



ASSIGNMENT : 05

**Course : Computational Statistics
And
Probability**

Submitted By,

**Group A
Section : K**

Date of Submission : 5th August, 2021

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Subject : _____

Date : _____

n	x	y	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
90	96	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 7532$

$$SS(x) = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 12420 - \frac{(348)^2}{10} = 309.6$$

$$SS(y) = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 75325 - \frac{(865)^2}{10} = 502.5$$

$$SP(xy) = \Sigma xy - \frac{\Sigma x \times \Sigma y}{n} = 30350 - \frac{348 \times 865}{10}$$

$$= 248$$

$$r = \frac{SP(xy)}{\sqrt{SS(x)SS(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}} = 0.63$$

The variable x and y are positively correlated

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b) We need to test, $H_0: \rho=0$ vs $H_1: \rho \neq 0$

$$\text{Test statistic } t = \frac{\rho\sqrt{n-2}}{\sqrt{1-\rho^2}} = \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

Since $|t| < t_{n-2} = t_8 = 2.306$ - So H_0 is accepted

$$c) b = \frac{SP(\bar{y}, \bar{x})}{SS(\bar{x})} = \frac{248}{309.6} = 0.801 \approx 0.80$$

$$\begin{aligned} a = \bar{y} - b\bar{x} &= \frac{\sum y}{n} - b \frac{\sum x}{n} \\ &= \frac{865}{10} - 0.8 \times \frac{348}{10} = 58.66 \end{aligned}$$

$$\therefore \text{fitted line: } \hat{y} = a + bx = 58.66 + 0.80x$$

d) If $n=60$

$$\text{then } \hat{y} = 58.66 + 0.80(60) = 107.26$$

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

$$\text{Test statistic } t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{0.80}{\sqrt{\frac{38.0125}{309.6}}} = 2.28$$

$$s^2 = \frac{SS(\bar{y}) - bSP(\bar{y}, \bar{x})}{n-2} = \frac{502.5 - 0.8 \times 248}{10-2} = 38.0125$$

Since $|t| < t_{n-2} = t_8 = 2.306$. So H_0 is accepted. Hence
the regression is significant

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Ex: 1

x	y	xy	x^2	y^2
10.4	122.72	139.24	108.16	
16.8	206.25	156.85	272.25	
22.9	359.53	246.40	524.41	
26.9	516.48	368.64	723.61	
33.8	740.22	479.61	1142.44	
42.8	997.24	542.89	1831.84	
$\sum x = 104.4$	$\sum y = 153.3$	$\sum xy = 2942.44$	$\sum x^2 = 433.12$	$\sum y^2 = 4602.71$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 104.4^2 - \frac{(104.4)^2}{6} = 116.56$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 4602.71 - \frac{(153.3)^2}{6} = 685.89$$

$$SP(xy) = \sum xy - \frac{\sum x \sum y}{n} = 2942.44 - \frac{(104.4)(153.3)}{6}$$

$$= 275.02$$

$$\therefore r = \frac{275.02}{\sqrt{116.56 \times 685.89}} = 0.97$$

The variable x and y are positively correlated.

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b) We need to test, $H_0: \rho = 0$ vs $H_1: \rho \neq 0$
test statistic $= t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97 \sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.98$

Since $|t| > t_{n-2} = t_4 = 2.776$. So H_0 is rejected.

c) $b = \frac{SP(nv)}{SS(n)} = \frac{275.02}{116.56} = 2.36$

$$a = \bar{y} - b\bar{x} = \frac{\sum y}{n} - 2.36 \times \frac{\sum x}{n}$$
$$= \frac{153.3}{6} - 2.36 \times \frac{104.9}{6}$$
$$= -15.514$$

∴ fitted line of y on x : $\hat{y} = a + bx$
 $= -15.514 + 2.36x$

d) If $x = 25.5$

$$\text{then, } \hat{y} = -15.514 + (2.36 \times 25.5)$$
$$= 44.666 \approx 44.67$$

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

test statistics $t = \frac{b}{\sqrt{\frac{s^2}{SS(X)}}} = \frac{2.36}{\sqrt{\frac{2.21}{116.56}}} = 8.396 \approx 8.4$

$$S^2 = \frac{685.895 - (2.36 \times 275.02)}{6-2} = 0.21$$

Since, $|t| > t_{n-2} = t_4 = 2.776$.

So, H_1 is accepted.

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Example 11.1

(a)

x	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

$$SS(x) = \Sigma x^2 - \frac{(\Sigma x)^2}{n}$$
$$= 12420 - \frac{(348)^2}{10} = 309.6$$

$$SS(y) = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 75325 - \frac{(865)^2}{10} = 502.5$$

$$Sp(xy) = \Sigma xy - \frac{\Sigma x \Sigma y}{n}$$
$$= 30350 - \frac{348 \times 865}{10}$$
$$= 248$$

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$$\rho = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} \\ = \frac{248}{\sqrt{309.6 \times 502.5}} = 0.63$$

The variable x (age) and y (BP) are possibly correlated.

⑥ we need to test,

$$H_0: \rho = 0 \quad \text{vs} \quad H_1: \rho \neq 0$$

$$\text{Test Statistic } t = \frac{\rho \sqrt{n-2}}{\sqrt{1-\rho^2}} = \frac{0.63 \sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

$$\text{Since } |t| < t_{n-2} = t_8 = 2.306. \text{ So } H_0 \text{ is}$$

accepted we can conclude that BP of the investigated person are not significantly correlated with their age.

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$$\textcircled{C} \quad b = \frac{SP(xy)}{SS(x)} = \frac{248}{308.6} = 0.801 \approx 0.80$$

$$\begin{aligned} a &= \bar{y} - b\bar{x} \\ &= \frac{\sum y}{n} - b \frac{\sum x}{n} \\ &= \frac{865}{10} - 0.8 \times \frac{348}{10} \\ &= 58.66 \end{aligned}$$

$$\therefore \text{fixed line: } \hat{y} = a + bx \\ = 58.66 + 0.80x$$

d) if $x = 60$

$$\text{Then } \hat{y} = 58.66 + 0.80(60) = 107.26$$

e) we need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$\text{Test statistic } t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{0.80}{\sqrt{\frac{38.0125}{308.6}}} = 2.28$$

$$s^2 = \frac{SS(y) - b \cdot SP(xy)}{n-2} = \frac{502.5 - 0.8 \times 248}{10-2} = 38.0125$$

Since $|t| < t_{n-2} = t_8 = 2.306$, so H_0 is accepted.

Hence the regression is not accepted.

