Assignment : 4

Answer to the question no 1

The randomly selected variables:

x	Y	$x - \bar{x}$	$Y - \bar{y}$	$(x-\bar{x})(y-\bar{y})$	$(x - \bar{x})^2$	$(Y - y)^2$
4	4	-1.6	-1.8	2.88	2.56	3.24
5	6	-0.6	0.2	-0.12	0.36	0.04
3	5	-2.6	-0.8	2.08	6.76	0.64
6	7	0.4	1.2	0.48	0.16	1.44
10	7	4.4	1.2	5.28	19.36	1.44
$\bar{x} = 5.6$	$\bar{Y} = 5.8$			$\Sigma = 10.6$	$\Sigma = 29.2$	$\Sigma = 6.8$

We know,

$$r = \frac{S_{xy}}{S_x S_y}$$

Here,

$$S_{xy} = \frac{\Sigma (x-\bar{x})(y-\bar{y})}{n-1} = \frac{10.6}{4} = 2.65$$

$$S_x = \sqrt{\frac{29.2}{4}} = 7.3$$

$$S_y = \sqrt{\frac{6.8}{4}} = 1.7$$

So, $$r = \frac{2.65}{7.3 \times 1.7} = 0.21$$

Comment: There is a weak positive linear relationship between a random observation x & y.

Answer to the question no 2

Sales ($million) (X)	Earnings ($million) (Y)	$x - \bar{x}$	$y - \bar{y}$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$	$(y-\bar{y})^2$
89.2	4.9	47.64	0.7	33.35	2269.33	0.49
18.6	4.4	-22.96	0.2	4.59	527.28	0.04
18.2	1.3	-23.36	-2.9	67.75	545.81	8.41
71.7	8	30.14	3.8	114.52	908.27	14.44
58.6	6.6	17.04	2.4	40.89	290.28	5.76
46.8	4.1	5.24	-0.1	-0.52	27.43	0.01
17.5	2.6	-24.06	-1.6	38.5	579.01	2.56
11.9	1.7	-29.66	-2.5	74.16	879.86	6.25
$\bar{x}=41.56$	$\bar{y}=4.2$			$\Sigma=364.05$	$\Sigma=6027.26$	$\Sigma=37.96$

(1)

We know,

the estimation equation, $\hat{y} = a + bx$

here,

$$b = \frac{S_{xy}}{S_x^2} = \frac{52.007}{29.343} = 0.06$$

$$a = \bar{y} - b\bar{x} = 4.2 - 0.06 \times 41.56 = 1.69$$

$\therefore \hat{Y} = 1.96 + 0.06x$

Comment: On an average, for every $1 million of sales increment, the estimated earning increment is $60,000.

(ii)

· From (i) we get the Regression equation,

$$\hat{Y} = 1.96 + 0.06X$$

So for a small company with a sales of \$50.0 million their estimated earning is,

$$\hat{Y} = 1.96 + 0.06 \times 50$$

$$= 4.71$$

or, \$4710000.

Comment: The estimated earning for the company with a sales of \$50 million is \$4710000 or, \$4.71 million.

(iii)

We know,

standard error, $S_y = \sqrt{\frac{\Sigma(Y-\hat{Y})^2}{n-2}} = \sqrt{\frac{15.971}{6}}$

$$= 2.66$$

Comment: On an average, the gap between the estimated earning and actual earning is 2.66 million.

(iv)

We know,

The co-efficient of determination, ~~$R^2 = r^2$~~

$$= \frac{S_{xy}}{S_x S_y}$$

$$R^2 = 1 - \frac{SSE}{SST}$$

$$= 1 - \frac{15.97}{37.96}$$

$$= 0.579$$

here,

$SSE = \Sigma(y - \hat{y})^2 = 15.97$

$SST = \Sigma(y - \bar{y})^2 = 37.96$

Comment: The variation in earning is 57.9% explained by the variation in sales.