

# Assignment 28

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## 1 Problem

Suppose you are given the following dataset:  $\text{data} = [(1,0.2), (2,0.25), (3,0.5)]$   
Fit a linear regression model  $y=a+bx$  by hand by setting up a system of equations, turning the system into a matrix equation, finding the best approximation to the solution of that matrix equation by using the pseudoinverse, and substituting your solution for the coefficients of the model. Show all of your steps. No code allowed!

**Answer**

$$y = a + bx$$

$$0.2 = 1a + 1b$$

$$0.25 = 1a + 2b$$

$$0.5 = 1a + 3b$$

$$\begin{bmatrix} 0.2 \\ 0.25 \\ 0.5 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 0.2 \\ 0.25 \\ 0.5 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 0.2 \\ 0.25 \\ 0.5 \end{bmatrix} = \begin{bmatrix} 3 & 6 \\ 6 & 14 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix}$$

$$\begin{bmatrix} 3 & 6 \\ 6 & 14 \end{bmatrix}^{-1} \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 0.2 \\ 0.25 \\ 0.5 \end{bmatrix} = \begin{bmatrix} a \\ b \end{bmatrix}$$

$$\begin{bmatrix} 0.016667 \\ 0.15 \end{bmatrix} = \begin{bmatrix} a \\ b \end{bmatrix}$$

$$y = 0.016667 + 0.15b$$