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Exerzeise 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	26.9	516.48	368.64	723.61
21.9	33.8	740.22	479.61	1142.44
23.3	42.8	997.24	542.89	1831.84
$\Sigma x = 104.4$	$\Sigma y = 153.3$	$\Sigma xy = 2942.44$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

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

$$= 1933.12 - \frac{(104.4)^2}{6} = 116.56$$

$$\textcircled{A} \quad SS(y) = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 4602.71 - \frac{(153.3)^2}{6} = 685.895$$

$$SP(xy) = \Sigma xy - \frac{\Sigma x \times \Sigma y}{n}$$

$$= 2942.44 - \frac{(104.4) \times (153.3)}{6} = 275.02$$

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$$\therefore r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{275.02}{\sqrt{(116.56) \times (685.895)}} = 0.97$$

The variables x (inflation rate) and y (lending rate) are positively connected (A)

b) we need to taste $H_0: P = 0$ vs $H_1: P \neq 0$

b) Test statistic $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.78$

Since $|t| > t_{n-2} = t_4 = 2.776$, so, H_0 is rejected we can conclude that lending rate increases significantly with the increase of inflation rate

c) $b = \frac{SP(xy)}{SS(x)} = \frac{275.02}{11.56} = 2.36$

$$\begin{aligned} a = \bar{y} - b\bar{x} &= \frac{\sum y}{n} - 2.36 \times \frac{\sum x}{n} \\ &= \frac{153.3}{6} - 2.36 \times \frac{104.9}{6} \\ &= -15.514 \end{aligned}$$

∴ fitted line of y on x : $\hat{y} = a + bx$

$$= -15.514 + 2.36x$$

A

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d) if $x = 60$

Then,

$$\hat{y} = 58.66 + 0.80(60) = 107.26$$

e) we need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

Test statistic $t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{0.80}{\sqrt{\frac{38.0125}{309.6}}} = 2.28$

$$S^2 = \frac{SS(y) - b SP(xy)}{n-2} = \frac{502.5 - 0.8 \times 248}{10-2} = 38.0125$$

Since $|t| < t_{n-2} = t_8 = 2.306$ so H_0 is accepted. Hence the regression is not significant.

18-39062-3

Example 11.1

x	y	xy	x^2	y
25	75	1875	625	562
30	80	2400	900	640
35	85	2975	1225	728
30	90	2700	900	8100
32	95	3040	1024	9024
40	85	3400	1600	722
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400

$$\Sigma x = 348 \quad | \quad \Sigma y = 865 \quad | \quad \Sigma xy = 30350 \quad | \quad \Sigma x^2 = 12420 \quad | \quad \Sigma y^2 = 75$$

$$SS(x) = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 12420 - \frac{348^2}{10} = 309.6$$

$$SS(y) = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 75325 - \frac{865^2}{10} = 562.6$$

$$SP(xy) = \Sigma xy - \frac{\Sigma x \times \Sigma y}{n} = 30350 - \frac{348 \times 865}{10} = 201$$

$$R = \frac{SP(xy)}{\sqrt{SS(x) \cdot SS(y)}} = \frac{201}{\sqrt{309.6 \times 562.6}} = 0.63$$



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By OveIslam

$$H_0: \rho = 0 \quad \text{vs} \quad H_1: \rho \neq 0$$

$$\text{Test Statistic} = t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.63 \sqrt{10-2}}{1-(0.63)^2}$$

So, $|t| < t_{\alpha/2} = 2.306$ $\Rightarrow Q: H_0$

So, H_0 is accepted

We can conclude that BP of the investigated persons are not significantly correlated with their age

$$\text{C) } b = \frac{SP(yx)}{SS(x)} = \frac{248}{309.6} = 0.81 \approx 0.80$$

$$a - \bar{y} - bx = \frac{\bar{y}}{n} - b \frac{\bar{x}}{n} \\ = \frac{865}{10} - 0.8 \times \frac{348}{10}$$

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$$\text{Fitted line} = \hat{y} = a + bx = 58.66 + 0.80x$$

① {

$$x=60$$

$$0.78 : 11 \rightarrow 0 = 9$$

Then $\hat{y} = 58.66 + 0.80(60) = 107.26$

② we have to test

$$H_0: \beta = 0 \text{ vs } H_1: \beta \neq 0$$

test statistic, $t = \frac{b}{\sqrt{\frac{ss(x)}{ss(y)}}} = \frac{0.80}{\sqrt{\frac{38.0125}{309.6}}} = 2.28$

$$s^2 = \frac{ss(y) - b \cdot sp(xy)}{n-1}$$

$$\frac{562.5 - 0.8 \times 248}{10.2} = \frac{10.2}{2.2} = 4.59$$

$$\text{Since } |t| < t_{n-2} = t_8 = 2.366$$

So, we are accepted. Hence the regression

Exercise 11.1

x	y	xy	x^2	y^2
11.8	10.4	122	139.24	108.16
12.5	16.5	206	156.25	262.25
15.8	23.9	359	239.59	524.41
19.3	26.9	516	368.69	442.44
21.9	33.8	704	479.61	
23.3	42.8	997	542.89	1831.84
104.4	$\Sigma y = 153.3$	$\Sigma xy = 2942.49$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

$$SS(x) = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 1933.12 - \frac{10899.36}{6} = 116.56$$

$$SS(y) = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 4602.71 - \frac{23500.89}{6} = 685.898$$

$$\therefore R = \frac{SP(xy)}{\sqrt{SS(x) \cdot SS(y)}} = \frac{225.02}{(116.56) \times 685.898} = 0.97$$



⑥ Need to test

$$H_0: \rho = 0 \quad \text{vs} \quad H_1: \rho \neq 0$$

Test statistic, $t = \frac{\rho \sqrt{n-2}}{\sqrt{1-\rho^2}} = \frac{0.97 \sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 3.97$

Since

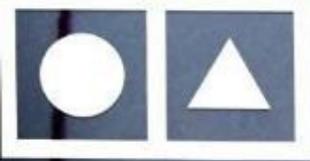
$$|t| > t_{n-2} = |t| > t_u = 2.776 \cdot H_0 \text{ is rejected}$$

⑦ b = $\frac{SP(\bar{x}, \bar{y})}{SS(\bar{x})} = \frac{275 \cdot 0.3}{116.56} = 2.36$

$$\begin{aligned} a = \bar{y} - b\bar{x} &= \bar{y} - 2.36 \left(\frac{\bar{x}}{n} \right) \\ &= \frac{153.3}{6} - 2.36 \left(\frac{104.4}{6} \right) \\ &= -15.514 \end{aligned}$$

Fitted line of y on x: $\hat{y} = a + bx$

$$= -15.514 + 2.36$$



Shot on OnePlus
By Ove Islam

② Need to test $H_0 : \beta = 0$ v. $H_1 : \beta \neq 0$

$$\text{Test statistic } t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{2.36}{\sqrt{\frac{19.26}{116.56}}} = 8.3$$

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

$$= \frac{685.895 - (2.36 \times 275.02)}{6-2}$$

$$= 9.21$$

$$s_{b_1}(t) = \sqrt{\frac{1}{n-2}} = \sqrt{\frac{1}{4}} = 0.5$$

$$= t_1 < t_{0.05}$$

$$t = \frac{(x_3)}{s_{b_1}} = \frac{2.36}{0.5} = 4.72$$

H_1 is accepted Hence the regression

is significant

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By Ove Islam

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Example 11.1

a)

X	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 12420 - \frac{(348)^2}{10} = 309.6$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 25325 - \frac{(865)^2}{10} = 502.5$$

$$SP(xy) = \sum xy = -\frac{\sum x \times \sum y}{n} = 30350 - \frac{348 \times 865}{10} = 298$$

$$r = \frac{SP(xy)}{\sqrt{SS(x)SS(y)}} = \frac{298}{\sqrt{309.6 \times 502.5}} = 0.603$$

The variables $x(\text{age})$ and $y(\text{BP})$ are positively correlated.

b) We need to test $H_0: \rho = 0$ vs $H_1: \rho \neq 0$

$$\text{Test statistic, } t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

$$\text{since } |t| < t_{n-2} = t_8 = 2.306$$

so, H_0 is accepted. Hence, we can conclude that BP of the investigated person are not significantly correlated with their age.

$$c) b = \frac{SP(xy)}{SS(x)} = \frac{298}{308.6} = 0.801$$

$$a = \bar{y} - b\bar{x} = \frac{\sum y}{n} - b \frac{\sum x}{n}$$

$$= \frac{865}{10} - \frac{0.8 \times 398}{10} = 58.66$$

Fitted line: $\hat{y} = a + bx = 58.66 + 0.80x$

d) If $x = 60$

$$\text{Then, } \hat{y} = 58.66 + 0.801(60) = 106.72$$

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

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{0.801}{\sqrt{\frac{38.0125}{308.6}}} = 2.28$$

$$s^2 = \frac{SS(y) - b SP(xy)}{n-2} = \frac{502.5 - 0.8 \times 298}{10-2} = 38.102$$

since $|t| < t_{n-2} = t_8 = 2.306$. So H_0 is accepted.

