Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

AY: 2024-25

Class:	TE	**Semester:**	V
Course Code:		**Course Name:**	Stats

Name of Student:	Sainath S. Khot
Roll No. :	20
Assignment No.:	6
Title of Assignment:	
Date of Submission:	
Date of Correction:	

Evaluation

Performance Indicator	Max. Marks	Marks Obtained
Completeness	5	
Demonstrated Knowledge	3	
Legibility	2	
Total	10	

Performance Indicator	Exceed Expectations (EE)	Meet Expectations (ME)	Below Expectations (BE)
Completeness	5	3-4	1-2
Demonstrated Knowledge Legibility	3	2	1
Legibility	2	1	0

Checked by

Name of Faculty :

Signature :

Date :

Q1

Year (x)	Sales (y)	$(x_i - \bar{x})$	$(y_i - \bar{y})$	$(x_i - \bar{x})(y_i - \bar{y})$	$(x_i - \bar{x})^2$
1	40	-4	-22.8	91.2	16
3	52	-2	-10.8	21.6	4
5	61	0	-1.8	0	0
7	74	2	11.2	22.4	4
9	87	4	24.8	96.8	16

$\bar{x} = 5 \qquad \bar{y} = 62.2$

$\Sigma (x_i - \bar{x})(y_i - \bar{y}) = 232$

$\Sigma (x_i - \bar{x}) = 40$

① Slope

$$\hat{b} = \frac{\Sigma (x_i - \bar{x})(y_i - \bar{y})}{(x_i - \bar{x})} = \frac{234}{40} = 5.8$$

② Intercept

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

$$\hat{a} = 33.8$$

③ Regression eqn

$$\hat{y} = a + b \cdot x$$

$$\hat{y} = 33.8 + 5.8x$$

when $x = 5$ years

$$\hat{y} = 33.8 + 5.8 \times 5$$
$$= 62.8$$

Or

⇒ Make matrix by adding 1's

$$X = \begin{bmatrix} 1 & 54.3 & 4 \\ 1 & 98.7 & 4 \\ 1 & 158.2 & 5 \\ 1 & 99.3 & 7 \\ 1 & 123.1 & 6 \end{bmatrix}_{5\times3}$$

Now $X^T \cdot X$

$$= \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 54.3 & 98.7 & 158.2 & 99.3 & 123.1 \\ 4 & 4 & 5 & 7 & 6 \end{bmatrix} \begin{bmatrix} 1 & 54.3 & 4 \\ 1 & 98.7 & 4 \\ 1 & 158.2 & 5 \\ 1 & 99.3 & 7 \\ 1 & 123.1 & 6 \end{bmatrix}$$

$$\therefore X^T X = \begin{bmatrix} 5 & 531.8 & 26 \\ 531.1 & 63488.23 & 3106.82 \\ 26 & 3106.82 & 143 \end{bmatrix}$$

$$(X^T \cdot X)^{-1} = \begin{bmatrix} 14.191 & -0.0727 & 0.3154 \\ -0.0727 & 0.0014 & -0.0118 \\ 0.3154 & -0.018 & 0.1176 \end{bmatrix}_{3\times3}$$

$$b^T \cdot y = \begin{bmatrix} 64.3 \\ 10059.19 \\ 310.5 \end{bmatrix}_{3\times1}$$

Now

$$(X^T \cdot X)^{-1} \cdot (X^T \cdot y) = \begin{bmatrix} 13.78 \\ 0.001986 \\ -0.217 \end{bmatrix}_{3\times1}$$

$$\therefore \hat{y} = \hat{a} + b_1 x_1 + b_2 x_2$$

$$\hat{y} = 13.78 + 0.\ldots + 1986 \cdot x_1 - 0.217 \cdot x_2$$

(2) Given $x = 82.0$, $x_2 = 5$

$$\therefore \hat{y} = 13.78 + 0.00186 \cdot x_1 - 0.217 x_2$$

$\therefore$

$\hat{y} = 13.78 + 0.0001986 \times 82.0 - 0.217 \times 5$

$\therefore \hat{y} = 12.86$ in thousands

Thus, the predicted price for a car 82,000 mileage and of it 5 years is $ 12,860.