ASSIGNMENT : 05

Course : Computational Statistics And Probability

Submitted By,

Group A

Section : K

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Subject :

Date :

11.

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
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 7532$

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

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

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

$$= 248$$

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

The variable x and Y are positively corelated

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b. We need to test, $H_0: \rho = 0$ Vs $H_1: \rho \neq 0$

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

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

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

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

$= \frac{865}{10} - 0.8 \times \frac{348}{10} = 58.66$

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

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 significant

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Ex: N.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
$\Sigma x = 104.4$	$\Sigma y = 153.3$	$\Sigma xy = 2942.44$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

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

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

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

$$= 275.02$$

$$\therefore r = \frac{275.02}{\sqrt{(116.56) \times (685.895)}} = 0.97$$

The variable x and y are possitively correlated.

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

test stistics $= t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.98$

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

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

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

$= \frac{153.3}{6} - 2.36 \times \frac{104.4}{6}$

$= -15.514$

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

$= -15.514 \cdot 2.36x$

d) If $x = 25.5$

then, $\hat{y} = -15.514 + (2.36 \times 35.5)$

$= 44.666 \approx 44.67$

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

test statistics $t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{2.36}{\sqrt{\frac{9.21}{116.56}}} = \cancel{8.396} \approx 8.4$

$s^2 = \frac{685.895 - (2.36 \times 275.02)}{6-2} = 9.21$

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

So, H_1 is accepted.

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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	~~[illegible]~~ 3040	1600	7225
45	100	~~[illegible]~~ 4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

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

$$= 12420 - \frac{(348)^2}{10} = 309.6$$

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

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

$$= 30350 - \frac{348 \times 865}{10}$$

$$= 248$$

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$$r = \frac{SP(xy)}{\sqrt{SS(x)\,SS(y)}}$$

$$= \frac{248}{\sqrt{309.6 \times 502.5}} \doteq 0.63$$

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

ⓑ we need to taste,

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

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 person are not significantly correalated with their age.

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

$a = \bar{y} - b\bar{x}$

$= \frac{\Sigma y}{n} - b\frac{\Sigma x}{n}$

$= \frac{865}{10} - 0.8 \times \frac{348}{10}$

$= 58.66$

$\therefore$ fixed line : $\hat{y} = a + bx$

$= 58.66 + 0.80\, x$

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

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

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

Hence the regression is not accepted.

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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	26.9	516.48	368.64	723.61
21.9	33.8	740.22	479.61	11,42.44
23.3	42.8	997.24	542.89	1831.84
$\Sigma x=104.4$	$\Sigma y=153.3$	$\Sigma xy=2942.44$	$\Sigma x^2=1933.12$	$\Sigma y^2=4602.71$

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

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

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

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

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

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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 possitively corrected (A)

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

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

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

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

$$= \frac{153.3}{6} - 2.36 \times \frac{104.4}{6}$$

$$= -15.574$$

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

$$= -15.574 + 2.36x$$

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

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

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

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Example 11.1

x	y	xy	x^2	y
25	75	1875	625	562
30	80	2400	900	640
35	85	2975	1225	722
30	90	2700	900	8100
32	95	3040	1024	9024
40	85	3400	1600	722
45	100	4500	2025	1000
40	90	3600	1600	8100
36	85	3060	1296	722
35	80	2800	1225	640

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

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

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

$SP(xy) = \Sigma xy - \frac{\Sigma x \times \Sigma y}{n} = 30350 - \frac{348 \times 865}{10} = 2$

$R = \frac{SP(xy)}{\sqrt{SS(x)\,SS(y)}} = \frac{248}{\sqrt{309.6 \times 562.5}} = 0.63$

(b) $\rho = 0$ vs $H_1 : \rho \neq 0$

Test Statistic $= t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{.63\sqrt{10-2}}{1-(0.63)^2}$

$= 2.29$

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

So, H_0 is accepted

We can conclude that Bp of the investigated persons are not significantly correlated with there age