Hence the regression isn't significant

Exercise 11.1

a)

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	26.9	516.48	368.64	723.61
21.9	33.8	740.22	479.61	1142.44
23.3	42.8	997.24	542.89	1831.84
$\Sigma x = 104.4$	$\Sigma y = 153.3$	$\Sigma xy = 2942.44$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 1933.12 - \left(\frac{104.4}{6}\right)^2 = 116.56$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 4602.71 - \left(\frac{153.3}{6}\right)^2 = 685.895$$

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 2942.99 - \frac{104.4 \times 153.3}{6} = 275.0$$

$$\therefore r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{275.0}{\sqrt{(116.56) \times (685.895)}} = 0.97$$

The variables x and y are positively correlated.

b) we need to test $H_0: \rho = 0$ vs $H_1: \rho \neq 0$

$$\text{Test statistic, } t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97 \sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.98$$

since $|t| > t_{n-2} = t_4 \approx 2.776$. so, H_0 is accepted

We can conclude that lending rate increases significantly with the increase of inflation rate.

$$c) b = \frac{sp(xy)}{ss(x)} = \frac{275.02}{116.56} = 2.36$$

$$a = \bar{y} - b\bar{x} = \frac{\sum y}{n} - 2.36 \times \frac{\sum x}{n}$$

$$= \frac{153.3}{6} - 2.36 \times \frac{109.9}{6} = -15.514$$

∴ Fitted line of y on x : $\hat{y} = a + bx$

$$= -15.514 + 2.36x$$

d) If $x = 25.5$

$$\text{Then, } \hat{y} = -15.514 + (2.36 \times 25.5)$$

$$= 99.666$$

e) we need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{ss(x)}{n}}} = \frac{2.36}{\sqrt{\frac{9.21}{116.56}}} = 8.396$$

$$s^2 = \frac{ss(y) - b sp(xy)}{n-2} = \frac{685.895 - (2.36 \times 275.02)}{6-2} = 9.21$$

Since, $|t| < t_{n-2} = t_4 = 2.776$. So, H_1 is accepted

Hence the regression is significant.

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P: 1

Example:

$$10.1 \quad \text{ss}(x) = \sum x^2 - \frac{(\sum x)^2}{n}$$
$$= 12420 - \frac{348^2}{10} = 309.6$$

$$\text{ss}(y) = \sum y^2 - \frac{(\sum y)^2}{n}$$
$$= 75325 - \frac{865^2}{10} = 502.5$$

$$sp(xy) = \sum xy - \frac{\sum x \sum y}{n}$$
$$= 30350 - \frac{348 \times 865}{10}$$
$$= 248$$

$$r^o = \frac{sp(xy)}{\sqrt{ss(x) ss(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}}$$
$$= 0.63$$

so, X and y are positively correlated.

Sonikat

P: 2

b $H_0: \rho = 0$ vs $H_1: \rho \neq 0$

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} \\ = 2.29$$

$\therefore H_1 < t_8 = 2.306$. H_0 is accepted.

So, BP is not significantly correlated with age.

c $b = \frac{SP(xy)}{SS(x)} = \frac{248}{309.6} = 0.801$

$$a = \frac{\sum y}{n} - b \frac{\sum x}{n} = \frac{865}{10} - 0.801 \frac{348}{10} \\ = 58.62$$

~~$\hat{y} = a + bx = 58.62$~~

$$\hat{y} = a + bx = 58.62 + 0.801x$$

(Ans.)

d here, $n=60$

$$\hat{y} = 58.62 + 0.801(60)$$

$$= 106.68$$

e $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$s^2 = \frac{ss(y) - b sp(m)}{n-2}$$

$$= \frac{502.5 - 0.801 \times 248}{8}$$

$$= 37.98$$

$$t = \frac{0.801}{\sqrt{\frac{37.98}{309.6}}} = 2.29$$

$|t| < t_8 = 2.306$. H_0 is accepted.

So, regression not significant.

Sankar

P:4

Exercise:

10.1 A

$$SS(x) = 1933.12 - \frac{104.4^2}{6} = 116.56$$

$$SS(y) = 4586.66 - \frac{153^2}{6} = 685.16$$

$$SP(xy) = 2936.68 - \frac{15973.2}{6} = 274.48$$

$$\therefore r = \frac{274.48}{\sqrt{116.56 \times 685.16}}$$

$$= 0.97$$

X and Y are positively correlated.

SaiKat

P:5

b

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

$$t = \frac{0.97 \sqrt{4}}{\sqrt{1 - 0.97^2}} = 7.98$$

$|t| > t_{\alpha/2} = 2.776$. H_0 is rejected

so, lending rate increases significantly with the increase of inflation rate.

c

$$b = \frac{274.48}{116.56} = 2.35$$

$$\underline{a} = \frac{685.16}{6} - 2.35 \times \frac{116.56}{6} =$$

$$a = \frac{153.}{6} - 2.35 \times \frac{104.4}{6} = -15.39$$

$$\hat{y} = -15.39 + 2.35 x$$

(Am.)

[d] Here, $n = 25.5$

$$\hat{y} = -15.39 + 2.35 \times 25.5 \\ = 44.53$$

[e] $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$s^2 = \frac{685.16 - 2.35 \times 274.48}{4} \\ = 10.03$$

$$t = \frac{2.35}{\sqrt{\frac{10.03}{116.56}}} = 8.011$$

$|t| > t_{\alpha/2} = 2.774$. H_0 is rejected.

~~So, the regression is significant.~~

So, the regression is significant.

(A)

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Assignment - 5

MD. Atique Rahman Rony

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Example :

11.1

(a)

x	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 12420 - \frac{348^2}{10} = 309.6$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 75325 - \frac{865^2}{10} = 502.5$$

$$SP(xy) = \sum xy - \frac{\sum x \sum y}{n} = 30350 - \frac{348 \times 865}{10} = 248$$

$$r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}} = 0.63$$

The variable x (age) and (BP) Y are positively correlated.

(2)

(b) We need to test,

$$H_0: \rho = 0 \text{ vs } H_1: \rho \neq 0$$

test statistic, $t = \frac{n\sqrt{n-2}}{\sqrt{1-\rho^2}}$

$$= \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

Since, $|t| < t_{n-2} = t_8 = 2.306$.

$\therefore H_0$ is accepted.

