Assignment-8

The due date for submitting this assignment has passed.

Due on 2021-03-17, 23:59 IST.

As per our records you have not submitted this assignment.

1) Consider the linear model $\bar{\mathbf{y}} = \mathbf{H}\bar{\mathbf{x}} + \bar{\mathbf{n}}$, where $E\{\bar{\mathbf{x}}\bar{\mathbf{x}}^T\} = \mathbf{R}_{xx} = \gamma\mathbf{I}$ and noise covariance $E\{\bar{\mathbf{n}}\bar{\mathbf{n}}^T\} = \epsilon\mathbf{I}$. The SNR is $\frac{\gamma}{\epsilon}$. The Linear Minimum Mean Square Error (LMMSE) estimate of $\bar{\mathbf{x}}$ for this system is given as *1 point*

- $(\mathbf{H}\mathbf{H}^T + \frac{1}{SNR}\mathbf{I})^{-1}\mathbf{H}^T\bar{\mathbf{y}}$
- $(\frac{1}{SNR}\mathbf{H}\mathbf{H}^T + \mathbf{I})^{-1}\mathbf{H}\bar{\mathbf{y}}$
- $(\frac{1}{SNR}\mathbf{H}^T\mathbf{H} + \mathbf{I})^{-1}\mathbf{H}\bar{\mathbf{y}}$
- $(\mathbf{H}^T\mathbf{H} + \frac{1}{SNR}\mathbf{I})^{-1}\mathbf{H}^T\bar{\mathbf{y}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$(\mathbf{H}^T\mathbf{H} + \frac{1}{SNR}\mathbf{I})^{-1}\mathbf{H}^T\bar{\mathbf{y}}$

2) Consider the linear model $\bar{\mathbf{y}} = \mathbf{H}\bar{\mathbf{x}} + \bar{\mathbf{n}}$, where $E\{\bar{\mathbf{x}}\bar{\mathbf{x}}^T\} = \mathbf{R}_{xx} = \gamma\mathbf{I}$ and noise covariance $E\{\bar{\mathbf{n}}\bar{\mathbf{n}}^T\} = \epsilon\mathbf{I}$. Consider the SNR $\frac{\gamma}{\epsilon} \to \infty$. The Linear Minimum Mean Square Error (LMMSE) estimate of $\bar{\mathbf{x}}$ for this system becomes *1 point*

- $(\mathbf{H}\mathbf{H}^T)^{-1}\mathbf{H}^T\bar{\mathbf{y}}$
- $(\mathbf{H}\mathbf{H}^T + \mathbf{I})^{-1}\mathbf{H}\bar{\mathbf{y}}$
- $(\mathbf{H}^T\mathbf{H})^{-1}\mathbf{H}^T\bar{\mathbf{y}}$
- $(\mathbf{H}^T\mathbf{H} + \mathbf{I})^{-1}\mathbf{H}^T\bar{\mathbf{y}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$(\mathbf{H}^T\mathbf{H})^{-1}\mathbf{H}^T\bar{\mathbf{y}}$

3) Consider the linear model $\bar{\mathbf{y}} = \mathbf{H}\bar{\mathbf{x}} + \bar{\mathbf{n}}$, where $E\{\bar{\mathbf{x}}\bar{\mathbf{x}}^T\} = \mathbf{R}_{xx} = \gamma\mathbf{I}$ and noise covariance $E\{\bar{\mathbf{n}}\bar{\mathbf{n}}^T\} = \epsilon\mathbf{I}$. The SNR is $\frac{\gamma}{\epsilon}$. The error covariance of the Linear Minimum Mean Square Error (LMMSE) estimate of $\bar{\mathbf{x}}$ for this system is given as *1 point*

- $(\frac{1}{\gamma}\mathbf{H}^T\mathbf{H} + \frac{1}{\epsilon}\mathbf{I})^{-1}$
- $(\frac{1}{\epsilon}\mathbf{H}^T\mathbf{H} + \frac{1}{\gamma}\mathbf{I})^{-1}$
- $(\mathbf{H}^T\mathbf{H} + \frac{1}{\mathbf{SNR}}\mathbf{I})^{-1}$
- $(\frac{1}{SNR}\mathbf{H}^T\mathbf{H} + \mathbf{I})^{-1}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$(\frac{1}{\epsilon}\mathbf{H}^T\mathbf{H} + \frac{1}{\gamma}\mathbf{I})^{-1}$

