

Regression :-

Heights of father and son is given in cm.

x (ht of father)	150	152	155	157	160	161	164	166
y (ht of son)	154	156	158	159	160	162	161	164

Find 2 Reg line or calculated
expected average height of the son when the
height of father is 154 cm.

Ans:-

x on y

$$(x - \bar{x}) = b_{xy} (y - \bar{y})$$

$$b_{xy} = r \frac{\sigma_x}{\sigma_y}$$

y on x

$$(y - \bar{y}) = b_{yx} (x - \bar{x})$$

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

$$\rho = \frac{\text{cov}(x, y)}{\sigma_x \sigma_y}$$

$$\text{cov}(x, y) = E(xy) - E(x) \cdot E(y)$$

x	y	x ²	y ²	xy
150	154	22500	23716	23100
152	156	23104	24336	23712
155	158	24025	24964	24490
157	159	24649	25281	24963
160	160	25600	25600	25600
161	162	25921	26244	26082
164	161	26896	25921	26404
166	164	27556	26896	27224
1265	1274	200251	202958	201575

$$\bar{x} = 158.125$$

$$\sigma_x = 5.2782$$

$$\bar{y} = 159.25$$

$$\sigma_y = 3.0311$$

$$\boxed{r = 0.9669}$$

$$b_{xy} = r \frac{\sigma_x}{\sigma_y} = (0.9669) \frac{(5.2782)}{(3.0311)}$$

$$\boxed{b_{xy} = 1.6837}$$

$$b_{yx} = r \frac{\sigma_y}{\sigma_x} = (0.9669) \frac{(3.0311)}{(5.2782)}$$

$$\boxed{b_{yx} = 0.5553}$$

X OR Y

$$(x - \bar{x}) = b_{xy} (y - \bar{y})$$

$$(x - 158.125) = 1.6837 (y - 159.25)$$

y on x

$$(y - \bar{y}) = b_{yx} (x - \bar{x})$$

$$(y - 159.250) = 0.5553 (x - 158.125)$$

expected average height of the son when the height of father is 154 cm.

$$(y - \bar{y}) = b_{yx} (x - \bar{x})$$

$$(y - 159.2500) = 0.5553 (x - 158.1250)$$

$$y = 0.5553x - 86.9687 + 159.2500$$

$$y = 0.5553x + 72.2813$$

$$y = 0.5553(154) + 72.2813$$

$$y = 156.9813$$

Average height of the son is 156.98 cm when the father height is 154 cm.

Correlation:-

Note:

let x on y

$$ax + by = c$$

$$ax = c - by$$

$$x = \frac{c}{a} - \frac{b}{a}y$$

$$bxy = -\frac{b}{a}$$

let y on x

$$ax + by = c$$

$$by = c - ax$$

$$y = \frac{c}{b} - \frac{a}{b}x$$

$$byx = -\frac{a}{b}$$

* Find $b_{yx} \cdot b_{xy}$ it is greater than 1
our assumption is wrong, reverse & proceed

Q In a correlation analysis the equations are $3x + 12y = 19$, $3y + 9x = 46$. Find correlation coefficient & mean value of x & y .

Sol:-

X on Y

$$3x + 12y = 19$$

$$19 - 12y = 3x$$

$$x = \frac{-12y + 19}{3}$$

$$\boxed{b_{xy} = -4}$$

Y on X

$$3y + 9x = 46$$

$$3y = 46 - 9x$$

$$y = \frac{46}{3} - \frac{9x}{3}$$

$$\boxed{b_{yx} = -3}$$

$$b_{xy} \cdot b_{yx} = (-4)(-3) \\ = 12 > 1$$

\therefore Assumption is wrong

let x on y

$$3y + 9x = 46$$

$$9x = 46 - 3y$$

$$x = \frac{46}{9} - \frac{3}{9}y$$

$$b_{xy} = -3/9$$

let y on x

$$3x + 12y = 19$$

$$12y = 19 - 3x$$

$$y = \frac{19}{12} - \frac{3}{12}x$$

$$b_{yx} = -3/12$$

$$b_{xy} b_{yx} = (-3/9)(-3/12) = (-1/3)(-1/4) \\ = 1/12$$

$$b_{xy} b_{yx} = 0.083$$

$$r = \pm \sqrt{0.083}$$

$$r = -0.288$$

To find mean:-

$$3\bar{x} + 12\bar{y} = 19$$

$$3\bar{y} + 9\bar{x} = 46$$

$$\begin{array}{l} \bar{x} = 5 \\ \bar{y} = 0.33 \end{array}$$