

Regression Assignment Two

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Question One Answer: (a) According to the basic SLR model, we can see that $\beta_1 = \frac{S_{xy}}{S_{xx}}$ and now we are given $\sum x$ and $\sum y$:

$$\begin{aligned} S_{xy} &= \sum (x_i - \bar{x})(y_i - \bar{y}) \\ &= \frac{\sum (x_i) \sum (y_i) - \frac{(\sum x_i)(\sum y_i)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} = 1 \\ S_{xx} &= \sum (x_i - \bar{x})^2 \\ &= \sum x^2 - \frac{(\sum x_i)^2}{n} \end{aligned}$$

We can get $\beta_1 = 1, \beta_0 = -1$ the LSR line is: $\hat{y} = 1 + 1x$

(b) $\beta_1 = 1$ is the estimated change in the average value of Y as a result of a one-unit change in X

$\beta_0 = 1$ represents the Y is also influenced by other factor(s).

$$(c) SS_{residual} = \sum (y_i - \hat{y}_i)^2 \quad SS_{total} = \sum_i (y_i - \bar{y})^2$$

The Sum of Squares Regression (SSR) is the sum of the squared differences between the prediction for each observation and the population mean.

(d)

Question Two Answer: Using the matrix, we can notice that $y = \mathbf{X}\beta_1 + \epsilon \Rightarrow \beta_1 = (\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T y$, we can get $\beta_1 = 0.37$ and $(\mathbf{X}^T \mathbf{X})^{-1} = 2 \times 10^{-5}$
 $b_1 = \beta_1 = 0.37, 0 = \bar{y} - 1\bar{x} = 0.19$