(c) $b = \frac{SP(xy)}{SS(x)} = \frac{248}{309.6} = 0.81 \approx 0.80$

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

$= \frac{865}{10} - 0.8 \times \frac{348}{10}$

$= 58.66$

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

(d) if $x = 60$

When $\hat{y} = 58.66 + 0.80(60) = 10\cancel{x}.26$

(e) We have to test

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

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

$$s^2 = \frac{SS(y) - (b)SP(xy)}{n-1}$$

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

$$= 38.0125$$

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

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

Exercise 11.11

x	y	xy	x^2	y^2
11.8	10.4	122	139.24	108.16
12.5	16.5	206	156.25	272.25
15.8	22.9	358	239.59	524.41
19.2	26.9	516	368.69	723.61
21.9	33.8	704	479.61	442.44
23.3	42.8	997	542.89	1831.84
Σx 104.4	$\Sigma y = 153.3$	$\Sigma xy = 2942.49$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

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

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

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

(b) Need to test

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

Test statistic, $t = \frac{\rho\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-(0.97)^2}} = 7.9$

Since

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

(c) $b = \frac{SP(xy)}{SS(x)} = \frac{275.03}{116.56} = 2.36$

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

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

$= -15.514$

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

$= -15.514 + 2.36$

(c) ~~Need~~ Need to test $H_0 : \beta = 0$ v. $H_1 : \beta \neq 0$

~~Test~~ statistic $t = \dfrac{b}{\sqrt{\frac{S^2}{SS(x)}}} = \dfrac{2.36}{\sqrt{\frac{9.26}{116.56}}} = 8.3$

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

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

$= 9.21$

So, $|t| < t_{n-2}$

$= |t| < t_4$

$= 2.776$

H_1 is accepted Hence the regression is significant

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Example 11.1

a)

x	y	xy	x^2	y^2
25	75	1875	628	5625
30	80	2400	900	6400
35	85	2975	1225	7225
30	90	2700	900	8100
32	95	3040	1024	9025
40	85	3400	1000	7225
45	100	4500	2025	10000
40	90	3600	1600	8100
36	85	3060	1296	7225
35	80	2800	1225	6400
Σx = 348	Σy = 865	Σxy=30350	Σx^2=12420	Σy^2=75325

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

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

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

$$r = \frac{SP(xy)}{\sqrt{SS(x) SS(y)}} = \frac{248}{\sqrt{309.6 \times 502.5}} = 0.603$$

The variables X (age) and y (BP) are positively correalated.

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

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

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

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

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

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

$= \dfrac{865}{10} - \dfrac{0.8 \times 348}{10} = 58.66$

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

d) If $x = 60$

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

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

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

$s^2 = \dfrac{SS(y) - b\,SP(xy)}{n-2} = \dfrac{502.5 - 0.8 \times 248}{10-2} = 38.102$

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

Hence the regression isn't significent

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
Σx=104.4	Σy=153.3	Σxy=2942.44	Σx^2=1933.12	Σy^2=4602.71

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

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

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 2942.44 - \frac{104.4 \times 153.3}{6} = 275.0$$

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

The variables x and y are positively correlated.

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

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 accepted

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

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

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

$= \frac{153.3}{6} - 2.36 \times \frac{104.4}{6} = -15.514$

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

$= -15.514 + 2.36x$

d) If $x = 25.5$

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

$= 44.666$

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

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

$s^2 = \frac{SS(y) - bSP(xy)}{x-2} = \frac{685.895 - (2.36 \times 275.02)}{6-2} = 9.21$

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

Hence the regression is significant.

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Example:

10.1 $\boxed{a}$ $SS(x) = \sum x^2 - \frac{(\sum x)^2}{n}$

$= 12420 - \frac{348^2}{10} = 309.6$

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

$= 75325 - \frac{865^2}{10} = 502.5$

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

$= 30350 - \frac{348 \times 865}{10}$

$= 248$

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

$= 0.63$

So, X and Y are positively corelated.

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

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

$$= 2.29$$

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

So, BP is not significantly correlated with age.

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

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

$$= 58.62$$

~~$\hat{y} = a + bx = 58.6$~~

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

(Ans.)

$\boxed{d}$ here, $x = 60$

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

$$= 106.68$$

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

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

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

$$= 37.98$$

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

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

So, regression not significant.

