Started on	Wednesday, 21 February 2024, 7:59 AM
State	Finished
Completed on	Friday, 23 February 2024, 8:08 PM
Time taken	2 days 12 hours
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

PDF of a Gaussian RV is

- $f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)}{2\sigma^2}}$
- $f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{|(x-\mu)|}{2\sigma^2}}$
- $f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ ✔
- $f_X(x) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(x-\mu)^2}{2\sigma}}$

Your answer is correct.

The correct answer is:

$$f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Question **2**

Correct

Mark 1.00 out of 1.00

PDF of a **Gaussian random vector** is

- $\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$ ✔
- $\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$
- $\frac{1}{\sqrt{(2\pi)^n\mathbf{R}}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$
- $\frac{1}{\sqrt{(2\pi)^n\mathbf{R}}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$

Your answer is correct.

The correct answer is:

$$\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$$

Question **3**

Correct

Mark 1.00 out of 1.00

The **mean** and **covariance matrix** of the multivariate Guassian are defined as

- $E\{\bar{\mathbf{x}}\} = \bar{\boldsymbol{\mu}}, E\{(\bar{\mathbf{x}} - \bar{\boldsymbol{\mu}})^2\} = \mathbf{R}$
- $E\{\bar{\mathbf{x}}\} = \mu, E\{(\bar{\mathbf{x}} - \bar{\boldsymbol{\mu}})^T(\bar{\mathbf{x}} - \bar{\boldsymbol{\mu}})\} = \mathbf{R}$
- $E\{\bar{\mathbf{x}}\} = \mu, E\{\bar{\mathbf{x}}\bar{\mathbf{x}}^T\} = \mathbf{R}$
- $E\{\bar{\mathbf{x}}\} = \bar{\boldsymbol{\mu}}, E\{(\bar{\mathbf{x}} - \bar{\boldsymbol{\mu}})(\bar{\mathbf{x}} - \bar{\boldsymbol{\mu}})^T\} = \mathbf{R}$ ✔

Your answer is correct.

The correct answer is:
$E\{\bar{\mathbf{x}}\} = \bar{\boldsymbol{\mu}}, E\{(\bar{\mathbf{x}} - \bar{\boldsymbol{\mu}})(\bar{\mathbf{x}} - \bar{\boldsymbol{\mu}})^T\} = \mathbf{R}$

Question **4**

Correct

Mark 1.00 out of 1.00

The multivariate Gaussian PDF for parameters below is

$$\bar{\boldsymbol{\mu}} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \mathbf{R} = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

- $\frac{1}{\sqrt{12\pi}} e^{-\frac{1}{3}(x_1^2+x_2^2-x_1-x_2-x_1x_2+1)}$
- $\frac{1}{\sqrt{12\pi}} e^{-\frac{1}{3}(x_1^2+x_2^2+x_1+x_2-2x_1x_2)}$
- $\frac{1}{\sqrt{12\pi}} e^{-\frac{1}{3}(x_1^2+x_2^2+3x_1+3x_2-x_1x_2-3)}$
- $\frac{1}{\sqrt{12\pi}} e^{-\frac{1}{3}(x_1^2+x_2^2-3x_1-3x_2+x_1x_2+3)}$ ✔

Your answer is correct.

The correct answer is:
$\frac{1}{\sqrt{12\pi}} e^{-\frac{1}{3}(x_1^2+x_2^2-3x_1-3x_2+x_1x_2+3)}$

Question **5**

Correct

Mark 1.00 out of 1.00

In Gaussian discriminant analysis, we **choose** $\mathcal{C}_0$ if

- $p(\bar{\mathbf{x}}; \mathcal{C}_0) < p(\bar{\mathbf{x}}; \mathcal{C}_1)$
- $p(\bar{\mathbf{x}}; \mathcal{C}_0) > p(\bar{\mathbf{x}}; \mathcal{C}_1)$
- $p(\bar{\mathbf{x}}; \mathcal{C}_0) = p(\bar{\mathbf{x}}; \mathcal{C}_1)$
- $p(\bar{\mathbf{x}}; \mathcal{C}_0) > 0$

Your answer is correct.