4) Consider the linear model $\bar{\mathbf{y}} = \mathbf{H}\bar{\mathbf{x}} + \bar{\mathbf{n}}$, where *1 point*

$$\mathbf{H} = \begin{bmatrix} 1 & -1 \\ -1 & -1 \\ -1 & -1 \\ 1 & -1 \end{bmatrix}, \bar{\mathbf{y}} = \begin{bmatrix} 2 \\ -1 \\ -2 \\ 3 \end{bmatrix}$$

with the covariance $E\{\bar{\mathbf{x}}\bar{\mathbf{x}}^T\} = \mathbf{R}_{xx} = \frac{1}{4}\mathbf{I}$ and noise covariance $E\{\bar{\mathbf{n}}\bar{\mathbf{n}}^T\} = \frac{1}{2}\mathbf{I}$. The Linear Minimum Mean Square Error (LMMSE) estimate of $\bar{\mathbf{x}}$ for this system is given as

- $\frac{1}{3}\begin{bmatrix} 4 \\ -1 \end{bmatrix}$
- $\frac{1}{3}\begin{bmatrix} -2 \\ -3 \end{bmatrix}$
- $\frac{1}{3}\begin{bmatrix} 1 \\ 3 \end{bmatrix}$
- $\frac{1}{3}\begin{bmatrix} -2 \\ 2 \end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{3}\begin{bmatrix} 4 \\ -1 \end{bmatrix}$

5) Consider the linear model $\bar{\mathbf{y}} = \mathbf{H}\bar{\mathbf{x}} + \bar{\mathbf{n}}$, where *1 point*

$$\mathbf{H} = \begin{bmatrix} 1 & -1 \\ -1 & -1 \\ -1 & -1 \\ 1 & -1 \end{bmatrix}, \bar{\mathbf{y}} = \begin{bmatrix} 2 \\ -1 \\ -2 \\ 3 \end{bmatrix}$$

with the covariance $E\{\bar{\mathbf{x}}\bar{\mathbf{x}}^T\} = \mathbf{R}_{xx} = \frac{1}{4}\mathbf{I}$ and noise covariance $E\{\bar{\mathbf{n}}\bar{\mathbf{n}}^T\} = \frac{1}{2}\mathbf{I}$. The error covariance of the Linear Minimum Mean Square Error (LMMSE) estimate of $\bar{\mathbf{x}}$for this system is given as

- $\frac{1}{12}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
- $\frac{3}{8}\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$
- $\frac{1}{4}\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$
- $\frac{1}{2}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{12}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

6) Autoregression refers to *1 point*

- Regression that is performed automatically
- Auto encoded regression using the principal components
- Regression performed using past samples of the same process
- Regression performed on auto-orthogonal random vectors

No, the answer is incorrect.
Score: 0

Accepted Answers:
Regression performed using past samples of the same process

7) Consider a zero-mean wide sense stationary time-series $x(n)$. For such a process, the auto-correlation $E\{x(i)x(j)\}$ *1 point*

- Depends only on the time-sum $i + j$
- Depends only on the time-product ij
- Is necessarily periodic with respect to i and j
- Depends only on the time-difference $i - j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
Depends only on the time-difference $i - j$

8) Consider a zero-mean wide sense stationary time-series $x(n)$ with auto-correlation $r_{xx}(n) = 0.8^n$. The best prediction of $x(n)$ based on $x(n-1)$ is given as *1 point*

- $\frac{1}{0.8}x(n-1)$
- $0.8^2x(n-1)$
- $0.8x(n-1)$
- $\frac{1}{0.8^2}x(n-1)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$0.8x(n-1)$

9) Consider a zero-mean wide sense stationary time-series $x(n)$ with auto-correlation $r_{xx}(n) = 0.8^n$. The regression error for the best prediction of $x(n)$ based on $x(n-1)$ is given as *1 point*

- 0.8
- 0.36
- 0.64
- 0.2

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.36

10) Consider a zero-mean wide sense stationary time-series $x(n)$ with the vector $\bar{\mathbf{x}}$ defined as *1 point*

$$\bar{\mathbf{x}} = \begin{bmatrix} x(n-1) \\ x(n-2) \\ \vdots \\ x(n-L) \end{bmatrix}$$

The covariance matrix $E\{\bar{\mathbf{x}}\bar{\mathbf{x}}^T\}$ has the following structure

- Toeplitz
- Circulant
- Diagonal
- Frobenius

No, the answer is incorrect.
Score: 0

Accepted Answers:
Toeplitz