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"Exercise ⇒ 11.1"

x	y	xy	x^2	y^2
11.8	10.4	122.72	139.24	108.16
12.5	16.5	206.25	156.25	272.25
15.7	22.9	359.53	246.49	524.41
19.2	26.6	510.72	368.64	707.56
21.9	33.8	740.22	479.61	1142.44
23.3	42.8	997.24	542.89	1831.84
$\sum x =$ 104.4	$\sum y =$ 153	$\sum xy =$ 2936.68	$\sum x^2$ = 1933.12	$\sum y^2$ = 4586.66

(a) $SS(x) = \sum x^2 - \frac{(\sum x)^2}{n}$

$= 1933.12 - \frac{(104.4)^2}{6}$

$= 116.56.$

$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 4586.66 - \frac{(153)^2}{6}$

$= 685.16.$

$Sp(xy) = \sum xy - \frac{\sum x \sum y}{n}$

$= 2936.68 - \frac{104.4 \times 153}{6}$

$= 274.48$

$r = \frac{Sp(xy)}{\sqrt{SS(x) \cdot SS(y)}}$

$= \frac{274.48 \cancel{274.5}}{\sqrt{116.56 \times 685.16}} = 0.9712$

The variables (x) inflation rate ~~mean~~ and (y) lending rate are strongly positively correlated.

(b) We need to test,

$H_0: P = 0$ vs $H_1: P \neq 0$

test statistic, $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.9712 \times \sqrt{6-2}}{\sqrt{1-(0.9712)^2}}$

$= 8.152$

Since $|t| > t_{n-2} = t_4 = 2.776$, So Ho is rejected. We can conclude that, lending rate increases significantly with the increase of inflation rate.

[Ans].

(c.) From the solution of 'a'.

$SS(x) = 116.56$

$SS(y) = 685.16$

$SP(xy) = 274.48$

Now, $b = \dfrac{SP(xy)}{SS(x)} = \dfrac{274.48}{116.56}$

$\Rightarrow b = 2.355$

$a = \bar{y} - b\bar{x} = \dfrac{\Sigma y}{n} - b \times \dfrac{\Sigma x}{n}$

$= \dfrac{153}{6} - (2.355) \times \dfrac{104.4}{6}$

$\Rightarrow a = -15.477$.

So, fitted line, $\hat{y} = a + bx$

$\Rightarrow \hat{y} = -15.477 + 2.355x$

[Ans].

(d.) If $x = 25.5$

then, $\hat{y} = -15.477 + 2.355 \times (25.5)$

$= 44.58$ [Ans]

(e.) We need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

Test statistic, $t = \dfrac{b}{\sqrt{s^2/SS(x)}}$

$= \dfrac{2.355}{\sqrt{\dfrac{9.69}{116.56}}} = 8.168$

Here,

$s^2 = \dfrac{SS(y) - b\,SP(xy)}{n-2}$

$= \dfrac{685.16 - 2.355 \times (274.48)}{6-2}$

$= 9.69$

Since, $|t| > t_{n-2} = t_4 = 2.776$, Ho is rejected, the regression is significant.

[Ans].