We can conclude that $B\rho$ of the investigated persons are not significantly correlated with their age.

(c)

$$b = \frac{sp(my)}{ss(x)} = \frac{248}{300.6} = 0.801 \approx 0.80$$

$$\begin{aligned} a &= \bar{y} - b\bar{x} = \frac{\sum y}{n} - b \frac{\sum x}{n} \\ &= \frac{865}{10} - 0.8 \times \frac{348}{10} \\ &= 58.66 \end{aligned}$$

$$\text{fitted line} = \hat{y} = a + bx = 58.66 + 0.80x$$

(d) if $x=60$

$$\text{then, } \hat{y} = 58.66 + 0.80(60) = 107.26$$

(5)

⑥ We need to test

$$H_0: \beta = 0 \text{ vs } H_1: \beta \neq 0$$

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{s^2}{SS_{(xy)}}}} = \frac{0.80}{\sqrt{\frac{38.0125}{369.67}}} = 2.28$$

$$S^2 = \frac{SS(y) - (b)SP(xy)}{n-2}$$

$$= \frac{502.5 - 0.8 \times 248}{10-2}$$

$$= 38.0125$$

Since, $|t| < t_{n-2} = t_8 = 2.306$ (from table)

so, H_0 is accepted, Hence the regression is not significant.

P.T.D.

(4)

Exercise : 11.1

@

x	y	xy	x^2	y^2
11.8	10.9	122.72	130.24	108.16
12.5	16.5	206.25	156.25	242.25
15.7	22.9	350.53	246.49	524.41
19.2	26.9	516.48	368.64	723.61
21.9	33.8	704.22	479.61	1122.49
23.3	42.8	997.24	542.89	1831.84
$\sum x = 104.4$	$\sum y = 153.3$	$\sum xy = 2042.44$	$\sum x^2 = 1033.12$	$\sum y^2 = 4602.71$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 1033.12 - \frac{10890.36}{6} = 116.56$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 4602.71 - \frac{23500.89}{6} = 685.895$$

$$SP(xy) = \sum xy - \frac{\sum x \sum y}{n} = 2042.44 - \frac{104.4 \times 153.3}{6} = 275.02$$

$$\therefore r = \frac{SP(xy)}{\sqrt{SS(x)SS(y)}} = \frac{275.02}{\sqrt{(116.56)(685.895)}} = 0.97$$

The variable of X (inflated rate) and Y (lending rate) are positively correlated.

(5)

(b) Need to test,

$$H_0: \rho = 0 \text{ vs. } H_1: \rho \neq 0$$

$$\text{Test statistic, } t = \frac{p\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-(0.07)^2}} = 7.08$$

since, ~~H₀~~

$$|t| > t_{n-2} = |t| > t_4 = 2.776, H_0 \text{ is rejected.}$$

We can calculate the lending rate increases significantly with the increase of inflate rate.

$$\textcircled{c} \quad b = \frac{SP(xy)}{SS(x)} = \frac{275.02}{116.56} = 2.36$$

$$a = \bar{y} - b\bar{x} = \frac{\sum y}{n} - 2.36 \left(\frac{\sum x}{n} \right)$$

$$= \frac{153.3}{6} - 2.36 \left(\frac{104.4}{6} \right)$$

$$= -15.514$$

\therefore Fitted line of y on x : $\hat{y} = a + bx$

$$= -15.514 + 2.36x$$

$$\textcircled{d} \quad x = 25.5$$

$$\text{Then, } \hat{y} = -15.514 + (2.36 \times 25.5)$$

$$= 44.666 \approx 44.67$$

(6)

② Need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{s^2}{s^2(n)}}} = \frac{2.36}{\sqrt{\frac{0.21}{116.56}}} = 8.396$$

$$s^2 = \frac{ss(y)}{n-2}$$

$$s^2 = \frac{ss(y) - b \times SP(xy)}{n-2}$$

$$s^2 = \frac{685.895 - (2.36 \times 275.02)}{6-2}$$

$$= 0.21$$

Since, $|t| > t_{n-2}$

$$= |t| > t_4$$

$$= 2.776$$

$\therefore H_1$ is accepted. Hence the regression is significant.

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Example - 11.1

x	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
95	100	9500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\sum x = 348$	$\sum y = 865$	$\sum xy = 30350$	$\sum x^2 = 12920$	$\sum y^2 = 75325$

$SS(x) = \sum yx^2 - \frac{(\sum x)^2}{n} = 12900 - \frac{(348)^2}{10} = 309.6$
 $SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 75325 - \frac{(865)^2}{10} = 502.5$
 $SP(xy) = \sum xy - \frac{\sum x \sum y}{n} = 30350 - \frac{348 \times 865}{10} = 248$

$$r = \frac{SP(x,y)}{\sqrt{SS(x)SS(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}} \approx 0.63$$

The variables x (age) and y (BP) are positively correlated.

b) We need to test

$$H_0: \rho = 0 \quad \text{vs} \quad H_1: \rho \neq 0$$

$$\text{Test statistic, } t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.63 \sqrt{10-2}}{\sqrt{1-0.63^2}} \approx 2.29$$

Since $|t| < t_{1-\alpha/2} = 2.306$ So H_0 is accepted

We can conclude that BP of the investigated persons are not significantly correlated with their age.

$$2.802 = \frac{(xy)}{n} - \frac{(x)\bar{y}}{n} = (x\bar{x})_{22}$$

$$2.502 = \frac{(xy)}{n} - \frac{(y)\bar{x}}{n} = (y\bar{y})_{22}$$

$$8.15 = \frac{(xx)}{n} - \frac{(x)\bar{x}}{n} = (x\bar{x})_{92}$$

$$c) b = \frac{SP(xy)}{SS(x)} = \frac{298}{309.6} = 0.80 \approx 0.8$$

$$\alpha = \bar{y} - b\bar{x} = \frac{\sum y}{n} - b \frac{\sum x}{n} = \frac{865}{10} - 0.8 \times \frac{398}{10} = 58.66$$

$$\therefore \text{Fitted line: } y = \alpha + bx = 58.66 + 0.80x$$

x
51.801 58.661 59.851 60.011 60.661

$$d) \text{ If } x=60 \text{ then } y = 58.66 + 0.80(60) = 107.26$$

51.801	58.661	59.851	60.011	60.661
18.582	24.345	22.628	23.555	24.211

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

$$\text{Test statistic: } t = \frac{\frac{SS_{OPF}}{SS_{SPH}} - b}{\sqrt{\frac{SS_{OPF}}{SS_{SPH}}}} = \frac{0.8}{\sqrt{\frac{38.0125}{309.6}}} = 2.28825$$

$$\frac{\sqrt{SS_{OPF}} - b \sqrt{SS_{SPH}}}{n-2} = \frac{562.5 - 0.8 \times 298}{10-2} = 38.0125$$

Since $|t| = 2.28825 > 2.302 \sim 2.301 = \frac{(n-2)}{n} = \frac{8}{10} = 0.8$, H_0 is accepted.

