Started on	Friday, 3 November 2023, 10:46 PM
State	Finished
Completed on	Friday, 3 November 2023, 11:35 PM
Time taken	48 mins 39 secs
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

Flag question

The probability of symbol error for 16-QAM with $\frac{E_s}{N_0} = 20$ is given as

Select one:

- $\frac{3}{2}Q\left(\frac{1}{\sqrt{2}}\right)$
- $3Q(1)$
- $\frac{7}{2}Q\left(\sqrt{\frac{1}{3}}\right)$
- $3Q(2)$ ✔

Your answer is correct.

The correct answer is: $3Q(2)$

Question **2**

Correct

Mark 1.00 out of 1.00

Flag question

Let the decision regions for $\mathcal{H}_1,\mathcal{H}_0$ be R_1,R_0, respectively, and corresponding prior probabilities of the hypotheses be π_1,π_0. The probability of error is given as

Select one:

- $\pi_1 \int_{R_1} p(\bar{\mathbf{y}}|\mathcal{H}_1)d\bar{\mathbf{y}} + \pi_0 \int_{R_0} p(\bar{\mathbf{y}}|\mathcal{H}_0)d\bar{\mathbf{y}}$
- $\pi_1 \int_{R_0} p(\bar{\mathbf{y}}|\mathcal{H}_0)d\bar{\mathbf{y}} + \pi_0 \int_{R_1} p(\bar{\mathbf{y}}|\mathcal{H}_1)d\bar{\mathbf{y}}$
- $\pi_1 \int_{R_0} p(\bar{\mathbf{y}}|\mathcal{H}_1)d\bar{\mathbf{y}} + \pi_0 \int_{R_1} p(\bar{\mathbf{y}}|\mathcal{H}_0)d\bar{\mathbf{y}}$ ✔
- $\pi_0 \int_{R_0} p(\bar{\mathbf{y}}|\mathcal{H}_1)d\bar{\mathbf{y}} + \pi_1 \int_{R_1} p(\bar{\mathbf{y}}|\mathcal{H}_0)d\bar{\mathbf{y}}$

Your answer is correct.

The correct answer is: $\pi_1 \int_{R_0} p(\bar{\mathbf{y}}|\mathcal{H}_1)d\bar{\mathbf{y}} + \pi_0 \int_{R_1} p(\bar{\mathbf{y}}|\mathcal{H}_0)d\bar{\mathbf{y}}$

Question **3**

Correct

Mark 1.00 out of 1.00

Flag question

The min P_e detector chooses $\mathcal{H}_0$ when

Select one:

- $\frac{p(\bar{\mathbf{y}}|\mathcal{H}_0)}{p(\bar{\mathbf{y}}|\mathcal{H}_1)} \geq \frac{\pi_1}{\pi_0}$ ✔

- $\frac{p(\bar{y}|\mathcal{H}_0)}{p(\bar{y}|\mathcal{H}_1)} \geq \frac{\pi_0}{\pi_1}$
- $\frac{p(\bar{y}|\mathcal{H}_0)}{p(\bar{y}|\mathcal{H}_1)} \leq \frac{\pi_1}{\pi_0}$
- $\frac{p(\bar{y}|\mathcal{H}_0)}{p(\bar{y}|\mathcal{H}_1)} \geq \frac{\pi_0}{\pi_1}$

Your answer is correct.

The correct answer is: $\frac{p(\bar{y}|\mathcal{H}_0)}{p(\bar{y}|\mathcal{H}_1)} \geq \frac{\pi_1}{\pi_0}$

Question **4**

Correct

Mark 1.00 out of 1.00

Flag question

The min P_e detector chooses $\mathcal{H}_0$ when

Select one:

- $\Pr(\mathcal{H}_0|\bar{\mathbf{y}}) \geq \Pr(\mathcal{H}_1|\bar{\mathbf{y}})$ ✔
- $\Pr(\mathcal{H}_1|\bar{\mathbf{y}}) \geq \Pr(\mathcal{H}_0|\bar{\mathbf{y}})$
- $\Pr(\bar{\mathbf{y}}|\mathcal{H}_0) \geq \Pr(\bar{\mathbf{y}}|\mathcal{H}_1)$
- $\Pr(\bar{\mathbf{y}}|\mathcal{H}_1) \geq \Pr(\bar{\mathbf{y}}|\mathcal{H}_0)$

Your answer is correct.

