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CS383-HW3

1.

$$\mu_1 = \frac{-2-5-3+0-8-2+1+5-1+6}{10} = 0.9$$

$$\sigma_1 = \sqrt{\frac{1}{10-1} \times \left|-2-\mu_1\right|^2 + \left|-5-\mu_1\right|^2 + \ldots + \left|6-\mu_1\right|^2} = \sqrt{\frac{1609}{90}} = 4.2282$$

$$X = \frac{X-\mu_1}{\sigma_1} = \begin{bmatrix} -0.2602 & 1 \\ -0.9697 & -4 \\ -0.4967 & 1 \\ 0.2129 & 3 \\ -1.6792 & 11 \\ -0.2602 & 5 \\ 0.4494 & 0 \\ 1.3954 & -1 \\ -0.0237 & -3 \\ 1.6319 & 1 \end{bmatrix}$$

Weight = $\theta = (X^T X)^{-1} X^T Y$

$(X^T X)$ =

$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -0.2602 & -0.9697 & -0.4967 & 0.2129 & -1.6792 & -0.2602 & 0.4494 & 1.3954 & -0.0237 & 1.6319 \end{bmatrix}$$

*

$$\begin{bmatrix} -0.2602 & 1 \\ -0.9697 & 1 \\ -0.4967 & 1 \\ 0.2129 & 1 \\ -1.6792 & 1 \\ -0.2602 & 1 \\ 0.4494 & 1 \\ 1.3954 & 1 \\ -0.0237 & 1 \\ 1.6319 & 1 \end{bmatrix} = \begin{bmatrix} 10 & -0.00009 \\ -0.00009 & 9.0002 \end{bmatrix}$$

$$(X^T X)^{-1} = \begin{bmatrix} 0.1 & 0 \\ 0 & 0.1111 \end{bmatrix}$$

$$\theta = \begin{bmatrix} 0.1 & 0 \\ 0 & 0.1111 \end{bmatrix} * \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -0.2602 & -0.9697 & -0.4967 & 0.2129 & -1.6792 & -0.2602 & 0.4494 & 1.3954 & -0.0237 & 1.6319 \end{bmatrix}$$

$$* \begin{bmatrix} 1 \\ -4 \\ 1 \\ 3 \\ 11 \\ 5 \\ 0 \\ -1 \\ -3 \\ 1 \end{bmatrix} = \begin{bmatrix} 1.4 \\ -1.7447 \end{bmatrix}$$

$$y = 1.4 - 1.7447x_1$$

2. $y = 3.4256 \times 10^3 + 846.9x_1 - 369.2x_2$

RMSE = 853.3806

3.

S =	RMSE =
3	671.2547
5	618.5403
20	611.3017
40	608.1616