Hence the regression is not significant.

$$SS_{OPF} = \frac{\sum (y - \hat{y})^2}{n} \rightarrow SS_{OPF} = \frac{\sum (y - 58.66 - 0.8x)^2}{10}$$

$$= \frac{50.278}{10} = \frac{50.278}{10 \times 2.302 \times 2.302} = \frac{50.278}{(n-2)(n-2)}$$

Interpretation: as x increases y increases at a rate of 0.8 per unit increase in x .

$$\text{Exerclse 11.1} \quad = \frac{(Ex) 72}{(x) 22} = 1.5$$

$$a) \bar{x} = \frac{\sum x}{n} = \frac{22.8}{6} = \frac{136.8}{36} = 3.73 \quad \bar{y} = \frac{\sum y}{n} = \frac{153.3}{6} = 25.55$$

x	y	xy	x^2	y^2
11.8	10.9	122.72	139.24	108.81
12.5	16.5	206.25	156.25	272.25
15.7	22.9	359.53	246.49	524.41
19.2	26.9	516.98	368.64	723.61
21.9	33.8	740.22	479.61	1192.49
23.3	42.8	997.24	542.89	1831.84
$\sum x = 109.9$	$\sum y = 153.3$	$\sum xy = 2992.49$	$\sum x^2 = 1933.12$	$\sum y^2 = 9602.71$
$n = 6$				

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 1933.12 - \frac{(109.9)^2}{6} = 116.5$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 9602.71 - \frac{(153.3)^2}{6} = 685.895$$

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 2992 - \frac{109.9 \times 153.3}{6} = 275.02$$

$$\therefore r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{275.02}{\sqrt{116.5 \times 685.895}} = 0.97$$

The variables x and y are positively correlated.

(b) We need to test $H_0: \rho = 0$ vs $H_1: \rho \neq 0$

Test statistic, $t = \frac{0.57\sqrt{n-2}}{\sqrt{1-\rho^2}} = \frac{0.57\sqrt{6-2}}{\sqrt{1-0.57^2}} = 7.98$

since $|t| > t_{n-2} = t_4 = 2.776$. So H_0 is rejected. We can conclude that landing rate increases significantly with the increase of inflation rate.

$$(c) b = \frac{sp(xy)}{ss(x)} = \frac{275.02}{116.56} = 2.36$$

$$a = \bar{y} - b\bar{x} = \frac{\sum y}{n} - 2.36 \times \frac{\sum x}{n} = \frac{153.3}{2} - 2.36 \times \frac{109.912}{2}$$

\therefore Fitted line of y on x : $\hat{y} = a + bx = -15.519 + 2.36x$

d) If $x = 25.5$

$$\begin{aligned} \text{Then } \hat{y} &= -15.519 + (2.36 \times 25.5) \\ &= 44.66 \approx 44.67 \end{aligned}$$

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

Test statistic, $t = \frac{b}{\sqrt{\frac{s^2}{SS_{(x)}}}} = \frac{2.34}{\sqrt{\frac{2.21}{116.56}}} = 8.394 \approx 8.4$

$$\text{Test statistic} = \frac{ss(y) - b s(x)}{n-2} = \frac{85 - 89.5 - (2.34 \times 275 \cdot 02)}{22} = -9.221$$

$$28.8 = \frac{-9.221}{22 \cdot 21} = \frac{(y) 92}{(x) 22} = 8.4$$

Since $|t| > t_{\alpha/2}$, H_0 is rejected.

Hence the regression is significant.

Also $t = \frac{b}{s_b} = \frac{2.34}{0.21} = 11.14$ is greater than $t_{\alpha/2}$.

$$2.25 = 11.14$$

$$(2.25 \times 28.8) \rightarrow p < 0.05$$

$$p < 0.05 \rightarrow H_0 \text{ is rejected}$$

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Jannatuil Ferdouse Jannat p-1
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a) Example - 11. 1

x	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\Sigma x = 340$	$\Sigma y = 865$	$\Sigma xy = 3035$	$\Sigma x^2 = 12120$	$\Sigma y^2 = 75325$

P-2

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 12120 - \frac{(348)^2}{10}$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 75325 - \frac{(865)^2}{10} = 509.5$$

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 30350 - \frac{348 \times 865}{10} = 248$$

$$r_{xy} = \frac{SP(xy)}{\sqrt{SS(x)SS(y)}} = \frac{248}{\sqrt{309.6 \times 509.5}} = 0.63$$

The variables x (age) and y (BP) are positively correlated.

b) We need to test,

$$H_0: P=0 \text{ vs } H_1: P \neq 0$$

$$\text{Test statistic, } t = \frac{n(\sqrt{n-2})}{\sqrt{1-\rho^2}} = \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

P-0.0003

c) $b = \frac{SP(x, y)}{SS(x)} = \frac{248}{309.6} = 0.801 \approx 0.8$

$$\begin{aligned} a &= \bar{y} - b\bar{x} = \frac{\sum y}{n} - b \frac{\sum x}{n} \\ &= \frac{865}{10} - 0.8 \times \frac{348}{10} \\ &\approx 58.66 \end{aligned}$$

∴ Fitted line: $\hat{y} = a + b x = 58.66 + 0.80 x$

d) $\sum x = 60$

Then

$$\hat{y} = 58.66 + 0.80(60) = 107.26$$

e) we need to test $H_0: \beta = 0 \text{ vs } H_1: \beta \neq 0$

$$\text{Test statistic } t = \frac{b}{\sqrt{\frac{SS(x)}{n}}} = \frac{0.80}{\sqrt{\frac{38.0125}{309.6}}} \approx 2.08$$

Ex- 8000 4

$$s_r = \frac{ss(y) - b SP(xy)}{n-2}$$

$$\approx \frac{502.5 - 0.81248}{10-2} = 38.00125$$

Since $|t| < t_{n-2} = 2.306$, so H_0 is accepted. Hence the regression is not significant.

$\hat{y} = 5d + a = B$; $B = 508.6$

$$0.2 = 5d + a$$

S.E. of (a) = 0.1, S.E. of d = 0.5

$t_0 = \frac{0.2 - 5(0.5)}{0.5} = -8$

P-~~Q~~ 5

since $|t| < t_{\alpha/2}$, so Ho is accepted. Hence the regression
Exercise 11.1

a)

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	359.59	246.49	524.41
19.2	26.9	516.48	368.64	723.61
21.2	33.8	740.22	479.61	1142.42
23.3	42.8	997.24	542.89	1831.84
$\sum x = 109.4$	$\sum y = 153.3$	$\sum xy = 2942.44$	$\sum x^2 = 1933.12$	$\sum y^2 = 4602.7$
$ss(x) = \frac{(\sum x)^2}{n} = 1933.12 - \frac{(109.4)^2}{6} = 116.56$				
$ss(y) = \frac{(\sum y)^2}{n} = 4602.71 - \frac{(153.3)^2}{6}$				

$$sp(xy) = \sum xy - \frac{\sum x \sum y}{n} = 2942 - \frac{109.4 \times 153.3}{6} = 275.02$$

Q 6 Q-7

P - C

$$\therefore r = \frac{SP(x,y)}{\sqrt{ss(x)ss(y)}} = \frac{275.02}{\sqrt{116.56 \times 685.895}} \\ = 0.97$$

The variable's X (inflation rate) and Y (lending rate.) are positively correlated.

