

ASSIGNMENT - I

1. Given the following data of Temperature ($^{\circ}\text{C}$) and Power Consumption (kWh)

Temperature ($^{\circ}\text{C}$) (X)	Power Consumption (kWh) (Y)
10	300
12	310
14	320
16	330
18	345
20	350
22	370
24	390
26	420
28	450

- a) Derive the regression equation, $Y = a + bX$, using the least squares method and calculate a (intercept) and b (slope). Also compute the value of $\sum X$, $\sum Y$, $\sum XY$.

- b) No. of observations (n) = 10

$$\sum X = 10 + 12 + 14 + 16 + 18 + 20 + 22 + 24 + 26 + 28$$

$$= 190$$

$$\sum Y = 300 + 310 + 320 + 330 + 345 + 360 + 370 +$$

$$390 + 420 + 450$$

$$= 3595$$

$$\sum XY = 10 \cdot 300 + 12 \cdot 310 + 14 \cdot 320 + 16 \cdot 330 +$$

$$18 \cdot 345 + 20 \cdot 360 + 22 \cdot 370 + 24 \cdot 390 +$$

$$26 \cdot 420 + 28 \cdot 450$$

$$= 70910$$

$$\sum X^2 = 10^2 + 12^2 + 14^2 + 16^2 + 18^2 + 20^2 + 22^2 +$$

$$24^2 + 26^2 + 28^2$$

$$= 3940$$

Slope :-

$$b = \frac{n \sum XY - (\sum X)(\sum Y)}{n \sum X^2 - (\sum X)^2}$$

$$b = \frac{10 (70,910) - 190 (3,595)}{10 (3940) - (190)^2}$$

$$b \approx 7.89394$$

Intercept :-

$$a = \frac{\sum Y - b \sum X}{n} = \frac{3595 - b(190)}{10}$$

$$a \approx 209.51515$$

So, the regression equation is

$$\hat{Y} = 209.51515 + 7.89394 X$$

b) Using your predicted values (\hat{Y}), compute R^2 .

(X)	Observed (Y)	Predicted (\hat{Y})
10	300	288.45
12	310	304.24
14	320	320.03
16	330	335.81
18	345	351.60
20	360	367.39
22	370	383.18
24	390	398.96
26	420	414.75
28	450	430.54

$$R^2 = 1 - \frac{\sum (Y_i - \hat{Y}_i)^2}{\sum (Y_i - \bar{Y})^2}$$

$$\bar{Y} = \frac{3595}{10} = 359.5$$

Sum of squared residuals (SSE)

$$\sum (y_i - \hat{y}_i)^2 \approx 958.7879$$

Total sum of squares (SST)

$$\sum (y_i - \bar{y})^2 \approx 21,522.5$$

$$R^2 = 1 - \frac{958.7879}{21522.5} \approx 0.95545$$

$$\boxed{R^2 \approx 0.95545}$$