Started on	Sunday, 21 January 2024, 10:58 AM
State	Finished
Completed on	Sunday, 21 January 2024, 1:11 PM
Time taken	2 hours 12 mins
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

Consider the linear regression problem with the design matrix $\mathbf{X}$ and response vector $\bar{\mathbf{y}}$ given below

$$\mathbf{X} = \begin{bmatrix} -1 & 1 \\ 1 & 1 \\ 1 & -1 \\ -1 & -1 \end{bmatrix}, \bar{\mathbf{y}} = \begin{bmatrix} -1 \\ 2 \\ -1 \\ 2 \end{bmatrix}$$

The pseudo-inverse of the design matrix X is

- $\begin{bmatrix} -1 & 1 & 1 & -1 \\ 1 & 1 & -1 & -1 \end{bmatrix}$
- $\begin{bmatrix} \frac{1}{4} & 0 \\ 0 & \frac{1}{4} \end{bmatrix}$
- $\frac{1}{4}\begin{bmatrix} -1 & 1 \\ 1 & 1 \\ 1 & -1 \\ -1 & -1 \end{bmatrix}$
- $\begin{bmatrix} -\frac{1}{4} & \frac{1}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{1}{4} & -\frac{1}{4} & -\frac{1}{4} \end{bmatrix}$ ✔

Your answer is correct.

The correct answer is: $\begin{bmatrix} -\frac{1}{4} & \frac{1}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{1}{4} & -\frac{1}{4} & -\frac{1}{4} \end{bmatrix}$

Question **2**

Correct

Mark 1.00 out of 1.00

Consider the linear regression problem with the design matrix $\mathbf{X}$ and response vector $\bar{\mathbf{y}}$ given below

$$\mathbf{X} = \begin{bmatrix} -1 & 1 \\ 1 & 1 \\ 1 & -1 \\ -1 & -1 \end{bmatrix}, \bar{\mathbf{y}} = \begin{bmatrix} -1 \\ 2 \\ -1 \\ -2 \end{bmatrix}$$

The vector of regression coefficients is

- (selected) $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ ✔
- $\begin{bmatrix} 1 \\ -1 \end{bmatrix}$
- $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$
- $\begin{bmatrix} -1 \\ -1 \end{bmatrix}$

Your answer is correct.

The correct answer is:

$\begin{bmatrix} 1 \\ 1 \end{bmatrix}$

Question **3**

Correct

Mark 1.00 out of 1.00

Logistic regression is well suited when the response is

- Continuous
- (selected) Discrete ✔
- Positive
- Arbitrary

Your answer is correct.

The correct answer is: Discrete

Question **4**

Correct

Mark 1.00 out of 1.00

Logistic regression can be used in which of the following applications

- Stock price forecasting
- Predicting the price of a home
- Clustering of users based on shopping information
- Disease detection

Your answer is correct.

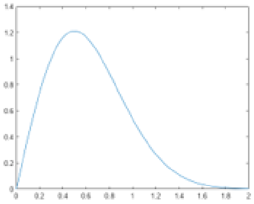
The correct answer is: Disease detection

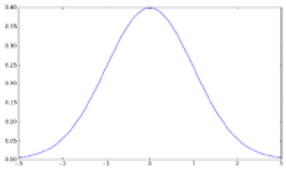
Question **5**

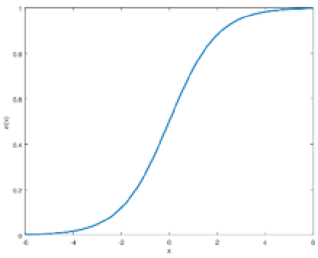
Correct

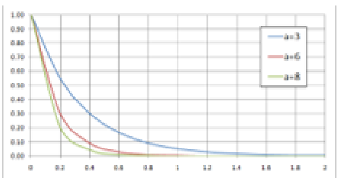
Mark 1.00 out of 1.00

Which of the following shows a plot of the logistic function



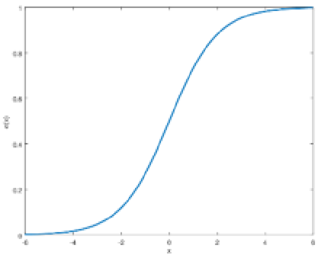






Your answer is correct.