The correct answer is:
$p(\bar{\mathbf{x}}; \mathcal{C}_0) > p(\bar{\mathbf{x}}; \mathcal{C}_1)$

Question **6**

Correct

Mark 1.00 out of 1.00

The Gaussian discriminant classifier can be simplified as Choose $\mathcal{C}_0$ if

- $\bar{\mathbf{h}}^T(\bar{\mathbf{x}} - \tilde{\boldsymbol{\mu}}) \geq 0, \tilde{\boldsymbol{\mu}} = \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1), \bar{\mathbf{h}} = \mathbf{R}^{-1}(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)$
- $\bar{\mathbf{h}}^T(\bar{\mathbf{x}} - \tilde{\boldsymbol{\mu}}) < 0, \tilde{\boldsymbol{\mu}} = \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1), \bar{\mathbf{h}} = \mathbf{R}^{-1}(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)$
- $\bar{\mathbf{h}}^T(\bar{\mathbf{x}} - \tilde{\boldsymbol{\mu}}) \geq 0, \tilde{\boldsymbol{\mu}} = \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1), \bar{\mathbf{h}} = (\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)$
- $\bar{\mathbf{h}}^T(\bar{\mathbf{x}} - \tilde{\boldsymbol{\mu}}) \geq 0, \tilde{\boldsymbol{\mu}} = \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1), \bar{\mathbf{h}} = (\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)$

Your answer is correct.

The correct answer is:
$\bar{\mathbf{h}}^T(\bar{\mathbf{x}} - \tilde{\boldsymbol{\mu}}) \geq 0, \tilde{\boldsymbol{\mu}} = \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1), \bar{\mathbf{h}} = \mathbf{R}^{-1}(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)$

Question **7**

Correct

Mark 1.00 out of 1.00

The Gaussian discriminant classifier for both classes with identical covariances is

- Ellipsoidal
- Spherical
- Linear
- Conical

Your answer is correct.

The correct answer is:
Linear

Question **8**

Correct

Mark 1.00 out of 1.00

For the **special case** $\mathbf{R} = \sigma^2\mathbf{I}$, the classifier reduces to

- Hyperplane parallel to $\bar{\boldsymbol{\mu}}_0$ and $\bar{\boldsymbol{\mu}}_1$
- Perpendicular bisector of $\bar{\boldsymbol{\mu}}_0$ and $\bar{\boldsymbol{\mu}}_1$
- Sphere at center with mid-point of $\bar{\boldsymbol{\mu}}_0$ and $\bar{\boldsymbol{\mu}}_1$
- Ellipsoid with semi-major axis along line joining $\bar{\boldsymbol{\mu}}_0$ and $\bar{\boldsymbol{\mu}}_1$

Your answer is correct.

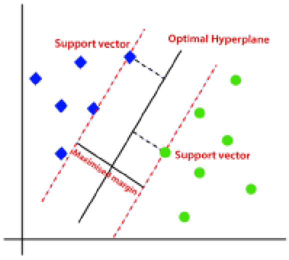
The correct answer is:
Perpendicular bisector of $\bar{\boldsymbol{\mu}}_0$ and $\bar{\boldsymbol{\mu}}_1$

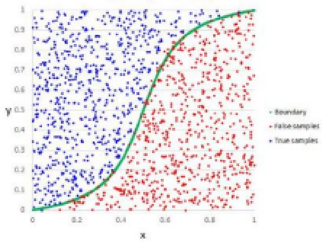
Question **9**

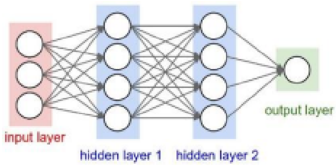
Correct

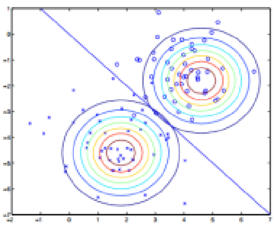
Mark 1.00 out of 1.00

Gaussian discriminant classifier is shown by the picture



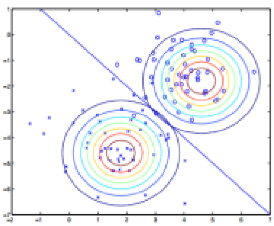






Your answer is correct.

The correct answer is:



Question **10**

Correct

Mark 1.00 out of 1.00

Consider the two classes C_0, C_1 distributed as below and determine when the classifier chooses $\mathcal{H}_0$

$$\mathcal{C}_0 \sim N\left(\begin{bmatrix}-4\\-2\end{bmatrix}, \begin{bmatrix}\frac{1}{2} & 0\\ 0 & \frac{1}{4}\end{bmatrix}\right), \mathcal{C}_1 \sim N\left(\begin{bmatrix}2\\4\end{bmatrix}, \begin{bmatrix}\frac{1}{2} & 0\\ 0 & \frac{1}{4}\end{bmatrix}\right)$$

- $2x_1 - x_2 \leq -1$
- $x_1 + 2x_2 \leq 1$ ✔
- $x_1 + 2x_2 \geq -1$
- $2x_1 + x_2 \leq 1$

Your answer is correct.

The correct answer is:

$x_1 + 2x_2 \leq 1$