Exercise:

10.1 $\boxed{a}$ $SS(x) = 1933.12 - \frac{104.4^2}{6}$

$= 116.56$

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

$= 685.16$

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

$= 274.48$

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

$= 0.97$

X and Y are positively correlated.

Saikat

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

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

$|t| > t_4 = 2.776$. H_0 is rejected

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

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

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

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

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

(Ans.)

$\boxed{d}$ Here, $x = 25.5$

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

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

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

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

$|t| > t_4 = 2.774$. H_0 is rejected.

~~So, the regretion is significant.~~

So, the regretion is significant.

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Assignment - 5

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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
$\sum x = 348$	$\sum y = 865$	$\sum xy = 30350$	$\sum x^2 = 12420$	$\sum y^2 = 75325$

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

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

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

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

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

(b) We need to test,

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

test statistic, $t = \dfrac{r\sqrt{n-2}}{\sqrt{1-r^2}}$

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

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

$\therefore$ H_0 is accepted.

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

(c)

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

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

$$= \frac{865}{10} - 0.8 \times \frac{348}{10}$$

$$= 58.66$$

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

(d) if $x = 60$

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

(c) We need to test

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

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

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

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

$$= 38.0125$$

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

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

P.T.O.

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	242.25
15.7	22.9	359.53	246.49	524.41
19.2	26.9	516.48	368.64	723.61
21.9	33.8	704.22	479.61	442.44
23.3	42.8	997.24	542.89	1831.84
$\sum x = 104.4$	$\sum y = 153.3$	$\sum xy = 2942.44$	$\sum x^2 = 1933.12$	$\sum y^2 = 4602.71$

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

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

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 2942.44 - \frac{104.4 \times 153.3}{6} = 275.02$$

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

The variable of X (inflate rate) and Y (lending rate) are possitively correlated.

(b) 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, ~~ltl~~

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

We can calcutated the lending rate increses significantly with the increse of inflate rate.

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

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

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

$= -15.514$

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

$= -15.514 + 2.36x$

(d) $x = 25.5$

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

$= 44.666 \approx 44.67$

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

Test statistic, $t = \dfrac{b}{\sqrt{\dfrac{s^2}{SS(x)}}} = \dfrac{2.36}{\sqrt{\dfrac{0.21}{116.56}}} = 8.396$

~~$s^2 = SS(y) - b(SP)(xy)$~~

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

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

$$= 0.21$$

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

$= |t| < t_4$

$= 2.776$

H_1 is accepted. Hence the regression is ~~significal~~ significant.

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ID : 19-41692-3

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
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

$$SS(x) = \Sigma \cancel{y} x^2 - \frac{(\Sigma x)^2}{n} = 12400 - \frac{(348)^2}{10} = 309.6$$

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

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

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

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

b) We need to test

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

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

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

$a = \bar{y} - b\bar{x} = \frac{\Sigma y}{n} - b\frac{\Sigma x}{n} = \frac{865}{10} - 0.8 \times \frac{348}{10} = 58.66$

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

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: $t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{0.8}{\sqrt{\frac{38.0125}{309.6}}} = 2.28$

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

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

Hence the ~~rege~~ regression is not 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	4892.8	997.24	542.89	1831.84
$\Sigma x = 109.4$	$\Sigma y = 153.3$	$\Sigma xy = 2942.44$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

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

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

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

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

The variables X and X are positively correlated.

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

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

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

$= -15.514$

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

d) If $x = 25.5$

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

$= 44.66 \approx 44.67$

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

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

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

$= 9.21$

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

Hence the regression is significant.

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Jannatuil Ferdouse Jannat P-1

19-41735-3

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
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

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

$$= 309.6$$

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

$$= 502.5$$

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

$$= 30350 - \frac{348 \times 865}{10} = 248$$

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

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

b) We need to test,

$H_0 : \rho = 0$ vs $H_2 : \rho \neq 0$

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

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

P-~~20~~.06 5.3

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

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

$= \frac{865}{10} - 0.8 \times \frac{348}{10}$

$= 58.66$

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

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

P-8000 4

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

$$= \frac{502.5 - 0.8 \times 248}{10-2} = 38.0125$$

Since $|t| < t_{n-2} = 2.306$. so H_0 is accepte. Hence the regression in not sinificant.

