2020101088

Q1.

(a.) $x_1 = 8$

$x_2 = 88$

$x_3 = 088 = 588$

$x_4 = 5+8+8 = 21$

$x_5 = 8+8 = 16$

$x_6 = 21+16 = 37$

(b.) MR = $\{ y_1 - 1, y_2 + 1, y_3 - 2, y_4 - 1, y_5, y_6 + 1 \}$

MR = $\{ 7, 89, 586, 20, 16, 38 \}$

Bias = $E(\hat{f}(x) - f(x))$

Bias(x_1) =

(b.) $y_1 = 9$

$y_2 = 89$

$y_3 = 590$

$y_4 = 22$

$y_5 = 16$

$y_6 = 36$

Mean Square Error Formula = $(y - \hat{f}(x))^2$

$= \text{bias}[\hat{f}(x)]^2 + \text{var}[\hat{f}(x)] + \sigma^2$

Here $\hat{f}(x)$ is approximation of $f(x)$.

$\sigma^2 = \text{Var}(\varepsilon)$ where ε = Error

Bias represents the mean of the difference between the predicted values & the actual value for a data point.

$$\text{Bias} = E[\hat{f}(x) - f(x)]$$

Variance represents the deviation of the predicted values from the mean of the predicted values.

$$\text{Variance} = E(\hat{f}(x) - E[\hat{f}(x)]^2]$$

(c)

$$\text{Bias}(x_1) = \frac{8-9}{1} = -1$$

$$\text{Bias}(x_2) = \frac{88-87}{1} = 1$$

$$\text{Bias}(x_3) = \frac{588-590}{1} = -2$$

$$\text{Bias}(x_4) = 21-22 = -1$$

$$\text{Bias}(x_5) = 16-16 = 0$$

$$\text{Bias}(x_6) = 37-36 = 1$$

$$\text{Var}(x_1) = \frac{8^2}{1} - \frac{8^2}{1} = 0$$

$$\text{Var}(x_2) = (88)^2 - (88)^2 = 0$$

$$\text{Var}(x_3) = (588)^2 - (588)^2 = 0$$

$$\text{Var}(x_4) = (21)^2 - (21)^2 = 0$$

$$\text{Var}(x_5) = (16)^2 - (16)^2 = 0$$

$$\text{Var}(x_6) = (37)^2 - (37)^2 = 0$$

$$MSE(x_1) = \text{Bias}(x_1)^2 + \text{Var}(x_1)$$
$$= (-1)^2 + (0) = 1$$

$$MSE(x_2) = 1^2 + 0 = 1$$

$$MSE(x_3) = (-2)^2 + 0 = 4$$

$MSE(x_4) = (-1)^2 + 0 = 1$

$MSE(x_5) = 0^2 + 0 = 0$

$MSE(x_6) = 1^2 + 0 = 1$

Here since noise was not given in the question, so I assumed it to be 0. $\boxed{\sigma^2 = 0}$