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Tutorial - 3

Ans 1 $b_{xy} = \frac{cov.(x,y)}{\sigma_y^2}$

Ans 2 $b_{xy} = \frac{-8}{15}$, $b_{yx} = \frac{-5}{6}$, $r = ?$

$b_{xy} \cdot b_{yx} = r^2$

$\left(\frac{-8}{15}\right)\left(\frac{-5}{6}\right) = r^2$

$r = \sqrt{\frac{40}{90}}$

$r = \pm 0.666 \approx 0.667$

Ans 3 $9x + y - \lambda = 0$
$4x + y = \mu$

let suppose $9x + y - \lambda$ be line of regression of y on x and $4x + y = \mu$ be line of regression of x on y.

$$y = \lambda - 9x \quad \text{and} \quad x = \frac{214}{40} + \frac{18}{40}y$$

Ans3

$$9x + y - \lambda = 0$$
$$4x + y = \mu$$
$$\bar{x} = 2, \bar{y} = -3$$

$\because$ Both both regression line pass through point $(\bar{x}, \bar{y})$

$$9\bar{x} + \bar{y} - \lambda = 0$$
$$4\bar{x} + \bar{y} - \mu = 0$$

$$\lambda = 9\bar{x} + \bar{y}$$

$$\lambda = 9(2) + (-3)$$
$$\lambda = 15$$

$$4\bar{x} + \bar{y} = \mu$$
$$4(2) + (-3) = \mu$$

$$\mu = 5$$

Ans4 $\because$ Line of regression y on x is $8x - 10y + 66 = 0$
Line of regression x on y is $40x - 18y - 214 = 0$

$$\therefore \quad y = \frac{8}{10}x + \frac{66}{10}, \quad x = \frac{18}{40}y + \frac{214}{40}$$

$y = 0.8x + 6.6$, $x = 0.45y + 5.35$

$b_{yx} = 0.8$, $b_{xy} = 0.45$

Correlation coeff. x and y is

$$r = \sqrt{b_{xy} \times b_{yx}} = \sqrt{0.45 \times 0.8}$$

Since both regression are positive, $r = \pm 0.6$

Ans 5. Line of regression y on x is $3x + 2y = 26$
Line of regression x on y is $6x + y = 31$

$$\sigma_x^2 = 25$$

$$\Rightarrow \sigma_x = 5$$

$$\Rightarrow \quad y = \frac{26}{2} - \frac{3x}{2} \quad , \quad x = \frac{31}{6} - \frac{1}{6}y$$

$$y = 13 - 1.5x \quad , \quad x = 5.166 - 0.166y$$

$$b_{yx} = -1.50 \quad , \quad b_{xy} = -0.16$$

Correlation coeff. $r = \sqrt{b_{xy} \cdot b_{yx}}$

$$r = \sqrt{(-1.50)(-0.16)}$$

$$r = \pm 0.48$$

Since both regression are negative

$\Rightarrow r = -0.48$

$\because \sigma_x = 5$

$\therefore b_{yx} = r \cdot \frac{\sigma_y}{\sigma_x}$

$= -1.5 = (-0.48) \cdot \frac{\sigma_y}{5}$

$\Rightarrow \sigma_y = 15.5$