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SUGGESTED SOLUTION

SYJC

SUBJECT- MATHS & STATS

Test Code - SYJ 6043 A

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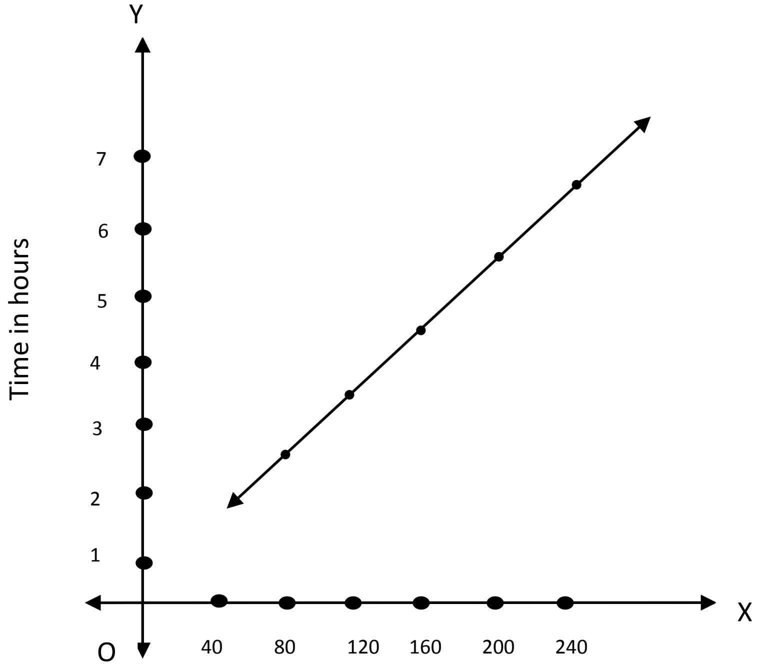
Ans. : 1

1. Here we take distance on X – axis and time on Y – axis and plot the points as below



Distance in kms

Since all the points lie on the straight line rising from left to right, there is perfect positive correlation between distance and time for the train. **(02)**

2. Given R = 0.6, $\sum d_i^2$ = 66

$\therefore$ R = $1 - \frac{6\sum d_i^2}{n(n^2-1)}$

$\therefore$ 0.6 = $1 - \frac{6\sum d^2{}_i}{n(n^2-1)}$

= $1 - \frac{6 \times 66}{n(n^2-1)}$

$\therefore$ $\frac{6 \times 66}{n(n^2-1)}$ = 0.4

$\therefore$ n $(n^2 - 1)$ = $\frac{6 \times 66}{0.4}$ = 990

$\therefore$ (n – 1)(n) (n + 1)= 990 = 9 × 10 × 11

$\therefore$ n = 10.

(02)

3. Given : r = 0.48, Cov (x, y) = 36, Var(x) = 16 $\therefore$ $\sigma_x = 4$

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

$\therefore$ 0.48 = $\frac{36}{4 \times \sigma_y}$ $\therefore$ 0.48 = $\frac{9}{\sigma_y}$ $\therefore$ $0.48\sigma_y = 9$ $\therefore$ $\sigma_y = \frac{9}{0.48}$

$\therefore\ \sigma_y = 18.75$

Hence, S.D. of y is 18.75.

(02)

Ans.: 2

1. (i) Marginal frequency distribution of age of husband :

Age of husband (in yrs)	20 – 30	30 – 40	40 – 50	50 – 60	Total
No. of husbands	5	20	44	24	93

(ii) Conditional frequency distribution of age of husbands when age of wives lie in 25 – 35 :

Age of husband (in yrs)	20 – 30	30 – 40	40 – 50	50 – 60	Total
No. of husbands	0	10	25	2	37

(iii) Couples with age of husbands above 40 years and of wives below 45 years :

= Sum of frequencies of cell (1, 3), cell (2, 3), cell (2, 4), cell (3, 3) and cell (3, 4)

= 3 + 25 + 2 + 12 + 2 = 44

Hence, 44 couples with age of husband above 40 years and age of wives below 45 years.

(03)

2. Given : $r = 0.4$, $\Sigma (x_i - \bar{x})(y_i - \bar{y}) = 108$, $\sigma_y = 3$ and $\Sigma(x_i - \bar{x})^2 = 900$

$\Sigma(x_i - \bar{x})^2 = 900$

Now, $r = \dfrac{\frac{1}{n}\Sigma (x_i - \bar{x})(y_i - \bar{y})}{\sigma_x \cdot \sigma_y}$

$= \dfrac{\frac{1}{n}\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n}} \times \sigma_y}$

Putting $r = 0.4$, $\Sigma (x_i - \bar{x})(y_i - \bar{y}) = 108$, $\sigma_y = 3$,

$\Sigma (x_i - \bar{x})^2 = 900$ in the formula, we get

$0.4 = \dfrac{\frac{1}{n} \times 108}{\sqrt{\frac{900}{n}} \times 3}$

$\therefore\ 0.4 = \dfrac{36}{n \times \sqrt{\frac{900}{n}}}$

$\therefore\ 0.4 = \dfrac{36}{\sqrt{n} \cdot \sqrt{900}}$

$\therefore\ 0.16 = \dfrac{1296}{n \times 900}$ ....(Taking square of both sides)

$\therefore\ 0.16 \times n \times 900 = 1296$

$\therefore\ 144n = 1296$

$\therefore\ n = \dfrac{1296}{144}$

$\therefore\ n = 9$

(03)

Ans.: 3

1. Let us give ranks to the values of X and Y by assigning rank 1 to the highest value and next highest the ranked 2 etc.