12.00%	12.00%	12.00%	12.00%
12.00%	12.00%	12.00%	12.00%
12.00%	12.00%	12.00%	12.00%
12.00%	12.00%	12.00%	12.00%
12.00%	12.00%	12.00%	12.00%

P-T

We need to test, $H_0: \rho = 0$ vs, $H_1: \rho \neq 0$

test statistic, $t = \frac{\tau \sqrt{n-2}}{\sqrt{1-\tau^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-0.97^2}}$

$|t| = 7.98$

since,

~~$|t| > t_{n-2}$~~ $|t| > t_{n-2} = 2.776$. so H_0 is rejected, we can conclude that lending rate increases significantly with the increase of inflation rate.

③ $b = \frac{SP(XY)}{SS(X)} = \frac{275.02}{116.56} = 2.36$

$a = \bar{Y} - b\bar{x} = \frac{\sum Y}{n} - 2.36 \times \frac{\sum x}{n}$

$= \frac{153.3}{6} - 2.36 \times \frac{109.4}{6}$

$a = -15.514$

∴ fitted line of Y on x : \hat{y}

$$= a + bx = -15.514 + 2.36x$$

∴ Fitted line of y on x : $\hat{y} = a + bx$
 $= -15.514 + 2.36x$

$$R=0.10 \quad P=8$$

$$\textcircled{a} \quad \bar{x} = 25.5$$

$$\text{then, } \hat{Y} = -15.514 + (2.36 \times 25.5) \\ \approx 44.666 \approx 44.67$$

c) we need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{2.36}{\sqrt{\frac{9.21}{116.56}}} = 8.396 \approx 8.4$$

$$s^2 = \frac{SS(Y) - b SP(XY)}{n-2} = \frac{6.85 \cdot 8.95 - (2.36 \times 25.5)}{6-2}$$

$$= 9.21$$

since, $|t| < t_{n-2} = 2.776$. so H_1 is accepted. hence the regression is

significant.

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Syeda Aynul Karim.

Pg: 01

19-41829-3

Assignment : 05

Example - 11.1(a,b)

(a)

x	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\sum x = 348$	$\sum y = 865$	$\sum xy = 30350$	$\sum x^2 = 12920$	$\sum y^2 = 75325$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 12920 - \frac{(348)^2}{10} = 309.6$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 75325 - \frac{(865)^2}{10} = 502.5$$

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 30350 - \frac{348 \times 865}{10} = 248$$

19-41829-3

$$P = \frac{SP(xy)}{\sqrt{SS(x)SS(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}} = 0.63$$

The variables x (age) & y (BP) are positively correlated.

(b) We need to test,

$$H_0: P=0 \text{ vs } H_1: P \neq 0$$

Test statistic, $t = \frac{n\sqrt{n-2}}{\sqrt{1-n^2}} = \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$

Since $|t| < t_{n-2} = t_8 = 2.306$. So, H_0 is accepted.

We can conclude that BP of the investigated persons are not significantly correlated with their age.

$$(b) b = \frac{SP(xy)}{SS(x)} = \frac{248}{309.6} = 0.801 \approx 0.80$$

$$\begin{aligned} a - \bar{y} - bx &= \frac{\sum y}{n} - b \frac{\sum x}{n} \\ &= \frac{865}{10} - 0.8 \times \frac{398}{10} \\ &= 58.66 \end{aligned}$$

$$\therefore \text{Fitted Line: } \hat{y} = a + bx = 58.66 + 0.80x$$

19-41829-3

④ If $x = 60$

Then,

$$\hat{y} = 58.66 + 0.80(60) = 107.26$$

old iron art

⑤ We need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$\text{Test statistic, } t = \frac{b - 0}{\sqrt{\frac{SS}{n}}} = \frac{0.80}{\sqrt{\frac{38.0125}{10}}} = 2.28$$

$$S^2 = \frac{SS(y) - b SP(xy)}{n-2}$$

$$= \frac{502.5 - 0.8 \times 298}{10-2}$$

$$= 38.0125$$

Since $|t| < t_{n-2} = t_8 = 2.306$, H_0 accepted.

Hence, the regression is not significant.

19-91829-3

Exercise 11.1

@

x	y	xy	x^2	y^2
11.8	10.4	122.82	130.24	108.16
12.5	16.5	206.25	156.25	272.25
15.7	22.9	359.53	248.49	529.41
19.2	26.9	516.48	368.64	723.61
21.9	33.8	790.22	479.61	1142.49
23.3	42.8	997.24	592.89	1831.84
$\sum x = 109.4$	$\sum y = 153.3$	$\sum xy = 2992.99$	$\sum x^2 = 1933.12$	$\sum y^2 = 4602.71$

$$SS(x) = \sum x - \frac{(\sum x)^2}{n} = 1933.12 - \frac{(109.4)^2}{6} = 116.56$$

$$SS(y) = \sum y - \frac{(\sum y)^2}{n} = 4602.71 - \frac{(153.3)^2}{6} = 685.895$$

$$SP(xy) = \sum xy - \frac{\sum x \sum y}{n} = 2992.99 - \frac{(109.4)(153.3)}{6} = 275.02$$

$$\therefore r = \frac{SP(xy)}{\sqrt{SS(x)SS(y)}} = \frac{275.02}{\sqrt{(116.56)(685.895)}} \approx 0.97$$

The variables x (inflation rate) and Y (lending rate) are positively correlated. (Ans)

19-41829-3

(b) We need to test, $H_0: \rho = 0$ vs $H_1: \rho \neq 0$

$$\text{Test statistic } t = \frac{n\sqrt{n-2}}{\sqrt{1-\rho^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.98$$

Since $|t| > t_{n-2} = t_4 = 2.776$. So, H_0 is rejected. We can conclude that lending rate increases significantly with the increase of inflection rate. (Ans.)

$$(c) b_1 = \frac{SP(xy)}{SS(x)} = \frac{275.02}{116.56}$$

$$= 2.36.$$

$$a = \bar{y} - b\bar{x} = 153.3 - 2.36 \times 62.5 = -15.514$$

$$= \frac{\sum y}{n} - 2.36 \times \frac{\sum x}{n}$$

$$= \frac{153.3}{6} - 2.36 \times \frac{109.9}{6}$$

$$= -15.514$$

$$\therefore \text{Fitted line of } y \text{ on } x: \hat{y} = a + bx = -15.514 + 2.36x \quad (\text{Ans.})$$

19-41829-3

④ If, $x = 25.5$

Then,

$$\begin{aligned}\hat{y} &= -15.519 + (2.36 \times 25.5) \\ &= 49.666 \approx 49.67 \quad (\text{Ans.})\end{aligned}$$

⑤ We need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{SS(x)}{SS(y)}}} = \frac{2.36}{\sqrt{\frac{9.21}{116.56}}} = 8.396 \approx 8.4$$

$$\begin{aligned}s^2 &= \frac{SS(y) - b SP(xy)}{n-2} = \frac{685.895 - (2.36 \times 275.02)}{6-2} \\ &= 9.21\end{aligned}$$

Since, $|t| < t_{n-2} = t_4 = 2.776$. So, H_1 is accepted.

Hence, the regression is significant.

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20-41906-1

Example - II. I (a, b)

①

x	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\sum x = 398$	$\sum y = 865$	$\sum xy = 30350$	$\sum x^2 = 12420$	$\sum y^2 = 75325$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 12420 - \frac{(398)^2}{10} = 309.6$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 75325 - \frac{(865)^2}{10} = 502.5$$

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 30350 - \frac{398 \times 865}{10} = 298$$

$$R = \frac{SP(xy)}{\sqrt{SS(x)SS(y)}} = \frac{298}{\sqrt{309.6 \times 502.5}} = 0.63$$

The variable x (age) and y (BP) are positively connected.

