

**Started on** Tuesday, 16 January 2024, 7:42 PM

**State** Finished

**Completed on** Friday, 19 January 2024, 1:07 AM

**Time taken** 2 days 5 hours

**Grade** 10.00 out of 10.00 (100%)

Question **1**

Correct

Mark 1.00 out of 1.00

Consider the ML example below for prediction of sales based on advertising

Year	Sales (Million Euro)	Advertising (Million Euro)
1	651	23
2	762	26
3	856	30
4	1,063	34
5	1,190	43
6	1,298	48
7	1,421	52
8	1,440	57
9	1,518	58

In this example, Sales is the

- ☒ Response
- ☐ Regressor
- ☐ Regression coefficient
- ☐ Model error



Your answer is correct.

The correct answer is:

Response

Question **2**

Correct

Mark 1.00 out of 1.00

Consider the ML example below for prediction of sales based on advertising

Year	Sales (Million Euro)	Advertising (Million Euro)
1	651	23
2	762	26
3	856	30
4	1,063	34
5	1,190	43
6	1,298	48
7	1,421	52
8	1,440	57
9	1,518	58

In this example, Advertising is the

- ☐ Response
- ☐ Regression coefficient
- ☒ Regressor
- ☐ Model error



Your answer is correct.

The correct answer is:

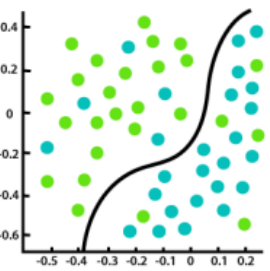
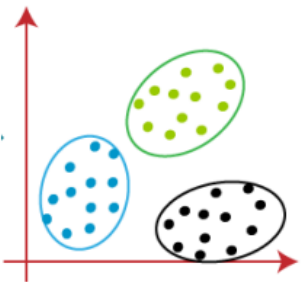

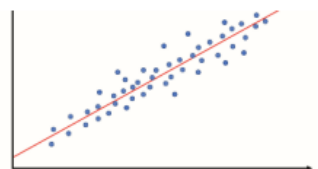
Regressor

Question 3

Correct

Mark 1.00 out of 1.00

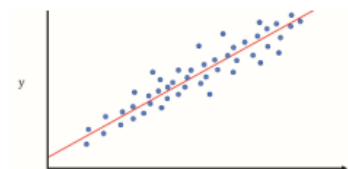
Which figure below represents linear regression

- ☐  A scatter plot with x-axis from -0.5 to 0.2 and y-axis from -0.6 to 0.4. It shows two classes of data points (green and blue) separated by a non-linear, S-shaped decision boundary.
- ☐  A scatter plot with three distinct clusters of points (blue, green, and black) separated by non-linear boundaries.
- ☐  A diagram of a neural network with four layers of nodes. The first layer has 4 blue nodes, the next two have 4 green nodes each, and the last has 4 blue nodes. They are fully connected.
- ☒  A scatter plot with a positive linear correlation between x and y. A red line represents the linear regression fit through the data points.



Your answer is correct.

The correct answer is:



Question **4**

Correct

Mark 1.00 out of 1.00

Consider the linear regression model below

$$y(k) = h_0 + h_1 x_1(k) + \dots + h_n x_n(k) + \epsilon(k)$$

The quantity  $y(k)$  is

- ☐ Regressor
- ☐ Regression coefficient
- ☐ Model error
- ☒ Response



Your answer is correct.

The correct answer is:

Response

Question **5**

Correct

Mark 1.00 out of 1.00

Consider the linear regression model below

$$y(k) = h_0 + h_1 x_1(k) + \dots + h_n x_n(k) + \epsilon(k)$$

The quantities  $x_i(k)$  are

- ☐ Response
- ☒ Regressor
- ☐ Regression coefficient
- ☐ Model error



Your answer is correct.

The correct answer is:

Regressor

Question **6**

Correct

Mark 1.00 out of 1.00

Consider the linear regression model below:

$$y(k) = h_0 + h_1x_1(k) + \cdots + h_nx_n(k) + \epsilon(k)$$

The quantities  $h_i$  are

- ☒ Regression coefficient
- ☐ Regressor
- ☐ Response
- ☐ Model error



Your answer is correct.

