Semester IV Subject Statistics for AI & DS Academic Year 2023-2024

Example :-

Find the coefficient of correlation and obtain the equation of line of regression for the given data :

x	6	2	10	4	8
y	9	11	5	8	7

Solution :

To find correlation of coefficient :

$$r = \frac{\Sigma XY}{\sqrt{\Sigma X^2 \Sigma Y^2}}$$

$$X = x - \bar{x} \qquad Y = y - \bar{y}$$

$$\Rightarrow \bar{x} = \frac{\Sigma x}{n} = \frac{30}{5} = 6 \qquad \Rightarrow \bar{y} = \frac{\Sigma y}{n} = \frac{40}{5} = 8$$

x	y	$X = x - \bar{x}$ (i)	$Y = y - \bar{y}$ (ii)	X^2	Y^2	XY
6	9	0	1	0	1	0
2	11	-4	3	16	9	-12
10	5	4	-3	16	9	-12
4	8	-2	0	4	0	0
8	7	2	-1	4	1	-2
			Total	40	20	-26

∴ Coefficient of Correlation:

$$r = \frac{-26}{\sqrt{40 \times 20}}$$

$$\boxed{r = -0.919}$$

Equation of Regression line Y on X,

$$(y - \bar{y}) = \frac{\Sigma xy}{\Sigma x^2}(x - \bar{x})$$

Regression coefficient Y on X

(or) $$\boxed{(y - \bar{y}) = r\frac{\sigma y}{\sigma x}(x - \bar{x})}$$

$$(y - 8) = \frac{-26}{40}(x - 6)$$

$$(y - 8) = -0.65(x - 6)$$

$$(y - 8) = -0.65x + 13.9$$

$$\boxed{y = -0.65x + 11.9}$$

$$\boxed{a_1 = r\frac{\sigma y}{\sigma x}}$$

Equation of Regression Line X on Y,

$$(x - \bar{x}) = \frac{\Sigma xy}{\Sigma y^2}(y - \bar{y})$$

Regression coefficient X on Y

(or) $$\boxed{(x - \bar{x}) = r\frac{\sigma x}{\sigma y}(x - \bar{y})}$$

$$(x - 6) = \frac{-26}{20}(y - 8)$$

$$(x - 6) = -1.3(y - 8)$$

$$x - 6 = -1.3y + 10.4$$

$$\boxed{x = -1.3y + 16.4}$$

$$\boxed{b_1 = r\frac{\sigma x}{\sigma y}}$$

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Example:

Find the equation of line of regression and the coefficient of correation for the following data:

x	2	4	5	6	8	11
y	18	12	10	8	7	5

Solution:

Here $n = 6$.

$$\bar{x} = \frac{\Sigma x}{n} = \frac{36}{6} = 6$$

$$\bar{y} = \frac{\Sigma y}{n} = \frac{60}{6} = 10.$$

x	y	$X = x - \bar{x}$ (6)	$Y = y - \bar{y}$ (10)	X^2	Y^2	XY
2	18	-4	8	16	64	-32
4	12	-2	2	4	4	-4
5	10	-1	0	1	0	0
6	8	0	-2	0	4	0
8	7	2	-3	4	9	-6
11	5	5	-5	25	25	-25
			Total.	50	106	-67

$$r = \frac{\Sigma XY}{\sqrt{\Sigma X^2 . \Sigma Y^2}} = \frac{-67}{\sqrt{50 \times 106}}$$

$$r = -0.9283$$

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Equation of Regression Line Y on X,

$$(y-\bar{y}) = \frac{\Sigma XY}{\Sigma X^2}(x-\bar{x})$$

$$(y-10) = \frac{-67}{50}(x-6)$$

$$(y-10) = -1.34(x-6)$$

$$y-10 = -1.34x + 8.04$$

$$\boxed{y = 1.34x + 18.04}$$

Equation of Regression Line X on Y,

$$(x-\bar{x}) = \frac{\Sigma XY}{\Sigma y^2}(y-\bar{y})$$

$$(x-6) = \frac{-67}{106}(y-10)$$

$$(x-6) = -0.632(y-10)$$

$$x-6 = -0.632y + 6.32$$

$$\boxed{x = -0.632y + 12.32}$$