॥श्री॥

Chapter → 11 → Correlation
→ Regression.

⇒ **Correlation :→**

What is relation between two things.

Correlation
↳ r = Coeffn of Correlation

$$-1 \le r \le 1$$

$0 < r \le 1$ ⟶ +ve relation
$-1 \le r < 0$ ⟶ -ve relation
$r = 0$ ⟶ Zero.

Correlation
↓
Methods

1. Karl Pearson Method
2. Rank Method
3. Coeffn of Concurrent deviation
4. Scatter diagram

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① Karl Pearson Method / Product Movement Method :→

$$\boxed{\text{(i) } r = \frac{Cov(x,y)}{\sigma_x \cdot \sigma_y}}$$

σ_x = S.D of x
σ_y = S.D of y
$Cov(x,y)$ = covariance

when table of x & y is given →

(ii)
$$r = \frac{N\Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{N\Sigma x^2 - (\Sigma x)^2}\sqrt{N\Sigma y^2 - (\Sigma y)^2}}$$

(Huge no)

If you subract any no. from x & y.

$u = x - A_1$ $\qquad$ $v = y - A_2$

(iii)
$$r = \frac{N\Sigma uv - \Sigma u \cdot \Sigma v}{\sqrt{N\Sigma u^2 - (\Sigma u)^2} \cdot \sqrt{N\Sigma v^2 - (\Sigma v)^2}}$$

If you subract arithmetic mean from x & y then u & v will be zero.

(iv) $u = x - \bar{x}$ $\qquad$ $v = y - \bar{y}$

$$r = \frac{\Sigma uv}{\sqrt{\Sigma u^2}\sqrt{\Sigma v^2}}$$

- Useful for quantity data

diff^n opinion. we can rank them.
relation in opinion → Rank Method. ①, ② & ③

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② Rank Method / Spearman's Method :→

- Useful for quality data [eg→ singing, beauty, intelligence]

(i) $$\boxed{r = 1 - \frac{6\sum d^2}{n(n^2-1)}}$$

d = rank$_1$ − rank$_2$

n = no. of observation
d = difference of rank.

Problem of tie t = length of tie

(ii) $$\boxed{r = 1 - \frac{6\left[\sum d^2 + \frac{\sum t^3 - t}{12}\right]}{n(n^2-1)}}$$

③ Coefficient of Concurrent deviation :→

$$r = \pm\sqrt{\frac{\pm(2c-m)}{m}}$$

n = no. of observation

m = no. of pairs of deviation = (n−1)

c = no. of concurrent deviation
same. (+,−)

2c−m = +ve → + +
2c−m = −ve → − −

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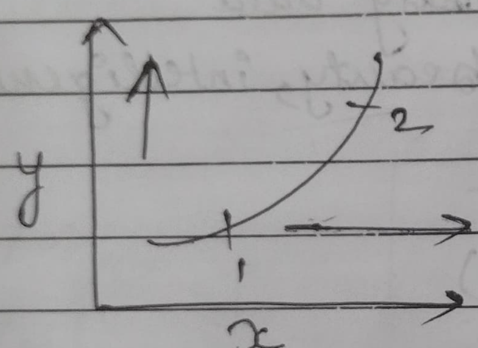
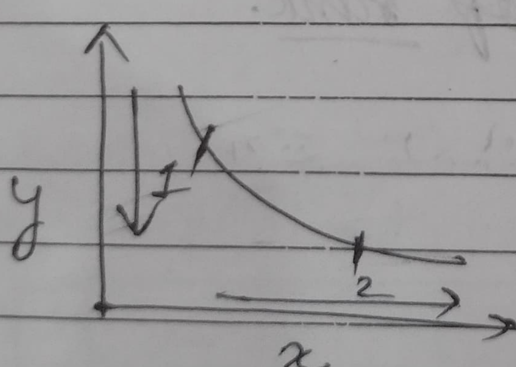
(4) Scatter Diagram :→



$x\uparrow \quad y\uparrow$

$r = +ve$



$x\uparrow \quad y\downarrow$

$r = -ve$

$\frac{r_{xy}}{r_{xv}}$ then $b=1$ | $\frac{r_{xy}}{r_{vy}}$ then $d=1$

Properties of Correlation :→

① $-1 \leq r \leq 1$

② Coeffecient of correlation are has no unit. It is unit free.

③ Change of scale $(\times, \div)$ & change of origin $(+, -)$

Coeffecient of correlation are is effected neither by scale nor by origin.

Value same hogi. But sign may get change

$\boxed{u = a + bx}$ $b = \frac{-x}{u}$

$\boxed{v = c + dy}$ $d = \frac{-y}{v}$

* Corrected Correlation :-

Wrong side	Correct side
$r =$	$r =$
$n =$	$n =$
$\Sigma d^2 =$	$\Sigma d^2 =$
$d =$	$d =$

r = coeffⁿ of correlation

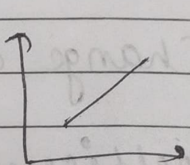
b = coeffⁿ of Regression

⇒ Regression :→

- It can give exact value / relation between x & y.
- It tells → what is the equation (chemistry) between x & y.

eg → $2x + 3y = 8$

$y = 7 + 2x$



Regression

Line of y on x	Line of x on y
दिखाने कि eqⁿ → $\boxed{y = a + bx}$	$\boxed{x = a + by}$
for solving Qns. → $\boxed{y - \bar{y} = b_{yx}(x - \bar{x})}$	$\boxed{x - \bar{x} = b_{xy}(y - \bar{y})}$
b_{yx} = coeffⁿ of regression of y on x	b_{xy} = coeffⁿ of regⁿ of x on y.
when r, σ_y, σ_x are given → $\boxed{b_{yx} = r \cdot \frac{\sigma_y}{\sigma_x}}$	$\boxed{b_{xy} = r \cdot \frac{\sigma_x}{\sigma_y}}$
when table is given → $\boxed{b_{yx} = \frac{N\sum xy - \sum x \sum y}{N\sum x^2 - (\sum x)^2}}$	$\boxed{b_{xy} = \frac{N\sum xy - \sum x \sum y}{N\sum y^2 - (\sum y)^2}}$

line of y on x → eq^n → $y = a + bx$

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

Application of regression line

x = given
y = find
$\boxed{y = a + bx}$

y = give
x = find
$\boxed{x = a + by}$

Relation between Correlation & Regression :→

r

b_{xy} → b_{yx}

$$\boxed{r = \pm\sqrt{b_{yx} \cdot b_{xy}}}$$

$b_{yx} = +$, $b_{xy} = +$ ⟶ $+$

$b_{yx} = -$, $b_{xy} = -$ ⟶ $-$

$r = \mp 1$

↓

There is singe line

↓

y on x & x on y are coincident

Parallel

r is GM of b_{xy} & b_{yx}.

Perfect correlation = $r = +1$

no relation = $r = 0$