weight (pounds)	145	158	156	148	163	155	153	158	150	154

(a) Calculate the correlation coefficient and show that it is significantly different from zero. ($\alpha = 0.05$)

(b) Find the linear regression of height on weight.

(c) Find the linear regression of weight on height.

4. In this example we have coded measurements on a dependent variable y, and two controlled variables x_1 and x_2.

Test	y	x_1	x_2
1	1·6	1	1
2	2·1	1	2
3	2·4	2	1
4	2·8	2	2
5	3·6	2	3
6	3·8	3	2
7	4·3	2	4
8	4·9	4	2
9	5·7	4	3
10	5·0	3	4

Find the linear regression of y on x_1 and x_2.