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

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 P_{FA} for the generalized signal detection problem is

Select one:

- $Q\left(\frac{\gamma}{\sigma\|\bar{s}_1+\bar{s}_0\|}\right)$
- $Q\left(\frac{\gamma}{\sigma\|\bar{s}_1\|}\right)$
- $Q\left(\frac{\gamma}{\sigma\|\bar{s}_0\|}\right)$
- $Q\left(\frac{\gamma}{\sigma\|\bar{s}_1-\bar{s}_0\|}\right)$ ✔

Your answer is correct.

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

Question **3**

Correct

Mark 1.00 out of 1.00

Flag question

The P_D for the generalized signal detection problem is

Select one:

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

- $Q\left(\frac{\gamma}{\sigma\|\bar{s}_1\|}\right)$
- $Q\left(\frac{\gamma}{\sigma\|\bar{s}_1-\bar{s}_0\|}\right)$

Your answer is correct.

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

Question **4**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the generalized signal detection problem with

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

Let σ^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: $Q\left(\sqrt{\frac{2E_b}{N_0}}\right)$

For same energy per bit E_b ,

Select one:

Question **6**

Correct

Mark 1.00 out of 1.00

Flag question

- 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

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

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

$$\vdots$$

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

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

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

Select one:

Flag question

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

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 $\left(2i-(M-1)\right)A, 0 \leq i \leq M-1.$, 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