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CORE CONCEPT OF

BUSINESS MATHMATICS & STATISTICS

Regression Line: There are two regression lines such as:

1) Regression line of X on Y
2) Regression line of Y on X
3)

Regression Equation: As regression line there are two regression equations such as:

1) **When all the values are given except x & y**
   a) Regression equation of x on y- (b) Regression equation of y on x-
   $(x-\bar{x}) = r * \frac{\sigma x}{\sigma y}(y-\bar{y})$ $(y-\bar{y}) = r * \frac{\sigma y}{\sigma x}(x-\bar{x})$
2) **When mean is in whole number(deviations are taken from actual mean or mean is not in decimal)**
   a) Regression equation of x on y- (b) Regression equation of y on x-
   $(x-\bar{x}) = \frac{\Sigma dxdy}{\Sigma dy\,2}(y-\bar{y})$ $(y-\bar{y}) = \frac{\Sigma dxdy}{\Sigma dx\,2}(x-\bar{x})$
3) **When deviations are taken from assume mean(A) or mean is in decimal)**
   a) Regression equation of x on y- (b) Regression equation of y on x-
   $(x-\bar{x}) = \frac{\Sigma dxdy * N-(\Sigma dx * \Sigma dy)}{\Sigma dy\,2 * N-(\Sigma dy)2}(y-\bar{y})$ $(y-\bar{y}) = \frac{\Sigma dxdy * N-(\Sigma dx * \Sigma dy)}{\Sigma dx\,2 * N-(\Sigma dx)2}(x-\bar{x})$

Example-25: Find two regression equations from the following information:

Variable	x	y
Mean	47	96
Variance	64	81

Coefficient of correlation between x and y = 0.36.
Calculate y when x = 45and X when y=88.

Solution-25: Given: $\bar{x}$=47, $\bar{y}$=96, $\sigma x=\sqrt{64}$ = 8, $\sigma y=\sqrt{81}$ = 9, r= 0.36

a) Regression equation of x on y- (b) Regression equation of y on x-

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

$(x-47) = .36 * \frac{8}{9}(y-96)$ $(y-96) = .36 * \frac{9}{8}(x-47)$

$(x-47) = .36 * .89(y-96)$ $(y-96) = .36 * 1.13(x-47)$

(x-47) = 0.32(y-96)
(x-47) = 0.32y-30.72
x = 0.32y-30.72+47
x = 0.32y-16.28

(y-96) = .405(x-47)
(y-96) = .405x-19.035
y= .405x-19.035+96
y= .405x+76.965

Value of Y, when X=45

Y=.405*45+76.965=95.19

Value of X, when Y=88

X=.32*88+16.28=44.44

Example-26: Find two regression equations from the following data and estimate the value of X, if Y is 6:

X	78	89	99	60	59	79	68	61
Y	125	137	156	112	107	136	123	108

Solution-26:

	A=75				**A=114**		
x	**dx(x-A)**	**(dx)2**	**y**	**dy(y-A)**	**(dy)2**	**dxdy**
78	3	9	125	11	121	33
89	14	196	137	23	529	322
99	24	576	156	42	1764	1008
60	-15	225	118	4	16	-60
59	-16	256	112	-2	4	32
79	4	16	136	22	484	88
68	-7	49	123	9	81	-63
61	-14	196	108	-6	36	84
593	**-7**	**1523**	**1015**	**103**	**3035**	**1444**

$\bar{x} = \sum x/n$ **$\bar{x}$ = 593/8 =74.13** $\bar{y}=\sum y/n$ $\bar{y}$= 1015/8 = 126.88

a) **Regression equation of x on y-**

$$(x-\bar{x}) = \frac{\Sigma dxdy * N-(\Sigma dx * \Sigma dy)}{\Sigma dy\,2 * N-(\Sigma dy)2}(y-\bar{y})$$

$$(x-74.13) = \frac{1444*8-(-7*103)}{3035*8-(103)2}(y-126.88)$$

$$(x-74.13) = \frac{11552+721}{24280-10609}(y-126.88)$$

$$(x-74.13) = \frac{12273}{13671}(y-126.88)$$

$$(x-74.13) = 0.898\,(y-126.88)$$

$$x-74.13 = 0.898\,y-113.94$$

$$x = 0.898\,y-113.94+74.13$$

$$\mathbf{x = 0.898\,y-39.81}$$

(b) Regression equation of y on x-

$$(y-\bar{y}) = \frac{\Sigma dxdy * N-(\Sigma dx * \Sigma dy)}{\Sigma dx\,2 * N-(\Sigma dx)2}(x-\bar{x})$$

$$(y-126.88) = \frac{1444*8-(-7*103)}{1523*8-(-7)2}(x-74.13)$$

$$(y-126.88) = \frac{11552+721}{12184-49}(x-74.13)$$

$$(y-126.88) = \frac{12273}{12135}(x-74.13)$$

$$(y-126.88) = 1.011(x-74.13)$$

$$y-126.88 = 1.011x-74.95$$

$$y = 1.011x-74.95+126.88$$

$$\mathbf{y = 1.011x-51.93}$$

Value of X, when Y=6

$x = 0.898 * 6 - 39.81$

$x = 5.388 - 39.81$

$x = -34.42$

Regression Coefficient-

a) **Regression coefficient of x on y-**

$$b_{xy} = \frac{\Sigma dxdy * N - (\Sigma dx * \Sigma dy)}{\Sigma dy^2 * N - (\Sigma dy)^2}$$

(b) Regression coefficient of y on x-

$$b_{yx} = \frac{\Sigma dxdy * N - (\Sigma dx * \Sigma dy)}{\Sigma dx^2 * N - (\Sigma dx)^2}$$