Table 5.16

X	Y	Rank of X	Rank of Y	$d_i = x_i - y_i$	d^2_i
		x_i	y_i		
50	110	8	9.5	– 1.5	2.25
55	110	6.5	9.5	– 3.0	9.00
65	115	3.5	7	– 3.5	12.25
50	125	8	4	4.0	16.00
55	140	6.5	2	4.5	20.25
60	115	5	7	– 2.0	4.00
50	130	8	3	5.0	25.00
65	120	3.5	5	– 1.5	2.25
70	115	2	7	– 5.0	25.00
75	160	1	1	0.0	0.00
				Total	116.00

Here, in series X, 50 is repeated thrice, 55 is repeated twice, 65 is repeated twice. In series Y 110 is repeated twice and 115 is repeated thrice.

$\therefore$ $T_x = \frac{3\,(3^2-1)}{12} + \frac{2(2^2-1)}{12} + \frac{2(2^2-1)}{12} = 3$

$T_y = \frac{2(2^2-1)}{12} + \frac{3(3^2-1)}{12} = 2.5$

Corrected $\sum d^2{}_i = \sum d^2{}_i + T_x + T_y$

$= 116 + 3 + 2.5$

$= 121.5$

$\therefore$ $R = 1 - \frac{6\,[corrected\ \sum d^2{}_i]}{n(n^2-1)}$

$= 1 - \frac{6 \times 121.5}{10(10^2-1)}$

$= 1 - \frac{729}{990}$

$= \frac{261}{990} = 0.26$

(04)

2. Given : $n = 25$, $\Sigma x_i = 125$, $\sum x_i^2 = 650$, $\Sigma y_i = 100$, $\sum y_i^2 = 460$, $\Sigma x_i y_i = 508$.

Wrong pairs of observations : (6 , 14), (8, 6)

Correct pairs of observations : (8,12), (6, 8)

Corrected $\sum x_i = \sum x_i$ = (Sum of wrong observations) + (Sum of correct observations)

$= 125 - (6 + 8) + (8 + 6)$

$= 125 - 14 + 14 = 125$

Corrected $\sum x_i^2$ =

$\sum x_i^2$ – (sum of squares of wrong observations) + (sum of squares of correct observations)

= 650 – ($6^2 + 8^2$) + ($8^2 + 6^2$)

= 650 – (36 + 64) + (64 + 36)

= 650 – 100 + 100 = 650

Corrected Σy_i = Σy_i – (Sum of wrong observations) + (Sum of correct observations)

= 100 – (14 + 6) + (12 + 8)

= 100 – 20 + 20 = 100

Corrected $\sum y_i^2$ =

$\sum y_i^2$ – (Sum of squares of wrong observations) + (Sum of squares of correct observations)

= 460 – ($14^2 + 6^2$) + ($12^2 + 8^2$)

= 460 – (196 + 36) + (144 + 64)

= 460 – 232 + 208

= 460 – 24 = 436

Corrected $\Sigma x_i y_i$ =

$\Sigma x_i y_i$ – (Sum of products of wrong observations) + (Sum of products of correct observations)

= 508 – [(6 × 14) + (8 × 6)]+ [(8 × 12) + (6 × 8)]

= 508 – (84 + 48) + (96 + 48)

= 508 – 132 + 144

= 508 + 12 = 520

Correct correlation coefficient :

Correct $\bar{x} = \frac{Corrected\ \sum x_i}{n} = \frac{125}{25} = 5$

Correct $\bar{y} = \frac{Corrected\ \sum y_i}{n} = \frac{100}{25} = 4$

$$r(x, y)_{correct} = \frac{\frac{1}{n}(Corrected\ \sum x_i y_i) - Correct\ (\bar{x} \cdot \bar{y})}{\sqrt{\frac{Corrected\ \sum x_i^2}{n} - (Correct\ \bar{x})^2}\ \sqrt{\frac{Correct\ \sum y_i^2}{n} - (Correct\ \bar{y})^2}}$$

$$= \frac{\frac{1}{25} \times 520 - (5 \times 4)}{\sqrt{\frac{650}{25} - (5)^2} \cdot \sqrt{\frac{436}{25} - (4)^2}}$$

$$= \frac{20.8-20}{\sqrt{26-25}\cdot\sqrt{17.44-16}}$$

$$= \frac{0.8}{\sqrt{1}\cdot\sqrt{1.44}}$$

$$= \frac{0.8}{1 \times 1.2}$$

$$= \frac{0.8}{1.2} = \frac{8}{12} = \frac{2}{3} = 0.67$$

$\therefore$ $r(x, y)_{correct} = 0.67$.

(04)