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B.COM. PART 1

CORE CONCEPT OF BUSINESS MATHMATICS & STATISTICS

Regression Analysis

Regression Analysis is the measure of average relationship between two or more variables in terms of the original units of the data. The technique of correlation is used to measure statistical relationship which provides information regarding the degree and direction of relationship between two related series. But, if the two value of one series (variable) is given and the value of the other series is to be predicted, the technique of regression analysis is required for this purpose. The credit of using regression technique in statistics for the first time goes to British Biometrician **Sir Francis Galton** who used this term in 1877 while studying the relationship between the height of fathers and sons.

Definition:-

"Regression analysis is a mathematical measure of the average relationship between two or more variables in terms of the original unit of data." – **According to M.M. Blair**

Types of Regression

1) **Simple Regression-** This distinction is based on the number of variables studied. If regression analysis is based only two variables is known as simple regression.
2) **Multiple and Partial Regression:** When more than two variables are studied, it is a problem of either multiple or partial regression.
3) **Linear Regression:** If the regression line is in the form of a straight line, it indicates linear regression.
4) **Curvi-linear Regression:** If the regression line is not a straight line but a smoothed curve, regression is termed as curvi-linear or non-linear.

   The linear function is useful because it is mathematically simple and it can be shown to be reasonably close to the approximation of many situations.

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-

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

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-

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

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

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

$(x-47) = 0.32(y-96)$ $(y-96) = .405(x-47)$

$(x-47) = 0.32y-30.72$ $(y-96) = .405x-19.035$

$x = 0.32y-30.72+47$ $y= .405x-19.035+96$

x = 0.32y-16.28 **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