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Tutorial No: 5

Q.1.

Ans.

x	y	$dx = x - A$	$dy = y - B$	$-dx \cdot dy$	dx^2	dy^2
10	19	-6	-8	48	36	64
12	22	-4	-5	20	16	25
13	24	-3	-3	9	9	9
16	27	0	0	0	0	0
17	29	1	2	2	1	4
20	33	4	6	24	16	36
25	37	9	10	90	81	100
$\Sigma x = 113$	$\Sigma y = 191$	$\Sigma dx = 1$	$\Sigma dy = 2$	$\Sigma dx dy = 193$	$\Sigma dx^2 = 159$	$\Sigma dy^2 = 238$

Here,

$$\therefore \bar{x} = \frac{\Sigma x}{n} = 16.1428$$

$$\therefore \bar{y} = \frac{\Sigma y}{n} = 27.2857$$

$$\therefore b_{yx} = \frac{\Sigma dx \cdot dy - \left(\frac{\Sigma dx \cdot \Sigma dy}{n}\right)}{\Sigma dx^2 - \frac{(\Sigma dx)^2}{n}}$$

$$\therefore \boxed{b_{yx} = 1.2131}$$

$$\therefore b_{xy} = \frac{\Sigma dx \cdot dy - \left(\frac{\Sigma dx \cdot \Sigma dy}{n}\right)}{\Sigma dy^2 - \frac{(\Sigma dy)^2}{n}}$$

$$\therefore \boxed{b_{xy} = 0.8116}$$

$\therefore$ Since, $r^2 = b_{yx} \times b_{xy}$

$$\therefore r = \sqrt{b_{yx} \times b_{xy}}$$

$$\therefore \boxed{r = 0.9922}$$

Regression line of y on x is,

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

$\therefore (y - 27.2857) = 1.2131\,(x - 16.1428)$

$\therefore y - 27.2857 = x(1.2131) - 19.5823$

$\therefore y = 1.2131x + 7.7029$

Regression line of x on y is,

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

$\therefore (x - 16.1428) = 0.8116\,(y - 27.2857)$

$\therefore x - 16.1428 = 0.8116y - 22.1450$

$\therefore x = 0.8116y - 6.0022$

Q.2

Ans.

x	y	R_1	R_2	$d = R_1 - R_2$	d^2
35	51	2	3	-1	1
38	37	3	1	2	4
43	48	4	2	2	4
30	62	1	5	-4	16
54	93	6	10	-4	16
68	73	8	8	0	0
70	56	9	4	5	25
92	72	10	7	3	9
44	70	5	6	-1	1
56	92	7	9	-2	4
				$\Sigma d = 0$	$\Sigma d^2 = 80$

$$\therefore R = 1 - 6 \cdot \left(\frac{\Sigma d^2}{n^3 - n} \right)$$

$$\therefore R = 1 - 6 \left(\frac{80}{10^3 - 10} \right)$$

$$\therefore R = 0.5151$$

Q.3.

Ans.

x	y	dx	dy	dx dy	dx^2	dy^2
57	10	15	-17	-255	225	289
42	26	0	-1	0	0	1
38	41	-4	14	-56	16	196
42	29	0	2	0	0	4
45	27	3	0	0	9	0
42	27	0	0	0	0	0
44	19	2	-8	-16	4	64
40	18	-2	-9	18	4	81
46	19	4	-8	-32	16	64
44	31	2	4	8	4	16
43	29	1	2	2	1	4
40	33	-2	6	-12	4	36
		$\Sigma dx = 19$	$\Sigma dy = -15$	$dz = -343$	$\Sigma dx^2 = 283$	$\Sigma = 755$

$$\therefore r = \frac{\Sigma dx \cdot dy - \left(\frac{\Sigma dx \cdot \Sigma dy}{n}\right)}{\sqrt{\Sigma dx^2 - \frac{(\Sigma dx)^2}{n}} \cdot \sqrt{\Sigma dy^2 - \frac{(\Sigma dy)^2}{n}}}$$

$$\therefore r = -0.7398$$

Q.4. "x" be father's height & "y" by eldest son's height.

Ans.

x	y	dx	dy	dx·dy	dx^2	dy^2
165	173	7	5	35	49	25
160	168	2	0	0	4	0
170	173	12	5	60	144	25
163	165	5	-3	-15	25	9
173	175	15	7	105	225	49
168	168	0	0	0	0	0
178	173	20	5	100	400	25
168	165	10	-3	-30	100	9
173	180	15	12	180	225	144
170	170	12	2	24	144	4
175	173	17	5	85	289	25
180	178	22	10	220	484	100
$\Sigma = 2033$	$\Sigma = 2061$	$\Sigma = 137$	$\Sigma = 45$	$\Sigma = 764$	$\Sigma = 2089$	$\Sigma = 415$

$\therefore \bar{x} = 169.4166$

$\therefore \bar{y} = 171.75$

$$\therefore b_{yx} = \frac{\Sigma dx \cdot dy - \frac{(\Sigma dx \cdot \Sigma dy)}{n}}{\Sigma dx^2 - \frac{(\Sigma dx)^2}{n}}$$

$$\therefore b_{yx} = 0.4767$$

$$\therefore b_{xy} = \frac{\Sigma dx \cdot dy - \frac{(\Sigma dx \cdot \Sigma dy)}{n}}{\Sigma dy^2 - \frac{(\Sigma dy)^2}{n}}$$

$$\therefore b_{xy} = 1.0162$$

$\therefore r^2 = b_{xy} \times b_{yx}$

$\therefore r = 0.6960$

Regression line of y on x is,

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

$\therefore (y-171.75) = 0.4767(x-169.4166)$

$\therefore y-171.75 = 0.4767x - 80.7608$

$\therefore y = 0.4767x + 90.9892$ —(i)

Regression line of x on y is,

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

$\therefore (x-169.4166) = 1.0162\cdot(y-171.75)$

$\therefore x-169.4166 = 1.0162y - 174.53235$

$\therefore x = 1.0162y - 5.1157$ — (ii)

Put $x = 172$ in eqn (i)

$\therefore y = 0.4767(172) + 90.9892$

$\therefore y = 81.9924 + 90.9892$

$\therefore y = 172.9816$

Put $y = 173$ in eqn (ii)

$\therefore x = 1.0162(173) - 5.1157$

$\therefore x = 175.8026 - 5.1157$

$\therefore x = 170.6869$

$\therefore$ Height of eldest son if father is 172cms $\Rightarrow$ 172.9816 cms

$\therefore$ Height of father if eldest son is 173cms $\Rightarrow$ 170.6869.

As, b_{yx} and b_{xy} are positive i.e same sign

Hence, coifficent of correlation (r) is 0.6960