12 September 2024 09:19

-> Least Squares Estimate

$$\hat{\beta} = \begin{pmatrix} \hat{b} \\ \hat{b}_1 \\ \hat{b}_2 \\ \vdots \\ \hat{b}_n \end{pmatrix} = (X^T \cdot X)^{-1} X^T \cdot y$$

Product 1 Sales	Product 2 Sales	Weekly Sales
1	4	1
2	5	6
3	8	8
4	2	12

-> Bias : An arbitrary weight.

-> Mul-Reg : Always select ones.

$$X = \begin{pmatrix} 1 & 1 & 4 \\ 1 & 2 & 5 \\ 1 & 3 & 8 \\ 1 & 4 & 2 \end{pmatrix}$$

$$X^T \cdot X = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & 4 \\ 4 & 5 & 8 & 2 \end{pmatrix} \begin{pmatrix} 1 & 1 & 4 \\ 1 & 2 & 5 \\ 1 & 3 & 8 \\ 1 & 4 & 2 \end{pmatrix}$$

$3 \times 4 \qquad 4 \times 3$

$$= \begin{pmatrix} 4 & 10 & 19 \\ 10 & 30 & 46 \\ 19 & 46 & 109 \end{pmatrix} \quad 3 \times 3$$

$$(X^T X)^{-1} = \begin{pmatrix} 3.15 & -0.59 & -0.30 \\ -0.59 & 0.20 & 0.016 \\ -0.30 & 0.016 & 0.054 \end{pmatrix}$$

$$(X^T \cdot X)^{-1} \cdot X^T = \begin{pmatrix} 3.15 & -0.59 & -0.30 \\ -0.59 & 0.20 & 0.016 \\ -0.30 & 0.016 & 0.054 \end{pmatrix} \times \begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 & 4 \\ 4 & 5 & 8 & 2 \end{pmatrix}$$

$3 \times 3 \qquad 3 \times 4$

$$= \begin{pmatrix} 1.36 & 0.47 & -1.02 & 0.13 \\ -0.31 & -0.098 & 0.85^{-} & 0.262 \\ -0.065^{-} & 0.005^{-} & 0.185^{-} & -0.12 \end{pmatrix}$$

$$\left((X^T X)^{-1} \cdot X^T\right) y = \begin{pmatrix} 1.36 & 0.47 & -1.02 & 0.13 \\ -0.31 & -0.098 & 0.85^{-} & 0.262 \\ -0.065^{-} & 0.005^{-} & 0.185^{-} & -0.12 \end{pmatrix} \times \begin{pmatrix} 1 \\ 6 \\ 8 \\ 12 \end{pmatrix}$$

$3 \times 4 \qquad 4 \times 1$

$$= \begin{pmatrix} -1.7 \\ 3.486 \\ 0.005^{-} \end{pmatrix}$$

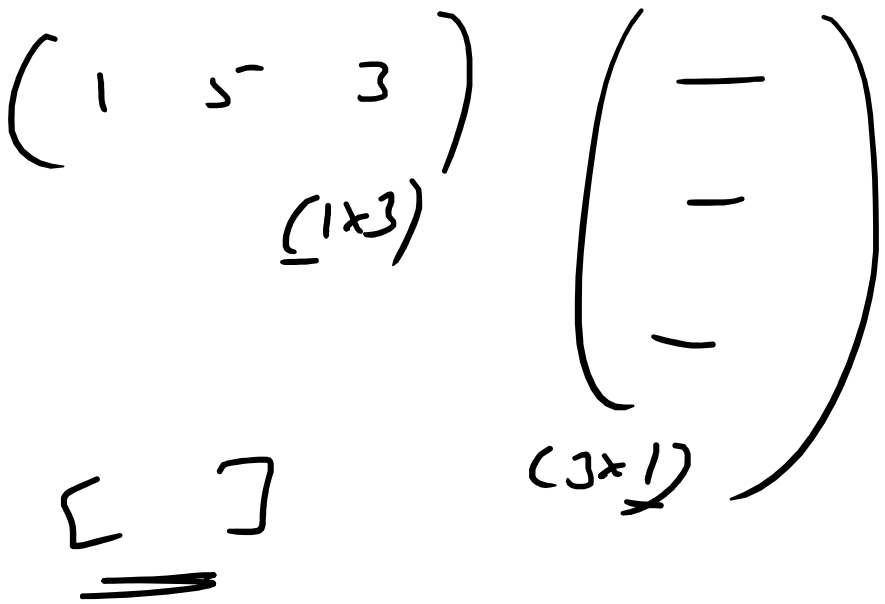
$$\hat{y} = -1.7 + 3.486 \times x_1 + 0.005^{-} \times x_2$$

$$= a + b_1 x_1 + b_2 x_2$$

$P1 = 5^{-}$; $P2 = 3$

$$\hat{y} = -1.7 + (3.486 \times 5^{-}) + (0.005^{-} \times 3)$$

$$= 15.74$$


(1 s- 3)
(1x3)
(3x1)

[ ]