P-5

since $|t| < t_{\alpha/2,n-2} = t_3 = 2.306$. so H_0 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
$\Sigma x = 104.4$	$\Sigma y = 153.3$	$\Sigma xy = 2942.44$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.7$

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

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

$$SP(xy) = \Sigma xy - \frac{\Sigma x \times \Sigma y}{n} = 2942 - \frac{104.4 \times 153.3}{6} = 275.02$$

P-C

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

$$= 0.97$$

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

P-7

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

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

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

$= \frac{153.3}{6} - 2.36 \times \frac{104.4}{6}$

$= -15.514$

$\therefore$ fitted line of y on x : $\hat{y}$

$= a + bx = -15.514$

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

~~R-0 10~~ R - 8

(d) If, $x = 25.5$

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

$= 44.666 \approx 44.67$

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

Test statistic, $t = \dfrac{b}{\sqrt{\dfrac{s^2}{SS(x)}}} = \dfrac{2.36}{\sqrt{\dfrac{9.21}{116.56}}}$

$= 8.396 \approx 8.4$

$s^2 = \dfrac{SS(Y) - b\,SP(XY)}{n-2} = \dfrac{6.85.895 - (2.36 \times 275.02)}{6-2}$

$= 9.21$

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

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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	6900
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12920$	$\Sigma y^2 = 75325$

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

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

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

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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 possitively correlated.

(b) We need to test,

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

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

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

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

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

$$= 58.66$$

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

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(d) If $x = 60$

Then,

$\hat{y} = 58.66 + 0.80(66) = 107.26$

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

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

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

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

$$= 38.0125$$

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

Hence, the regression is not significant.

19-41829-3

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	248.49	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
$\Sigma x = 109.4$	$\Sigma y = 153.3$	$\Sigma xy = 2942.44$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

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

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

$$SP(xy) = \Sigma xy - \frac{\Sigma x \times \Sigma y}{n} = 2942.44 - \frac{(109.9)\times(153.3)}{6} = 275.02$$

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

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

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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. We can conclude that lending rate increases significally with the increase of inflection rate. (Ans:)

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

$= 2.36$

$a = \bar{y} - b\bar{x}$

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

$= \frac{153.3}{6} - 2.36 \times \frac{104.9}{6}$

$= -15.514$

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

$= -15.514 + 2.36x$ (Ans:)

19-41829-3

(d) If, $x = 25.5$

Then,
$$\hat{y} = -15.519 + (2.36 \times 25.5)$$
$$= 44.666 \approx 44.67 \text{ (Ans.)}$$

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

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

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

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

Hence, the regression is significant.

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ID : 20-41906-1

20-41906-1

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	9024
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
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

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

$$SS(y) = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 75325 - \frac{(865)^2}{10} = 502.6$$

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

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

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

(b) We need to test,

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

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

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

So, H_0 is accepted.

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

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

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

$= 58.66$

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

(d) If $x = 60$

So, we know,

$\hat{y} = 58.66 + 80\ (60)$

$= 107.26$

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

Test statics, $t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{0.80}{\sqrt{\frac{38.0125}{307.6}}}$

$= 2.28$

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

$= \frac{502.5 - 0.8 \times 248}{10-2} = 38.0125$

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

Exercise 11.1

(a)

x	y	xy	x^2	y^2
11.8	10.4	122.72	139.29	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	724.61
21.9	33.8	740.22	479.61	1142.44
23.3	42.8	997.24	542.89	1831.84
$\Sigma x = 104.4$	$\Sigma y = 153.3$	$\Sigma xy = 2942.44$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4602.71$

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

$SS(y) = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 460.71 - \frac{(153.3)^2}{6} = 685.875$

$SS(xy) = \Sigma xy - \frac{\Sigma x \times \Sigma y}{n} = 2942.44 - \frac{(104.4) \times (153.3)}{6} = 275.02$

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

The variables x (inflation rate) and Y (lending rate) are positavely corelated.

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(b) We need to test,

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

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

sine $|t| > t_{n-2} = t_4 = 2.776$

So, H_0 is Rejected.