The correct answer is:



Question **6**

Correct

Mark 1.00 out of 1.00

As $z \to \infty$, $z \to -\infty$, the logistic function approaches the limits

- ◉ $1{,}0$ ✓
- ○ $0{,}1$
- ○ $\infty, 0$
- ○ $0, \infty$

Your answer is correct.

The correct answer is: $1{,}0$

Question **7**

Correct

Mark 1.00 out of 1.00

In logistic regression, the quantity $P(y = 1|\bar{\mathbf{x}})$ is modeled as

- ○ $\frac{e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}}{1+e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}}$
- ○ $e^{-(\bar{\mathbf{x}}^T\bar{\mathbf{h}})^2}$
- ○ $e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}$
- ◉ $\frac{1}{1+e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}}$ ✓

Your answer is correct.

The correct answer is:

$\frac{1}{1+e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}}$

Question **8**

Correct

Mark 1.00 out of 1.00

The log-likelihood of the regression parameter $\bar{\mathbf{h}}$ in logistic regression can be written as

- $\sum_{k=1}^{M} y(k) \ln g(\bar{\mathbf{x}}(k)) + (1 - y(k)) \ln \left(1 - g(\bar{\mathbf{x}}(k))\right)$ ✔
- $\sum_{k=1}^{M} (1 - y(k)) \ln g(\bar{\mathbf{x}}(k)) + y(k) \ln \left(1 - g(\bar{\mathbf{x}}(k))\right)$
- $\prod_{k=1}^{M} \left(g(\bar{\mathbf{x}}(k))\right)^{y(k)} \left(1 - g(\bar{\mathbf{x}}(k))\right)^{1-y(k)}$
- $\prod_{k=1}^{M} \left(g(\bar{\mathbf{x}}(k))\right)^{1-y(k)} \left(1 - g(\bar{\mathbf{x}}(k))\right)^{y(k)}$

Your answer is correct.

The correct answer is:
$\sum_{k=1}^{M} y(k) \ln g(\bar{\mathbf{x}}(k)) + (1 - y(k)) \ln \left(1 - g(\bar{\mathbf{x}}(k))\right)$

Question **9**

Correct

Mark 1.00 out of 1.00

The update rule in logistic regression is

- $\bar{\mathbf{h}}(k+1) = \bar{\mathbf{h}}(k) - \eta \left(y(k+1) - g(\bar{\mathbf{x}}(k+1))\right) \bar{\mathbf{x}}(k+1)$
- $\bar{\mathbf{h}}(k+1) = \bar{\mathbf{h}}(k) + \eta \left(y(k+1) - \bar{\mathbf{h}}^T(k)\bar{\mathbf{x}}(k+1)\right) \bar{\mathbf{x}}(k+1)$
- $\bar{\mathbf{h}}(k+1) = \bar{\mathbf{h}}(k) - \eta \left(y(k+1) - \bar{\mathbf{h}}^T(k)\bar{\mathbf{x}}(k+1)\right) \bar{\mathbf{x}}(k+1)$
- $\bar{\mathbf{h}}(k+1) = \bar{\mathbf{h}}(k) + \eta \left(y(k+1) - g(\bar{\mathbf{x}}(k+1))\right) \bar{\mathbf{x}}(k+1)$ ✔

Your answer is correct.

The correct answer is:
$\bar{\mathbf{h}}(k+1) = \bar{\mathbf{h}}(k) + \eta \left(y(k+1) - g(\bar{\mathbf{x}}(k+1))\right) \bar{\mathbf{x}}(k+1)$

Question **10**

Correct

Mark 1.00 out of 1.00

The threshold function $g(\bar{\mathbf{x}})$ for the perceptron learning algorithm is given as

- ○ -1 for $\bar{\mathbf{h}}^T\bar{\mathbf{x}} \leq 0$ and 0 otherwise
- ○ $\frac{e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}}{1+e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}}$
- ○ $\frac{1}{1+e^{-\bar{\mathbf{x}}^T\bar{\mathbf{h}}}}$
- ◉ 1 for $\bar{\mathbf{h}}^T\bar{\mathbf{x}} \geq 0$ and 0 otherwise ✔

Your answer is correct.

The correct answer is:
1 for $\bar{\mathbf{h}}^T\bar{\mathbf{x}} \geq 0$ and 0 otherwise