The correct answer is:  
Regression coefficient

## Question 7

Correct

Mark 1.00 out of 1.00

The learning model for the linear regression problem described in class is

- ☐ 
$$\underbrace{\begin{bmatrix} y(1) \\ y(2) \\ \vdots \\ y(M) \end{bmatrix}}_{\bar{\mathbf{y}}} = \underbrace{\begin{bmatrix} \bar{\mathbf{x}}(1) \\ \bar{\mathbf{x}}(2) \\ \vdots \\ \bar{\mathbf{x}}(M) \end{bmatrix}}_{\bar{\mathbf{X}}} \bar{\mathbf{h}} + \underbrace{\begin{bmatrix} \epsilon(1) \\ \epsilon(2) \\ \vdots \\ \epsilon(M) \end{bmatrix}}_{\bar{\boldsymbol{\epsilon}}}$$
- ☐ 
$$\underbrace{\begin{bmatrix} y(1) \\ y(2) \\ \vdots \\ y(M) \end{bmatrix}}_{\bar{\mathbf{y}}} = \underbrace{\begin{bmatrix} \bar{\mathbf{x}}(1) \\ \bar{\mathbf{x}}(2) \\ \vdots \\ \bar{\mathbf{x}}(M) \end{bmatrix}}_{\bar{\mathbf{X}}} \bar{\mathbf{h}}^T + \underbrace{\begin{bmatrix} \epsilon(1) \\ \epsilon(2) \\ \vdots \\ \epsilon(M) \end{bmatrix}}_{\bar{\boldsymbol{\epsilon}}}$$
- ☐ 
$$\underbrace{\begin{bmatrix} y(1) \\ y(2) \\ \vdots \\ y(M) \end{bmatrix}}_{\bar{\mathbf{y}}} = \underbrace{\begin{bmatrix} \bar{\mathbf{x}}^T(1) \\ \bar{\mathbf{x}}^T(2) \\ \vdots \\ \bar{\mathbf{x}}^T(M) \end{bmatrix}}_{\bar{\mathbf{X}}} \bar{\mathbf{h}}^T + \underbrace{\begin{bmatrix} \epsilon(1) \\ \epsilon(2) \\ \vdots \\ \epsilon(M) \end{bmatrix}}_{\bar{\boldsymbol{\epsilon}}}$$
- ☒ 
$$\underbrace{\begin{bmatrix} y(1) \\ y(2) \\ \vdots \\ y(M) \end{bmatrix}}_{\bar{\mathbf{y}}} = \underbrace{\begin{bmatrix} \bar{\mathbf{x}}^T(1) \\ \bar{\mathbf{x}}^T(2) \\ \vdots \\ \bar{\mathbf{x}}^T(M) \end{bmatrix}}_{\bar{\mathbf{X}}} \bar{\mathbf{h}} + \underbrace{\begin{bmatrix} \epsilon(1) \\ \epsilon(2) \\ \vdots \\ \epsilon(M) \end{bmatrix}}_{\bar{\boldsymbol{\epsilon}}}$$



Your answer is correct.

The correct answer is:

$$\underbrace{\begin{bmatrix} y(1) \\ y(2) \\ \vdots \\ y(M) \end{bmatrix}}_{\bar{\mathbf{y}}} = \underbrace{\begin{bmatrix} \bar{\mathbf{x}}^T(1) \\ \bar{\mathbf{x}}^T(2) \\ \vdots \\ \bar{\mathbf{x}}^T(M) \end{bmatrix}}_{\bar{\mathbf{X}}} \bar{\mathbf{h}} + \underbrace{\begin{bmatrix} \epsilon(1) \\ \epsilon(2) \\ \vdots \\ \epsilon(M) \end{bmatrix}}_{\bar{\boldsymbol{\epsilon}}}$$

## Question 8

Correct

Mark 1.00 out of 1.00

The problem to determine the regression coefficient vector  $\bar{\mathbf{h}}$  given as

- ☐  $\min \bar{\mathbf{y}} - \bar{\mathbf{X}} \bar{\mathbf{h}}$
- ☐  $\min |\bar{\mathbf{y}} - \bar{\mathbf{X}} \bar{\mathbf{h}}|$
- ☒  $\min \|\bar{\mathbf{y}} - \bar{\mathbf{X}} \bar{\mathbf{h}}\|^2$
- ☐  $\min (\bar{\mathbf{y}} - \bar{\mathbf{X}} \bar{\mathbf{h}})^2$



Your answer is correct.

The correct answer is:

$$\min \|\bar{\mathbf{y}} - \bar{\mathbf{X}} \bar{\mathbf{h}}\|^2$$

Question **9**

Correct

Mark 1.00 out of 1.00

The regression coefficient vector from the training data is determined as

- ☐  $\bar{\mathbf{h}} = \mathbf{X}^T (\mathbf{X}^T \mathbf{X})^{-1} \bar{\mathbf{y}}$
- ☒  $\bar{\mathbf{h}} = (\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T \bar{\mathbf{y}}$
- ☐  $\bar{\mathbf{h}} = (\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X} \bar{\mathbf{y}}$
- ☐  $\bar{\mathbf{h}} = (\mathbf{X} \mathbf{X}^T)^{-1} \mathbf{X}^T \bar{\mathbf{y}}$



Your answer is correct.

The correct answer is:

$$\bar{\mathbf{h}} = (\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T \bar{\mathbf{y}}$$

Question **10**

Correct

Mark 1.00 out of 1.00

The pseudo-inverse of the training or design matrix  $\mathbf{X}$  is given as

- ☒  $(\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T$
- ☐  $\mathbf{X}^T (\mathbf{X}^T \mathbf{X})^{-1}$
- ☐  $(\mathbf{X} \mathbf{X}^T)^{-1} \mathbf{X}^T$
- ☐  $\mathbf{X}^T (\mathbf{X} \mathbf{X}^T)^{-1}$



Your answer is correct.

The correct answer is:

$$(\mathbf{X}^T \mathbf{X})^{-1} \mathbf{X}^T$$