

<b>Started on</b>	Friday, 27 October 2023, 8:44 AM
<b>State</b>	Finished
<b>Completed on</b>	Saturday, 28 October 2023, 10:28 AM
<b>Time taken</b>	1 day 1 hour
<b>Grade</b>	<b>10.00</b> out of 10.00 ( <b>100%</b> )

Question **1**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider the generalized signal detection problem

$$\mathcal{H}_0: \bar{\mathbf{y}} = \begin{bmatrix} 1 \\ 1 \\ -1 \\ -1 \end{bmatrix} + \bar{\mathbf{v}}$$

$$\mathcal{H}_1: \bar{\mathbf{y}} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} + \bar{\mathbf{v}}$$

The optimal detector for this is given as: choose  $H_0$  if

Select one:

- ☒  $y(3) + y(4) \leq \gamma$  ✓
- ☐  $y(2) + y(4) \leq \gamma$
- ☐  $y(1) + y(2) + y(3) + y(4) \geq \gamma$
- ☐  $y(1) - y(2) + y(3) - y(4) \geq \gamma$

Your answer is correct.

The correct answer is:  $y(3) + y(4) \leq \gamma$

Question **2**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

The PFA for the generalized signal detection problem is

Select one:

- ☐  $Q\left(\frac{\gamma}{\sigma\|\bar{\mathbf{s}}_1 + \bar{\mathbf{s}}_0\|}\right)$
- ☐  $Q\left(\frac{\gamma}{\sigma\|\bar{\mathbf{s}}_1\|}\right)$
- ☐  $Q\left(\frac{\gamma}{\sigma\|\bar{\mathbf{s}}_0\|}\right)$
- ☒  $Q\left(\frac{\gamma}{\sigma\|\bar{\mathbf{s}}_1 - \bar{\mathbf{s}}_0\|}\right)$  ✓

Your answer is correct.

The correct answer is:  $Q\left(\frac{\gamma}{\sigma\|\bar{\mathbf{s}}_1 - \bar{\mathbf{s}}_0\|}\right)$

Question **3**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

The  $P_D$  for the generalized signal detection problem is

Select one:

- ☐  $Q\left(\frac{\gamma - \|\bar{\mathbf{s}}_1 + \bar{\mathbf{s}}_0\|^2}{\sigma\|\bar{\mathbf{s}}_1 + \bar{\mathbf{s}}_0\|}\right)$
- ☒  $Q\left(\frac{\gamma - \|\bar{\mathbf{s}}_1 - \bar{\mathbf{s}}_0\|^2}{\sigma\|\bar{\mathbf{s}}_1 - \bar{\mathbf{s}}_0\|}\right)$  ✓
- ☐  $Q\left(\frac{\gamma}{\sigma\|\bar{\mathbf{s}}_1\|}\right)$
- ☐  $Q\left(\frac{\gamma}{\sigma\|\bar{\mathbf{s}}_1 - \bar{\mathbf{s}}_0\|}\right)$

Your answer is correct.

The correct answer is:  $Q\left(\frac{\gamma - \|\bar{\mathbf{s}}_1 - \bar{\mathbf{s}}_0\|^2}{\sigma\|\bar{\mathbf{s}}_1 - \bar{\mathbf{s}}_0\|}\right)$

Question **4**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider the generalized signal detection problem with

$$\bar{\mathbf{s}}_0 = \begin{bmatrix} -4 \\ 4 \\ 4 \\ -4 \end{bmatrix}, \bar{\mathbf{s}}_1 = \begin{bmatrix} 4 \\ 4 \\ 4 \\ 4 \end{bmatrix}$$

Let  $\sigma^2 = 4$ . The probability of error for the ML detector with equiprobable signals is

Select one:

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

Your answer is correct.