The correct answer is: $\Pr(\mathcal{H}_0|\bar{\mathbf{y}}) \geq \Pr(\mathcal{H}_1|\bar{\mathbf{y}})$

Question **5**

Correct

Mark 1.00 out of 1.00

Flag question

The min P_e decision rule is the

Select one:

- ML rule
- LRT
- Least Squares
- MAP rule ✔

Your answer is correct.

The correct answer is: MAP rule

Question **6**

Correct

Mark 1.00 out of 1.00

Flag question

For equiprobable hypotheses, the min P_e decision rule reduces to the

Select one:

- LRT
- ML rule ✔
- Least Squares
- Maximum Apriori Probability rule

Your answer is correct.

The correct answer is: ML rule

Question **7**

Correct

Mark 1.00 out of 1.00

Flag question

Consider $\bar{s} = \begin{bmatrix} 2 \\ -2 \\ 2 \\ -2 \end{bmatrix}$, $\sigma^2 = 2$ and $\pi_0 = \frac{e}{1+e}$. For the binary signal detection problem described in class, the threshold for the MAP decision rule is given as

Select one:

- 10 ✔
- 8
- 6
- 12

Your answer is correct.

The correct answer is: 10

Question **8**

Correct

Mark 1.00 out of 1.00

Flag question

For the binary signal detection problem described in class, the minimum P_e achieved using the MAP rule is given as

Select one:

- $\pi_0 Q\left(\frac{\|\bar{s}\|^2+2\sigma^2 \ln\frac{\pi_1}{\pi_0}}{2\sigma\|\bar{s}\|}\right) + \pi_1 Q\left(\frac{\|\bar{s}\|^2-2\sigma^2 \ln\frac{\pi_1}{\pi_0}}{2\sigma\|\bar{s}\|}\right)$
- $\pi_0 Q\left(\frac{\|\bar{s}\|-2\sigma \ln\frac{\pi_1}{\pi_0}}{2\sigma^2\|\bar{s}\|^2}\right) + \pi_1 Q\left(\frac{\|\bar{s}\|+2\sigma \ln\frac{\pi_1}{\pi_0}}{2\sigma^2\|\bar{s}\|^2}\right)$
- $\pi_0 Q\left(\frac{\|\bar{s}\|^2-2\sigma^2 \ln\frac{\pi_1}{\pi_0}}{2\sigma\|\bar{s}\|}\right) + \pi_1 Q\left(\frac{\|\bar{s}\|^2+2\sigma^2 \ln\frac{\pi_1}{\pi_0}}{2\sigma\|\bar{s}\|}\right)$ ✔
- $\pi_0 Q\left(\frac{\|\bar{s}\|+2\sigma \ln\frac{\pi_1}{\pi_0}}{2\sigma^2\|\bar{s}\|^2}\right) + \pi_1 Q\left(\frac{\|\bar{s}\|-2\sigma \ln\frac{\pi_1}{\pi_0}}{2\sigma^2\|\bar{s}\|^2}\right)$

Your answer is correct.

The correct answer is: $\pi_0 Q\left(\frac{\|\bar{s}\|^2-2\sigma^2 \ln\frac{\pi_1}{\pi_0}}{2\sigma\|\bar{s}\|}\right) + \pi_1 Q\left(\frac{\|\bar{s}\|^2+2\sigma^2 \ln\frac{\pi_1}{\pi_0}}{2\sigma\|\bar{s}\|}\right)$

Question **9**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the binary signal detection problem with $SNR = 10\ dB$ and $\pi_1 = 0.60$. The min P_e achieved using the optimal decision rule is

Select one:

- 0.00787
- 0.0569
- 0.0555 ✔
- 0.1046

Your answer is correct.

The correct answer is: 0.0555

Question **10**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the binary signal detection problem with $SNR = 10\ dB$ and $\pi_1 = 0.60$. The P_e achieved using the ML decision rule is

Select one:

- 0.00787
- 0.0569 ✔
- 0.0555
- 0.1046

Your answer is correct.

The correct answer is: 0.0569

Finish review