



Regression :

definition :

Regression is to study the nature of relationship between the two variables. Regression is based on one dependent and another independent variables. Thus it is possible to study the cause and effect. But presence of association does not imply causation.

Regression Lines :

* The regression equation of x on y is given by

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

where $b_{xy} = \frac{\sum xy}{\sum y^2}$, $x = x - \bar{x}$, $y = y - \bar{y}$

* The regression equation of y on x is given by

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

where $b_{yx} = \frac{\sum xy}{\sum x^2}$, $x = x - \bar{x}$, $y = y - \bar{y}$

* Correlation coefficient is the geometric mean between the regression coefficient.

(i.e) : $r = \sqrt{b_{xy} \times b_{yx}}$



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* Both the regression coefficients will have the same sign and correlation coefficient and also has the same sign as that of regression coefficient.

problem : 1

Calculate the regression equations of x on y and y on x from the following data and estimate x when $y = 26$.

x	10	12	13	17	18	20	24	30
y	5	6	7	9	13	15	20	21

Calculate the coefficient of correlation also.

Solution: $\bar{x} = \frac{144}{8} = 18$, $\bar{y} = \frac{96}{8} = 12$
 $\bar{x} = 18$ $\bar{y} = 12$

x	y	$x = x - \bar{x}$	$y = y - \bar{y}$	x^2	y^2	xy
10	5	-8	-7	64	49	56
12	6	-6	-6	36	36	36
13	7	-5	-5	25	25	25
17	9	-1	-3	1	9	3
18	13	0	1	0	1	0
20	15	2	3	4	9	6
24	20	6	8	36	64	48
30	21	12	9	144	81	108
				$\Sigma x^2 = 310$	$\Sigma y^2 = 274$	$\Sigma xy = 282$



The regression line x on y is

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

$$\text{where } b_{xy} = \frac{\sum xy}{\sum y^2} = \frac{282}{274} = 1.029$$

$$x - 18 = 1.029 (y - 12)$$

$$x - 18 = 1.029y - 12.348$$

$$x = 1.029y - 12.348 + 18$$

$$x = 1.029y + 5.652$$

The regression line y on x is

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

$$\text{where } b_{yx} = \frac{\sum xy}{\sum x^2} = \frac{282}{310} = 0.91$$

$$y - 12 = 0.91 (x - 18)$$

$$y - 12 = 0.91x - 16.38$$

$$y = 0.91x - 16.38 + 12$$

$$y = 0.91x - 4.38$$

Estimated value of x when $y = 26$

$$x = 1.029(26) + 5.652$$

$$= 26.754 + 5.652$$

$$x = 32.406$$

Correlation coefficient is, $r = \sqrt{b_{xy} \cdot b_{yx}}$

$$= \sqrt{1.029 \times 0.91}$$

$$r = 0.968$$