Semester: 4 Subject: Statistics for AIDS Academic Year: 2023-2024

MULTIPLE REGRESSION:

* Multiple Regression: Considering the values of the available multiple independent variables and predicting the value of one dependent variables.

→ Y on X_1 & X_2: $Y = a + b_1X_1 + b_2X_2$.

→ Y on $X_1, X_2 \ldots X_n$ $Y = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n$

* The variables considered for the model should be relevant and reliable.
* The model should be linear and not non-linear; variables must have normal distribution.
* The purpose of constant a is to denote the dependent variable's value in case when all the independent variable values turn to zero.

Example:-

Perform multiple Regression on the below data:

Student Name	Marks	Liveclass	Book.
A	8	3	4
B	9	4	5
C	7	3	3
D	10	5	5
E	6	2	3.

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Solution :-

$$Y \text{ on } X_1 \& X_2 = a + b_1X_1 + b_2X_2$$

$$\Sigma Y = Na + b_1\Sigma X_1 + b_2\Sigma X_2 \quad \text{——— (1)}$$

$$\Sigma YX_1 = a\Sigma X_1 + b_1\Sigma X_1^2 + b_2\Sigma X_1X_2 \quad \text{——— (2)}$$

$$\Sigma YX_2 = a\Sigma X_2 + b_1\Sigma X_1X_2 + b_2\Sigma X_2^2 \quad \text{——— (3)}$$

Name	Y	X_1	X_2	YX_1	YX_2	X_1X_2	Y^2	X_1^2	X_2^2
A	8	3	4	24	32	12	64	9	16
B	9	4	5	36	45	20	81	16	25
C	7	3	3	21	21	9	49	9	9
D	10	5	5	50	50	25	100	25	25
E	6	2	3	12	18	6	36	4	9
Total	40	17	20	143	166	72	330	63	84

$$40 = 5a + 17b_1 + 20b_2 \quad \text{——— (1)}$$

$$143 = 17a + 63b_1 + 72b_2 \quad \text{——— (2)}$$

$$166 = 20a + 72b_1 + 84b_2 \quad \text{——— (3)}$$

Solve equation (1) & (2).

(1) × 17 $\Rightarrow$ $680 = 85a + 289b_1 + 340b_2$ ——— (4)

(2) × 5 $\Rightarrow$ $715 = 85a + 315b_1 + 360b_2$ ——— (5)

(4) − (5):

$$-35 = -26b_1 - 20b_2 \quad \text{——— (6)}$$

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$35 = 26b_1 + 20b_2$ —— (7)

Solve eqn (1) & (3)

(1) × 4 $\Rightarrow$ $160 = 20a + 68b_1 + 80b_2$ —— (8)

$166 = 20a + 72b_1 + 84b_2$

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$-6 = -4b_1 - 4b_2$

$6 = 4b_1 + 4b_2$ —— (9)

$85 = 26b_1 + 20b_2$

$80 = 20b_1 + 20b_2$

$35 = 26b_1 + 20b_2$

$b_1 = 5/6 = 0.833$

$b_2 = 0.667$, $a = 2.52$