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

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

$= \frac{153.3}{6} - 2.36 \times \frac{104.9}{6}$

$= -15.519$

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

(Ans)

(d) If, $x = 25.5$

Then, $\hat{y} = -15.519 + (2.36 \times 25.5)$
$= 44.666 \simeq 44.67$

(Ans).

20-91906-1

ⓔ We need to test,

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

Test statistic, $t = \frac{b}{\sqrt{\frac{s^2}{SS(x)}}} = \frac{2.36}{\sqrt{\frac{7.21}{116.56}}} = 8.396 \approx 8.9$

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

$= 9.21$

since, $|t| = t_{n-2} = t_4 = 2.776$. so, H_1 is accepted.

Hence the regression is significant.

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Nayeef (20-42048-1)

a) Example – 11.1 (a, b)

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
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

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

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

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

~~The variable X(age) X(age) and Y(BP) are positively~~

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

The variables X (age) and Y (BP) are positively correlated.

b) We need to test,

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

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 are not significantly correlated with their age.

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

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

$$= \frac{865}{10} - 0.8 \times \frac{348}{10}$$

$$= 58.66$$

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

d) If $x = 60$

Then,

$\hat{y} = 58.66 + 0.80\ (60) = \cancel{10.66}\ 107.26$

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

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

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

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

Exercise 11.1

g)

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

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

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

$$SP(xy) = \sum xy - \frac{\sum x \times \sum y}{n} = 2942.44 - \frac{(104.4) \times (153.3)}{6} = 275.02$$

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

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

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

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)

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

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

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

$= -15.519$

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

$= -15.519 + 2.36x$

(Ans)

d) If, $x = 25.5$

Then,

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

$= 44.666 \approx 44.67$

(Ans)

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

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

$s^2 = \dfrac{SS(y) - b\,SP(xy)}{n-2} = \dfrac{685.895 - (2.36 \times 275.02)}{6-2}$

$= 9.21$

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

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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
$\Sigma x = 348$	$\Sigma y = 865$	$\Sigma xy = 30350$	$\Sigma x^2 = 12420$	$\Sigma y^2 = 75325$

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

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

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

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

The variables x (age) an y (BP) are positively carrelated.

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

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

$$= \frac{865}{10} - 0.8 \times \frac{348}{10}$$

$$= 58.66$$

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

d) If $x=60$, then, $\hat{y} = 58.66+0.80\times60$ $\cancel{=108.66}$

$= 106.66$

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

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

$s^2 = \dfrac{SS(y) - b\,SP(xy)}{n-2} = \dfrac{502.5-0.8\times 248}{10-2} = 38.012$

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

Exercise 10.1

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
$\Sigma x = 104.4$	$\Sigma y = 153$	$\Sigma xy = 2936.68$	$\Sigma x^2 = 1933.12$	$\Sigma y^2 = 4586.66$

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

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

$$SP(x,y) = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 2936.68 - \frac{104.4 \times 153}{6} = 274.48$$

$$r = \frac{SP(xy)}{\sqrt{SS(x)\,SS(y)}} = \frac{274.48}{\sqrt{116.56 \times 685.16}} = 0.971$$

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

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

Test statistic, $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.97\sqrt{6-2}}{\sqrt{1-0.971^2}} = 8.12$

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 Infletion rate.

c) $b = \frac{SP(xy)}{SS(x)} = \frac{274.48}{116.56} = 2.354$

$$a = \bar{y} - b\bar{x} = \frac{\Sigma y}{n} - 2.354 \frac{\Sigma x}{n}$$

$$= \frac{153}{6} - 2.354 \frac{104.4}{6}$$

$$= -15.49$$

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

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

$$= 44.53$$

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

Test statistic, $t = \dfrac{b}{\sqrt{\dfrac{s^2}{SS(x)}}} = \dfrac{2.354}{\sqrt{\dfrac{9.758}{116.56}}} = 8.135$

$$s^2 = \frac{SS(y) - b\,SP(xy)}{n-2} = \frac{685.16 - 2.354 \times 274.48}{4}$$

$$= 9.758$$

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

Hence the regression is significant.