DEPARTMENT OF ELECTRICAL ENGINEERING

B. Tech MID SEMESTER EXAMINATION - WINTER SEMESTER 2024-'25

EE3058E Essentials of AI and Machine Learning-

Answer Key

1.

a) n

b) [1 -3; 30 9]

c)7

d) (7, 13.5) or (6,12.3)

e)[0.2298; 0.9732]

f) A- Under fitting B-generalization, C-Over fitting

6. 0

8. Covariant matrix=[14.85, 0; 0, 7.428];

Eigen values=[7.429; 14.8571];

datareduced=[

1

5

5

1

-1

-5

-5

-1];

10.

We rewrite the linear model in matrix form:

$$Y = X\theta$$

where:

- Y is the output vector:

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 2.9 \\ 3.6 \end{bmatrix}$$

- X is the design matrix (including a column of ones for the intercept term):

$$X = \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 1 & 3 \end{bmatrix}$$

- θ is the parameter vector:

$$\theta = \begin{bmatrix} c \\ m \end{bmatrix}$$

Compute the Pseudo-Inverse Solution

The least squares solution using the Moore-Penrose pseudo-inverse is:

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

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

$$\theta = \begin{bmatrix} 2.33 & -1 \\ -1 & 0.5 \end{bmatrix} \times \begin{bmatrix} 8.5 \\ 18.6 \end{bmatrix}$$

Computing each element:

$$c = (2.33)(8.5) + (-1)(18.6) = 19.805 - 18.6 = 1.205$$

$$m = (-1)(8.5) + (0.5)(18.6) = -8.5 + 9.3 = 0.8$$

Final Regression Model

Thus, the estimated regression line is:

$$y = 0.8x + 1.205$$