④ We need to test,

$$H_0: \rho = 0 \quad \text{vs} \quad H_1: \rho \neq 0$$

$$\text{Test statistic, } t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

$$\text{Since } |t| < t_{n-2} = t_8 = 2.306$$

So, H_0 is accepted.

$$⑤ b = \frac{sp(u_y)}{ss(u)} = \frac{298}{309 \cdot 6} = 0.801 \approx 0.80$$

$$\begin{aligned} a &= \bar{y} - b\bar{u} = \frac{\sum y}{n} - b \frac{\sum u}{n} \\ &= \frac{865}{10} - 0.8 \times \frac{398}{10} \\ &= 58.66 \end{aligned}$$

$$\therefore \text{Fitted line: } \hat{y} = a + bu = 58.66 + 0.80u$$

⑥ If $u=60$

So, we know,

$$\begin{aligned} \hat{y} &= 58.66 + 80 \quad (60) \\ &= 107.26 \end{aligned}$$

20-91906-1

② We need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$

$$\text{Test statistics, } t = \frac{b}{\sqrt{\frac{SS(u)}{n-2}}} = \frac{0.80}{\sqrt{\frac{38.0125}{307.6}}}$$

$$S^2 = \frac{SS(y) - b SP(xy)}{n-2} = 2.28$$

$$= \frac{502.5 - 0.8 \times 298}{16-2} = 38.0125$$

Since $|t| < t_{n-2, f_8} = 2.306$, so H_0 is accepted.

Exercise 11.1

①

x	y	xy	x ²	y ²
11.8	10.4	122.32	139.29	108.16
12.5	16.5	206.25	156.25	272.25
15.7	22.9	359.53	246.49	529.41
19.2	26.9	516.48	368.64	729.61
21.9	33.8	790.22	479.61	1142.99
23.3	42.8	997.29	592.89	1831.89
$\sum x = 109.9$	$\sum y = 153.3$	$\sum xy = 2992.49$	$\sum x^2 = 1933.12$	$\sum y^2 = 4602.71$

$$SS(u) = \sum x^2 - \frac{(\sum x)^2}{n} = 1933.12 - \frac{(109.9)^2}{6} = 116.56$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 4602.71 - \frac{(153.3)^2}{6} = 685.895$$

$$SS(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 2992.49 - \frac{(109.9) \times (153.3)}{6} = 275.02$$

$$\therefore r = \frac{SP(xy)}{\sqrt{SS(u)SS(y)}} = \frac{275.02}{\sqrt{(116.56)(685.895)}} = 0.97$$

The variables x (inflation rate) and Y (lending rate) are positively correlated.

20-91906-1

⑥ We need to test,

$$H_0: \rho = 0 \quad \text{vs} \quad H_1: \rho \neq 0$$

$$\text{Test static, } t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.98$$

$$\text{since } |t| > t_{n-2} = t_4 = 2.776$$

So, H_0 is rejected.

⑦ $b = \frac{\sum p(uY)}{\sum s(u)} = \frac{275.02}{176.56} = 2.36$

$$\begin{aligned} a = \bar{y} - b\bar{u} &= \frac{\sum Y}{n} - 2.36 \times \frac{\sum u}{n} \\ &= \frac{153.3}{6} - 2.36 \times \frac{109.9}{6} \\ &= -15.519 \end{aligned}$$

$$\therefore \text{Fitted line of } Y \text{ on } u: \hat{Y} = a + bu \\ = -15.519 + 2.36(u) \quad (\text{Ans})$$

⑧ If, $u = 25.5$

$$\begin{aligned} \text{Then, } \hat{Y} &= -15.519 + (2.36 \times 25.5) \\ &= 49.666 \approx 49.67 \quad (\text{Ans}) \end{aligned}$$

20-91906-1

② We need to test,

$$H_0 : \beta = 0 \quad \text{vs} \quad H_1 : \beta \neq 0$$

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{s^2}{SS(u)}}} = \frac{2.36}{\sqrt{\frac{2.21}{116.56}}} = 8.396 \approx 8.9$$

$$s^2 = \frac{SS(Y) - b S_{YP}(uY)}{n-2} = \frac{685.895 - (2.36 \times 275.02)}{6-2} \\ = 2.21$$

since, $|t| = t_{n-2} = t_q = 2.776$. so, H_1 is accepted.

Hence the regression is significant.

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Nayef (20-42048-1)

1

a)		<u>Example - 11.1 (a, b)</u>			
x	y	xy	x ²	y ²	
25	75	1875	625	5625	
30	80	2400	900	6400	
35	85	2975	1225	7225	
30	90	2700	900	8100	
32	95	3040	1024	9025	
90	85	3900	1600	7225	
45	100	4500	2025	10000	
90	90	3600	1600	8100	
36	85	3060	1296	7225	
35	80	2800	1225	6900	
$\sum x = 348$	$\sum y = 865$	$\sum xy = 30350$	$\sum x^2 = 12920$	$\sum y^2 = 75325$	

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 12920 - \frac{(348)^2}{10} = 309.6$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 75325 - \frac{(865)^2}{10} = 502.5$$

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 30350 - \frac{348 \times 865}{10} = 298$$

The variable ~~$x(\text{age})$~~ and $y(\text{BP})$ are positively.

$$r = \frac{SP(x,y)}{\sqrt{SS(x) SS(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}} = 0.63$$

The variables $X(\text{age})$ and $Y(\text{BP})$ are positively correlated.

b) We need to test,

$$H_0: \rho = 0 \quad \text{vs} \quad H_1: \rho \neq 0$$

$$\text{Test statistic, } t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.63 \sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

since $|t| < t_{n-2} = t_8 = 2.306$. so H_0 is accepted.

We can conclude that BP of the investigated persons are not significantly correlated with their age.

$$c) b = \frac{SP(X,Y)}{SS(X)} = \frac{248}{309.6} = 0.801 \approx 0.80$$

$$\begin{aligned} a - \bar{y} - b \bar{x} &= \frac{\sum y}{n} - b \frac{\sum x}{n} \\ &= \frac{865}{10} - 0.8 \times \frac{398}{10} \\ &= 58.66 \end{aligned}$$

$$\therefore \text{Fitted line: } \hat{y} = a + bx = 58.66 + 0.80x$$

d) If $x = 60$

Then,

$$\hat{y} = 58.66 + 0.80 \times (60) = \cancel{106.66} 107.26$$

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

Test statistic, $t = \frac{\hat{\beta}}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{0.80}{\sqrt{\frac{38.0125}{309.6}}} = 2.28$

$$s^2 = \frac{SS(y) - b SP(xy)}{n-2} = \frac{502.5 - 0.8 \times 298}{10-2} = 38.0125$$

Since $|t| < t_{n-2} = 2.306$, so H_0 is accepted. Hence

The regression is not significant.

$$R^2 = \frac{SS(\text{reg})}{SS(\text{tot})} = \frac{18.803}{502.5} = 0.0373 = 3.73\%$$

$$R^2 = \frac{\sum (y_i - \bar{y})^2}{\sum (y_i - \hat{y}_i)^2} = \frac{\sum (y_i - \bar{y})^2}{\sum (y_i - \hat{y}_i)^2} = R^2 = 3.73\%$$

