

Started on	Sunday, 15 October 2023, 5:00 PM
State	Finished
Completed on	Sunday, 15 October 2023, 5:22 PM
Time taken	22 mins 47 secs
Grade	10.00 out of 10.00 (100%)

Question **1**
Correct
Mark 1.00 out of 1.00
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The general problem in detection is

- Select one:
- ☒ Binary hypothesis testing ✓
 - ☐ Multiple cost determination
 - ☐ Gaussian discriminant analysis
 - ☐ Optimal pattern recognition

Your answer is correct.
The correct answer is: Binary hypothesis testing

Question **2**
Correct
Mark 1.00 out of 1.00
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Consider the binary hypothesis testing problem described in lectures with noise variance $\frac{1}{2}$. The distribution of the output under \mathcal{H}_1 is

- Select one:
- ☐ $\mathcal{N}(\bar{\mathbf{s}}, \mathbf{I})$
 - ☐ $\mathcal{N}(0, \mathbf{I})$
 - ☐ $\mathcal{N}\left(\|\bar{\mathbf{s}}\|^2, \frac{1}{2}\mathbf{I}\right)$
 - ☒ $\mathcal{N}\left(\bar{\mathbf{s}}, \frac{1}{2}\mathbf{I}\right)$ ✓

Your answer is correct.
The correct answer is: $\mathcal{N}\left(\bar{\mathbf{s}}, \frac{1}{2}\mathbf{I}\right)$

Question **3**
Correct
Mark 1.00 out of 1.00
🚩 Flag question

Consider the binary hypothesis testing problem described in lectures with noise variance σ^2 . The likelihood of \mathcal{H}_0 is

Select one:

- ☐ $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{\sum_{i=1}^N y(i)}{2\sigma^2}}$
- ☐ $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{\left(\sum_{i=0}^N y(i)-s(i)\right)^2}{2\sigma^2}}$
- ☐ $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{\sum_{i=0}^N \left(y(i)-s(i)\right)^2}{2\sigma^2}}$
- ☒ $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{\sum_{i=1}^N y^2(i)}{2\sigma^2}}$ ✓

Your answer is correct.

The correct answer is: $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{\sum_{i=1}^N y^2(i)}{2\sigma^2}}$

Question **4**

Correct

Mark 1.00 out of 1.00

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The LRT chooses \mathcal{H}_1 if

Select one:

- ☐ $\frac{p(\bar{\mathbf{y}};\mathcal{H}_0)}{p(\bar{\mathbf{y}};\mathcal{H}_1)} \geq \tilde{\gamma}$
- ☒ $\frac{p(\bar{\mathbf{y}};\mathcal{H}_1)}{p(\bar{\mathbf{y}};\mathcal{H}_0)} > \tilde{\gamma}$ ✓
- ☐ $\frac{p(\bar{\mathbf{y}};\mathcal{H}_0)}{p(\bar{\mathbf{y}};\mathcal{H}_1)} \geq 1$
- ☐ $\frac{p(\bar{\mathbf{y}};\mathcal{H}_1)}{p(\bar{\mathbf{y}};\mathcal{H}_0)} < \tilde{\gamma}$

Your answer is correct.

The correct answer is: $\frac{p(\bar{\mathbf{y}};\mathcal{H}_1)}{p(\bar{\mathbf{y}};\mathcal{H}_0)} > \tilde{\gamma}$

Question **5**

Correct

Mark 1.00 out of 1.00

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Consider $\bar{\mathbf{s}} = [2 \quad -2 \quad -2 \quad 2]^T$. The LRT reduces to the ML decision rule for $\gamma =$

Select one:

- ☐ 2
- ☐ 4
- ☒ 8 ✓
- ☐ 16

Your answer is correct.

The correct answer is: 8

Question **6**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider $\bar{\mathbf{s}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \end{bmatrix}^T$ and $\sigma^2 = \frac{1}{4}$. The distribution of the test statistic $\bar{\mathbf{s}}^T \bar{\mathbf{y}}$ under \mathcal{H}_0 is

Select one:

- ☐ $\mathcal{N}\left(0, \frac{1}{8}\right)$
- ☐ $\mathcal{N}\left(0, \frac{1}{2}\right)$
- ☐ $\mathcal{N}(0, 1)$
- ☒ $\mathcal{N}\left(0, \frac{1}{4}\right)$ ✓

Your answer is correct.

The correct answer is: $\mathcal{N}\left(0, \frac{1}{4}\right)$

Question **7**

Correct

Mark 1.00 out of 1.00

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Detection occurs when

Select one:

- ☒ The test correctly detects the presence of signal under H_1 ✓
- ☐ The test correctly detects the absence of signal under H_0
- ☐ The test falsely detects the absence of signal under H_1
- ☐ The test falsely detects the presence of signal under H_0

Your answer is correct.

The correct answer is: The test correctly detects the presence of signal under H_1

Question **8**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider $\bar{\mathbf{s}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \end{bmatrix}^T$ and $\sigma^2 = 2$. The distribution of the test statistic $\bar{\mathbf{s}}^T \bar{\mathbf{y}}$ under \mathcal{H}_1 is

Select one:

- ☒ $\mathcal{N}(1, 2)$ ✓
- ☐ $\mathcal{N}(2, 2)$
- ☐ $\mathcal{N}\left(\frac{1}{2}, 4\right)$
- ☐ $\mathcal{N}\left(\frac{1}{2}, 1\right)$

Your answer is correct.

The correct answer is: $\bar{\mathcal{N}}(1,2)$.

Question 9

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider $\bar{\mathbf{s}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \end{bmatrix}^T$, $\gamma = 2$ and $\sigma^2 = 2$. The probability of detection for the signal detection problem described in lectures is

Select one:

- ☐ $Q\left(-\frac{1}{2}\right)$
- ☐ $Q\left(-\frac{1}{2\sqrt{2}}\right)$
- ☒ $Q\left(\frac{1}{\sqrt{2}}\right)$ ✓
- ☐ $Q\left(-\frac{3}{2\sqrt{2}}\right)$

Your answer is correct.

The correct answer is: $Q\left(\frac{1}{\sqrt{2}}\right)$

Question 10

Correct

Mark 1.00 out of 1.00

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The ROC of the signal detection problem is given as

Select one:

- ☐ $Q\left(Q^{-1}(P_{FA}) - \sqrt{\frac{1}{SNR}}\right)$
- ☒ $Q\left(Q^{-1}(P_{FA}) - \sqrt{SNR}\right)$ ✓
- ☐ $Q(Q^{-1}(P_{FA}) - SNR)$
- ☐ $Q\left(Q^{-1}(P_{FA}) - \frac{1}{SNR}\right)$

Your answer is correct.

The correct answer is: $Q\left(Q^{-1}(P_{FA}) - \sqrt{SNR}\right)$

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