Assignment 2 (ICSE 2019 Grade 12)

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PROBLEM 2(A)

The following results were obtained with respect to two variable x and y

sigma	$\sum x$	$\sum y$	$\sum xy$	$\sum x^2$	$\sum y^2$	$\sum n$
value	15	25	83	55	135	5

TABLE I

ALL VALUES OF SIGMAS IN A TABLE

1) Find the regression coefficient b_{xy}
2) Find the regression equation of x on y

SOLUTION

Part 1

the formulae for calculating b_{xy} is

$$b_{xy} = \frac{\sum xy - \frac{\sum x \times \sum y}{n}}{\sum y^2 - \frac{(\sum y)^2}{n}} \tag{1}$$

substituting the values in eq(1)

$$b_{xy} = \frac{83 - \frac{15 \times 25}{5}}{135 - \frac{(25)^2}{5}} = \frac{4}{5} = 0.8 \tag{2}$$

$\therefore$ the value of b_{xy} is 0.8

Part 2

in this part we need to find the regression equation of x on y formulae for that is

The Normal equation of a line is given by

$$\mathbf{n}^\top \mathbf{x} = c \tag{3}$$

where $\mathbf{n}$ is the normal vector of the line. so we need to calculate $\mathbf{n}$ for that we need The direction vector of regression equation of that line which is $\mathbf{m}$, and is given by

$$\mathbf{m} = \begin{pmatrix} 4 \\ 5 \end{pmatrix} \tag{4}$$

$$\mathbf{m}^\top \mathbf{n} = 0 \tag{5}$$

om keeping value for solving $\mathbf{n}$ and $\mathbf{n}^\top$ we get

$$\implies \begin{pmatrix} 4 & 5 \end{pmatrix} \mathbf{n} = 0 \tag{6}$$

$$\implies \mathbf{n} = \begin{pmatrix} 5 \\ -4 \end{pmatrix} \tag{7}$$

$$\implies \mathbf{n}^\top = \begin{pmatrix} 5 & -4 \end{pmatrix} \tag{8}$$

for calculating c we use a point on line $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$ and based on that we get value of c as

$$c = \begin{pmatrix} 5 & -4 \end{pmatrix} \begin{pmatrix} 3 \\ 5 \end{pmatrix} \tag{9}$$

$$c = -5 \tag{10}$$

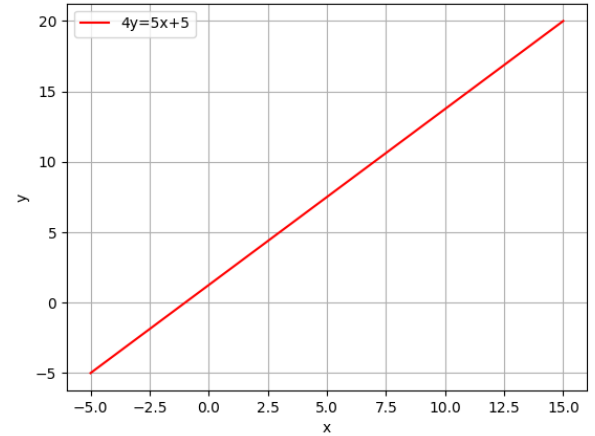Thus, line L $\equiv \begin{pmatrix} 5 & -4 \end{pmatrix} \mathbf{x} = -5$

Fig. 1. graph of regression equation of x on y