Exercise 11.1

Q5

x	y	xy	x^2	y^2
11.8	10.9	122.72	139.24	108.16
12.5	16.5	206.25	156.25	272.25
15.7	22.9	359.53	246.49	529.41
19.2	26.9	516.98	472.64 368.64	723.61
21.9	33.8	710.22	979.61	1112.49
23.3	42.8	997.29	592.89	1831.89
$\sum x = 109.4$		$\sum y = 153.3$	$\sum xy = 2992.99$	$\sum x^2 = 1933.12$
				$\sum y^2 = 4602.71$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 1933.12 - \frac{(109.4)^2}{6} = 116.56$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 4602.71 - \frac{(153.3)^2}{6} = 685.895$$

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 2992.99 - \frac{(109.4)(153.3)}{6} = 275.02$$

$$\therefore r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{275.02}{\sqrt{(116.56)(685.895)}} = 0.97$$

The variables X (inflation rate) and Y (lending rate) are positively correlated. (Ans)

b) We need to test, $H_0: \rho = 0$ vs $H_1: \rho \neq 0$

$$\text{Test statistic, } t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97 \sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.98$$

Since $|t| > t_{n-2} = t_4 = 2.776$. So H_0 is rejected. We can conclude that lending rate increases significantly with the increase of inflation rate. (Ans)

$$b = \frac{SP(xy)}{ss(x)} = \frac{275.02}{116.56} = 2.36$$

$$\begin{aligned} a = \bar{y} - b\bar{x} &= \frac{\sum y}{n} - 2.36 \times \frac{\sum x}{n} \\ &= \frac{153.3}{6} - 2.36 \times \frac{109.9}{6} \end{aligned}$$

$$= -15.519$$

\therefore Fitted line of y on x : $\hat{y} = a + bx$

$$= -15.519 + 2.36x$$

(Ans)

d) If $x_0 = 25.5$ - find the value of y

Then,

$$\hat{y} = -15.519 + (2.36 \times 25.5)$$

$$= 99.666 \approx 99.67$$

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

$$\text{Test statistic, } t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{2.36}{\sqrt{\frac{9.21}{116.56}}} \approx 8.396 \approx 8.4$$

$$s^2 = \frac{SS(y) - bSS(xy)}{n-2} = \frac{685.895 - (2.36 \times 275.02)}{6-2}$$

$$= \frac{113.81}{4} = 28.8 = 9.21$$

Since, $|t| < t_{n-2} = t_4 = 2.776$. So H_1 is accepted. Hence

the regression is significant.

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Problem 10.1

x	y	xy	x^2	y^2
25	75	1875	625	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1600	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\Sigma x = 348$		$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$
$\Sigma y^2 = 75325$				

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 12420 - \frac{348^2}{10} = 309.6$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 75325 - \frac{865^2}{10} = 502.5$$

$$SP(xy) = \sum xy - \frac{\sum x \sum y}{n} = 30350 - \frac{348 \times 865}{10} = 248$$

$$r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}} = 0.63$$

The variables x (age) and y (BP) are positively correlated.

b) We need to test,

$$H_0: \rho = 0 \text{ vs } H_1: \rho \neq 0$$

Test Statistic:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.63\sqrt{10-2}}{\sqrt{1-0.63^2}} = 2.29$$

Since $|t| < t_{n-2} = t_8 = 2.306$, So, H_0 is accepted
We can conclude that BP of the investigated persons is not significantly correlated with their age.

c) $b = \frac{SP(xy)}{SS(x)} = \frac{248}{309.6} = 0.80$

$$a = \bar{y} - b\bar{x} = \frac{\sum y}{n} - b \frac{\sum x}{n} = \frac{865}{10} - 0.8 \times \frac{348}{10} = 86.5 - 34.8 = 51.7$$

Fitted line: $\hat{y} = a + bx = 58.66 + 0.8x$

Plotting on graph paper obtained a fit line

d) If $x=60$, then, $\hat{y} = 58.66 + 0.80 \times 60 = 108.66$

$$= 106.66$$

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

Test Statistics: $t = \frac{b}{\sqrt{\frac{s^2}{ss(x)}}} = \frac{0.80}{\sqrt{\frac{38.012}{309.6}}} = 2.28$

$$s^2 = \frac{ss(y) - b sp(xy)}{n-2} = \frac{502.5 - 0.8 \times 248}{10-2} = 38.012$$

Since $|t| < t_{n-2} = 2.306$, So, H_0 is accepted.

Hence the regression is not significant.

Whether published all books after waitlisted or
not publishing, publishing not

Exercise 10.1

x	y	xy	\bar{x}	\bar{y}
11.8	10.4	122.32	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	70.856
21.9	33.8	740.22	479.61	1142.44
23.3	42.8	998.24	542.89	1831.84
$\sum x = 104.4$	$\sum y = 153$	$\sum xy = 2936.68$	$\sum x^2 = 1933.12$	$\sum y^2 = 4586.66$

$$SS(x) = \sum x^2 - \frac{(\sum x)^2}{n} = 1933.12 - \frac{104.4^2}{6} = 116.56$$

$$SS(y) = \sum y^2 - \frac{(\sum y)^2}{n} = 4586.66 - \frac{153^2}{6} = 685.16$$

$$SP(x,y) = \sum xy - \frac{\sum x \sum y}{n} = 2936.68 - \frac{104.4 \times 153}{6} = 284.48$$

$$r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{284.48}{\sqrt{116.56 \times 685.16}} = 0.971$$

The inflation rate (x) and the lending rate (y) are positively correlated.

b) We need to test $H_0: \rho = 0$ vs $H_1: \rho \neq 0$

$$\text{Test statistic, } t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-0.981^2}} = 8.12$$

Since $|t| > t_{n-2} = t_4 = 2.776$, So, H_0 is rejected.

We can conclude that lending rate increases significantly with the increases of inflation rate.

$$c) b = \frac{SP(x,y)}{SS(x)} = \frac{2x_4 \cdot 48}{116.56} = 2.354$$

$$\begin{aligned} a &= \bar{y} - b\bar{x} = \frac{\sum y}{n} - 2.354 \cdot \frac{\sum x}{n}, \\ &= \frac{153}{6} - 2.354 \cdot \frac{104.4}{6} \\ &= -15.49 \end{aligned}$$

Fitted line : $\hat{y} = a + bx = -15.49 + 2.354x$

$$d) \text{ If } x = 25.5, \text{ then, } \hat{y} = -15.49 + 2.354 \times 25.5 \\ = 44.53$$

e) We need to test $H_0: \beta = 0$ vs $H_1: \beta \neq 0$ at 5% level.

Test statistic, $t = \frac{b}{\sqrt{\frac{S_{yy}}{S_{xx}}}} = \frac{2.354}{\sqrt{\frac{9.758}{116.56}}} = 8.135$

$S^2 = \frac{S_{yy} - b S_{xy}}{n-2} = \frac{685.16 - 2.354 \times 234.48}{4} = 9.758$

Since, $|t| > t_{n-2} = t_4 = 2.776$. So H_0 is rejected.
Hence the regression is significant.

$$\begin{aligned} 0.22818 - \frac{2.354}{116.56}x + 35.8 - 0 &= 0 \\ 0.22818 - 2.354x + 35.8 &= 0 \end{aligned}$$