Ex.(3) Out of the two regression equations, given by $x+2y-5=0$, $2x+3y-8=0$ which one is the regression equation of x on y

Sol^n^. Suppose that $x+2y-5=0$ is regression of x on y

$$\Rightarrow x = -2y + 5 \quad \text{--- (1)}$$

$\therefore$ Regression coefficient x on y

$$b_{xy} = r\frac{\sigma_x}{\sigma_y} = -2 \quad \text{--- (2)}$$

Let $2x+3y-8=0$ be regression eq^n^ of y on x

$$\Rightarrow 3y = -2x + 8 \Rightarrow y = -\frac{2}{3}x + \frac{8}{3} \quad \text{--- (3)}$$

Regression coefficient y on x,

$$b_{yx} = r\cdot\frac{\sigma_y}{\sigma_x} = -\frac{2}{3} \quad \text{--- (4)}$$

from (2) + (4)

$b_{xy}\cdot b_{yx} = r^2 = \frac{4}{3} = \pm 1.15$ which is not possible $\because -1 \le r \le 1$

Now suppose $2x+3y-8=0$ be regression eq^n^ of x on y

$$\Rightarrow 2x = -3y + 8 \Rightarrow b_{xy} = r\frac{\sigma_x}{\sigma_y} = -\frac{3}{2}$$

$x + 2y - 5 = 0$ be regression of y on x

$\Rightarrow \quad x = -2y + 5$

$\Rightarrow y = -\frac{1}{2}x + 5 \Rightarrow b_{yx} = -\frac{1}{2}$ — (6)

$\Rightarrow \quad b_{xy} \cdot b_{yx} = r^2 = \frac{3}{4} \Rightarrow r = \pm 0.87$

$\therefore \; 2x + 3y - 8 = 0$ is the line of regression of x on y

Ex. (4) Two regression lines are $4x - 5y + 33 = 0$
$20x - 9y = 107$, variance of x is 25

Find (i) $\bar{x}, \bar{y}$ ii) r

Sol^n Let $4x - 5y + 33 = 0$ be line of regression of y on x

$5y = -4x - 33 \Rightarrow y = -\frac{4}{5}x - \frac{33}{5}$.

$\Rightarrow \quad b_{yx} = \frac{4}{5}$ — (1)

$20x - 9y = 107$ be the line of regression of x on y

$20x = 9y + 107 \Rightarrow x = \frac{9}{20}y + \frac{107}{20}$

$\Rightarrow \quad b_{xy} = \frac{9}{20}$ — (2)

$r^2 = \frac{4}{5} \times \frac{9}{20} = 0.36 \Rightarrow r = 0.6$

Solving $4x - 5y = -33$ & $20x - 9y = 107$

$\Rightarrow \bar{x} = 13, \ \bar{y} = 17$

Ex.

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