The correct answer is:  $Q(2\sqrt{2})$

Question **5**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider BPSK modulation of with energy per bit  $E_b$ . The bit error rate (BER) for this is

Select one:

- ☐  $Q\left(\sqrt{\frac{E_b}{N_0}}\right)$
- ☐  $Q\left(\sqrt{\frac{E_b}{2N_0}}\right)$
- ☒  $Q\left(\sqrt{\frac{2E_b}{N_0}}\right)$  ✓
- ☐  $Q\left(\frac{2E_b}{N_0}\right)$

Your answer is correct.

The correct answer is:  $Q\left(\sqrt{\frac{2E_b}{N_0}}\right)$

Question **6**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

For same energy per bit  $E_b$ ,

Select one:

- ☐ ASK is 3 dB more efficient than BPSK
- ☐ Both ASK and BPSK have the same BER
- ☐ There is no relation between BER of BPSK and ASK
- ☒ BPSK is 3 dB more efficient than ASK ✓

Your answer is correct.

The correct answer is:  
BPSK is 3 dB more efficient than ASK

Question **7**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider the multiple hypothesis testing problem

$$\mathcal{H}_0: \bar{\mathbf{y}} = \bar{\mathbf{s}}_0 + \bar{\mathbf{v}}$$

$$\mathcal{H}_1: \bar{\mathbf{y}} = \bar{\mathbf{s}}_1 + \bar{\mathbf{v}}$$

⋮

$$\mathcal{H}_{M-1}: \bar{\mathbf{y}} = \bar{\mathbf{s}}_{M-1} + \bar{\mathbf{v}}$$

The ML detector for this is choose  $H_i$  such that

Select one:

- ☐  $i = \arg \max_j \|\bar{\mathbf{y}} - \bar{\mathbf{s}}_j\|$
- ☐  $i = \arg \min_j \|\bar{\mathbf{y}} + \bar{\mathbf{s}}_j\|$
- ☐  $i = \arg \max_j \|\bar{\mathbf{y}} + \bar{\mathbf{s}}_j\|$
- ☒  $i = \arg \min_j \|\bar{\mathbf{y}} - \bar{\mathbf{s}}_j\|$  ✓

Your answer is correct.

The correct answer is:  $i = \arg \min_j \|\bar{\mathbf{y}} - \bar{\mathbf{s}}_j\|$

Question **8**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

In the multiple hypothesis testing problem, the decision region for each hypothesis is

Select one:

- ☐ Always square
- ☒ In general a polyhedron ✓
- ☐ Always rectangle
- ☐ Always a parallelogram

Your answer is correct.

The correct answer is: In general a polyhedron

Question **9**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

The union bound on the probability of error for an M - ary constellation is

Select one:

- ☐  $\frac{1}{M} \sum_i N_{min}^i Q\left(\frac{d_{min}^i}{\sigma}\right)$
- ☐  $\frac{1}{M} \sum_i Q\left(\frac{d_{min}^i}{2\sigma}\right)$
- ☒  $\frac{1}{M} \sum_i N_{min}^i Q\left(\frac{d_{min}^i}{2\sigma}\right)$  ✓
- ☐  $\frac{1}{M} \sum_i N_{min}^i Q(d_{min}^i)$

Your answer is correct.

The correct answer is:  $\frac{1}{M} \sum_i N_{min}^i Q\left(\frac{d_{min}^i}{2\sigma}\right)$

Question **10**

Correct

Mark 1.00 out of 1.00

🚩 Flag question

Consider an M - ary PAM constellation given by  $(2i - (M - 1))A, 0 \leq i \leq M - 1$ , The probability of error for an interior point is given as

Select one:

- ☒  $2Q\left(\frac{A}{\sigma}\right)$  ✓
- ☐  $2Q\left(\frac{2A}{\sigma}\right)$
- ☐  $Q\left(\frac{A}{\sigma}\right)$
- ☐  $Q\left(\frac{2A}{\sigma}\right)$

Your answer is correct.

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

[Finish review](#)