Assignment-04

Heres, Data table:

weight	Price
2	35
4	60
5	20
3	50
6	50
5	55
7	60

Here, $N = 7$,

Task 01:

Slope,

$$m = \frac{\Sigma (x-\bar{x}) \cdot (y-\bar{y})}{\Sigma (x-\bar{x})^2}$$

$$\bar{x} = \frac{\Sigma x}{N}$$

$$= \frac{2+4+5+3+6+5+7}{7}$$

$$= 4.57148$$

$$\bar{y} = \frac{\Sigma y}{N}$$

$$= \frac{35+60+20+50+50+55+60}{7}$$

$$= 47.14286$$

$$\Sigma(x-\bar{x}) \cdot (y-\bar{y}) = (2-4.5714) \cdot (35-47.1428) +$$
$$(4-4.5714) \cdot (60-47.1428) + (5-4.5714)$$
$$(20-47.1428) + (3-4.5714) \cdot (50-47.1428)$$
$$+ (6-4.5714) \cdot (50-47.1428) + (5-4.5714)$$
$$(55-47.1428) + (7-4.5714) \cdot (60-47.1428)$$
$$= 46.4286$$

$$\sum (x-\bar{x}) = (2-4.5714)^2 + (4-4.5714)^2 + (5-4.5714)^2$$
$$+ (3-4.5714)^2 + (6-4.5714)^2 + (5-4.5714)^2$$
$$+ (7-4.5714)^2$$

$$= 14.2448$$

Now,
$$m = \frac{\sum (x-\bar{x}).(y-\bar{y})}{\sum (x-\bar{x})^2}$$

$$= \frac{46.4286}{14.2448}$$

$$= 3.2593 ,$$

then,
$$c = \bar{y} - m\bar{x}$$

$$= 47.1428 - (3.2593).(4.5714)$$

$$= 32.2432 ,$$

then, predicted the value, $x = 6$,

Using this equation, $y = mx + c$

$$= (3.2593)(6) + 32.2432$$

$$= 51.799$$

$\therefore y = 51.799$

Task 02:

Compute the residuals for each data point:

Predicted Result:

Predicted = $mx + c$

Y_Pred = $3.2593 * (2) + 32.2432 = 38.7618$

Y_Pred = $3.2593 * (4) + 32.2432 = 45.2804$

Y_Pred = $3.2593 * (5) + 32.2432 = 48.5397$

Y_Pred = $3.2593 * (3) + 32.2432 = 42.0211$

Y_Pred = $3.2593 * (6) + 32.2432 = 51.799$

Y_Pred = $3.2593 * (5) + 32.2432 = 48.5397$

Y_Pred = $3.2593 * (7) + 32.2432 = 55.0583$

So,

Weight (x)	Price (y)	Predicted $\bar{y}$	Residuals $(y - \bar{y})$
2	35	38.7618	-3.7618
4	60	45.2804	14.7196
5	20	48.5397	-28.5397
3	50	42.0211	7.9789
6	50	51.799	-1.799
5	55	48.5397	6.4603
7	60	55.0583	4.9417

Then,

Residual (loss) = observed value − predicted value

Residual for x = (35 − 38.7618) = −3.7618

Residual for x = (60 − 45.2804) = 14.7196

Residual for x = (20 − 48.5397) = −28.5397

Residual for x = (50 − 42.0211) = 7.9789

Residual for x = (50 − 51.799) = −1.799

Residual for x = (55 − 48.5397) = 6.4603

Residual for x = (60 − 55.0583) = 4.9417

Task 03:

Mean Squared Error (MSE) = $\frac{1}{n}\sum_{i=1}^{n}(y_i-\hat{y}_i)^2$

So,

MSE = $\frac{1}{n}\sum_{i=1}^{n}(y_i-\hat{y}_i)^2$

$= \frac{1}{7}\left((35-38.7618)^2+(60-45.2804)^2+(20-48.5397)^2+(50-42.0211)^2+(50-51.799)^2+(55-48.5397)^2+(60-55.0583)^2\right)$

$$MSE = \frac{1}{7}\Big((-3.7618)^2 + (14.7196)^2 + (-28.5397)^2 + (7.9789)^2 + (-1.799)^2 + (6.4603)^2 + (4.9417)^2 \Big)$$

$$MSE = \frac{1}{7}\Big(14.1511 + 216.667 + 814.514 + 63.6628 + 3.2364 + 41.7354 + 24.4203 \Big)$$

$$MSE = \frac{1}{7}\left(1178.387 \right)$$

$$MSE = 168.341$$

and Mean Absolute Error $(MAE) = \frac{1}{n}\sum_{i=1}^{n} |y_i - \hat{y}_i|$

$$MAE = \frac{1}{n}\sum_{i=1}^{n} |y_i - \hat{y}_i|$$

$$MAE = \frac{1}{7}\Big(|35 - 38.7618| + |60 - 45.2804| + |20 - 48.5397| + |50 - 42.0211| + |50 - 51.799| + |55 - 48.5397| + |60 - 55.0583| \Big)$$

$$MAE = \frac{1}{7}\Big(3.7618 + 14.7196 + 28.5397 + 7.9789 + 1.799 + 6.4603 + 4.9417 \Big)$$

$$MAE = \frac{1}{7}(68.201)$$

$$MAE = 9.743$$

Ans.