(c) Multiple Corr. Coefficient :-

— It is between more than two indep. variables and one dependent variable, it is denoted by R and define as:-

$$R_{y,x_1x_2} = \frac{\sqrt{r_{x_1y}^2 + r_{x_2y}^2 - [2(r_{x_1y})(r_{x_2y})(r_{x_1x_2})]}}{\sqrt{1 - r_{x_1x_2}^2}}$$

Where: * $0 \leq R \leq 1$
* y: dependent var.
* x_1, x_2: Indepe. Var.'s.

- من الامثلة عليه الاصابة بأمراض القلب يعتمد على العمر وتناول الدهون وتناول السكائر.

(2) Regression: — الانحدار

— Defn:- The Regression theory is to describe the linear relation as mathematical Equation. and there is non-linear relation as of rank two or three --- ect.

— Here we study linear relation between two variables [dependent and indep.] which is called the (simple Linear Reg.).

The dependent variable say (y) it is change as the indep. variable (x) is change then the Regression equation called y - given x (y/x). it is define as:-

$$y_i = \beta_0 + \beta_1 X_i + e_i \quad ; \; i = 1, 2, \dots, n$$

Where:-

y_i:- the dependent variable.

X_i:- " indep. variable.

β_0:- The Regression Constant.

β_1:- The Regression Coefficeint for y/x

e_i:- the Sampling Error define as $[e_i = y_i - \hat{y}]$.

يمثل الفرق بين القيم الحقيقية والتقديرية للمتغير التابع .

and $\sum e_i = 0$.

— then after Estimate the (β_0, β_1) is :-

$$\beta_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

and $$\hat{\beta}_1 = \frac{\sum x_i y_i - n\bar{x}\,\bar{y}}{\sum x_i^2 - n\bar{x}^2} = \frac{S_{xy}}{S_x^2}$$

S_{xy} ⟵ (Cov. between xy)

S_x^2 ⟵ (variance (x))

— Then the Regression Estimation Equation given by:-

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 X_i$$

Where: if x is dep. and y is inde. then the Regression equation say X/y as:-

$X_i = \beta_0 + \beta_1 y_i$ and $e_i = X_i - \hat{X}$ and

$$\hat{\beta}_0 = \bar{X} - \hat{\beta}\bar{y} \quad \text{and} \quad \hat{\beta}_1 = \frac{\sum x_i y_i - n\bar{x}\,\bar{y}}{\sum y_i^2 - n\bar{y}^2} = \frac{S_{xy}}{S_y^2}$$

S_y^2 ⟵ Varince(y)

B_5

Example:- Find the Estimated Regression equation of y given x from the following data:-

$\bar{x} = 6.3$, $\bar{y} = 5$, $\sum x_i y_i = 366$, $\sum x_i^2 = 465$

$\sum x_i = 63$, $\sum y_i = 50$, $n = 10$

Then find e_5 if $x_5 = 7 = y_5$?

Sol:- The regression equation as:-

$$y_i = \beta_0 + \beta_1 x_i + e_i$$

$$\therefore \hat{\beta}_1 = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{\sum x_i^2 - n\bar{x}^2} \Rightarrow \hat{\beta}_1 = \frac{366 - [(10)(6.3)\cdot(5)]}{465 - (10)(6.3)^2}$$

$$\hat{\beta}_1 = \frac{51}{68.1} = 0.75$$

and $\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} = 5 - (0.75)\cdot(6.3) = 0.28$

$$\therefore \hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_i \Rightarrow \hat{y} = (0.28) + (0.75)(x_i)$$

$$\therefore e_5 = y_5 - \hat{y}_5$$

then $\hat{y}_5 = (0.28) + (0.75)(x_5) = (0.28) + (0.75)(7)$

$\therefore \hat{y}_5 = 5.52$

Thus $e_5 = y_5 - \hat{y}_5 = 7 - 5.52 = 1.48$

$$\therefore e_5 = 1.48$$