SIMPLE LINEAR REGRESSION

- The measure of the relationship between two variables is shown by the correlation coefficient. The range of the coefficient lies between -1 to +1. This coefficient shows the strength of the association of the observed data between two variables.

- Linear Regression Equation is given below:

    - $Y=b_0 + b_1 X$

  Where, X is the independent variable and it is plotted along the x-axis

  Y is the dependent variable and it is plotted along the y-axis

  Here, the slope of the line is b_1, and b_0 is the intercept (the value of y when x = 0).

Example 1

Calculate the regression line equation and predict the result for the following data. If x=8.

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14

Solution:

X	Y	X^2	Y^2	X^Y
1	9	1	81	9
2	8	4	64	16
3	10	9	100	30
4	12	16	144	48
5	11	25	121	55
6	13	36	169	78
7	14	49	196	98
$\sum X = 28$	$\sum Y = 77$	$\sum X^2 = 140$	$\sum Y^2 = 875$	$\sum XY = 334$

Table 9.7

$$\overline{X} = \frac{\Sigma X}{N} = \frac{28}{7} = 4 ,$$

$$\overline{Y} = \frac{\Sigma Y}{N} = \frac{77}{7} = 11$$

$Y=b_0 + b_1(X)$

METHOD 1:

$$b_0 = \frac{(\sum y)(\sum x^2)-(\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$b_1 = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$b_0 = \frac{(77) * (140) - (28) * (334)}{7 * 140 - (28)^2}$$

$$= \frac{10,780 - 9,352}{980 - 784}$$

$$= \frac{1,428}{196}$$

$$= 7.285$$

$$b_1 = \frac{7 * 334 - (28 * 77)}{7 * 140 - (28)^2}$$

$$= \frac{2,338 - 2,156}{980 - 784}$$

$$= \frac{182}{196}$$

$$= 0.928$$

$Y=b_0 + b_1(X)$

$= 7.285 + 0.928\ (8)$

$= 7.285 + 7.424$

= 14.709

If x= 8, then y = 14.709, So y = 14.71

METHOD 2:

X	Y	$X - \bar{x}$	$Y - \bar{Y}$	$(X - \bar{x})(Y - \bar{Y})$	$(X - \bar{x})^2$
1	9	-3	-2	6	9
2	8	-2	-3	6	4
3	10	-1	-1	1	1
4	12	0	1	0	0
5	11	1	0	0	1
6	13	2	2	4	4
7	14	3	3	9	9

$Y = b_0 + b_1(X)$

$\bar{x} = 4$

$\bar{Y} = 11$

$$b_1 = \frac{\sum(X - \bar{x})(Y - \bar{Y})}{\sum(X - \bar{x})^2}$$

$$= \frac{26}{28}$$

$$= 0.928$$

$b_0 = \bar{Y} - b_1(\bar{x})$

= 11- 0.928(4)

= 7.288

$Y=b_0 + b_1(X)$

If x= 8, then

= 7.288 + 0.928 *(8)

= 14.712

Y = 14.71

Example 2:

Calculate the regression line equation from the data given below:

Price(Rs.)	10	12	13	12	16	15
Amount demanded	40	38	43	45	37	43

Estimate the likely demand when the price is Rs.20.