Started on	Sunday, 15 October 2023, 12:30 PM
State	Finished
Completed on	Sunday, 15 October 2023, 12:54 PM
Time taken	24 mins
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

Flag question

In the context of estimation, the probability density function (PDF) of the observations, viewed as a function of the unknown parameter h is termed as the

Select one:

- Objective Function
- Cost Function
- Estimation Function
- Likelihood Function ✔

Your answer is correct.

The correct answer is: Likelihood Function

Question **2**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the wireless sensor network (WSN) estimation scenario described in lectures with each observation $y(k) = h + v(k)$, for $1 \leq k \leq N$, i.e. number of observations is N and i.i.d. real Gaussian noise samples of variance σ^2. The likelihood $p(\bar{\mathbf{y}}; h)$ of the parameter h, where $\bar{\mathbf{y}} = [y(1) \quad y(2) \quad \ldots \quad y(N)]^T$ is

Select one:

- $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\sum_{k=1}^{N}(y(k)-h)}$
- $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\sum_{k=1}^{N}|y(k)-h|}$
- $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\sum_{k=1}^{N}(y(k)-h)^2}$ ✔
- $\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left(\sum_{k=1}^{N}y(k)-h\right)^2}$

Your answer is correct.

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

Question **3**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the wireless sensor network (WSN) estimation scenario described in lectures with each observation $y(k) = h + v(k)$, for $1 \leq k \leq N$, i.e. number of observations is N and i.i.d. real Gaussian noise samples of variance σ^2. As the number of samples N increases, the spread of estimate around the true parameter

Select one:

- Decreases ✔
- Increases
- Remains constant
- Cannot be determined

Your answer is correct.

The correct answer is: Decreases

Question **4**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the wireless sensor network (WSN) estimation scenario described in lectures with each observation $y(k) = h + v(k)$, for $1 \leq k \leq 4$, with the observations given as $y(1) = -2$, $y(2) = 1$, $y(3) = -1$, $y(4) = -2$. What is the maximum likelihood estimate $\hat{h}$ of the unknown parameter h ?

Select one:

- $-\frac{1}{4}$
- $\frac{3}{4}$
- $\frac{1}{4}$
- -1 ✔

Your answer is correct.

The correct answer is: -1

Question **5**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the wireless sensor network (WSN) estimation scenario described in lectures with each observation $y(k) = h + v(k)$, for $1 \leq k \leq 4$, i.e. number of observations $N = 4$ and IID Gaussian noise samples of variance $\sigma^2 = 1$. What is the variance of the maximum likelihood estimate $\hat{h}$ of the unknown parameter h ?

Select one:

- $\frac{1}{2}$
- $\frac{1}{4}$ ✔
- 1
- $\frac{1}{8}$

Your answer is correct.

The correct answer is: $\frac{1}{4}$

Question **6**

Correct

Mark 1.00 out of 1.00

Flag question

Let $\bar{\mathbf{x}} = [-1 \quad 1 \quad 1 \quad -1]^T$ denote the vector of transmitted pilot symbols and $\bar{\mathbf{y}} = [-1 \quad -1 \quad 2 \quad 3]^T$ denote the corresponding received symbol vector. The maximum likelihood estimate of the channel coefficient h is,

Select one:

- $-\frac{1}{4}$ ✔
- $-\frac{1}{2}$
- $-\frac{3}{4}$
- $\frac{1}{8}$

Your answer is correct.

The correct answer is: $-\frac{1}{4}$

Question **7**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the fading channel estimation problem with i.i.d. Gaussian noise of zero-mean and variance $\sigma^2 = 1$ and pilot vector $\bar{\mathbf{x}} = [-1 \quad 1 \quad 1 \quad -1]^T$. The variance of the ML estimate $\hat{h}$ is,

Select one:

- 2
- 1
- $\frac{1}{4}$ ✔
- $\frac{1}{2}$

Your answer is correct.

The correct answer is: $\frac{1}{4}$

Question **8**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the fading channel estimation problem where $\bar{\mathbf{x}}$ denotes the complex vector of transmitted pilot symbols. Let $v(k)$ be i.i.d. symmetric complex Gaussian noise with zero-mean and variance σ^2. The variance of the maximum likelihood estimate $\hat{h}$ is

Select one:

- $\frac{\sigma^2}{\bar{\mathbf{x}}^T\bar{\mathbf{x}}}$
- $\sigma^2\frac{\bar{\mathbf{x}}^T\bar{\mathbf{y}}}{\bar{\mathbf{x}}^T\bar{\mathbf{x}}}$
- $\frac{\sigma^2}{\bar{\mathbf{x}}^H\bar{\mathbf{x}}}$ ✔
- $\sigma^2\frac{\bar{\mathbf{x}}^H\bar{\mathbf{y}}}{\bar{\mathbf{x}}^H\bar{\mathbf{x}}}$

Your answer is correct.

The correct answer is: $\frac{\sigma^2}{\bar{\mathbf{x}}^H\bar{\mathbf{x}}}$

Question **9**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the fading channel estimation problem with $\bar{\mathbf{x}} = [1+j \quad -1+j \quad -1-j \quad -1+j]^T$ and $\bar{\mathbf{y}} = [-j \quad 1 \quad -j \quad 1]^T$. The maximum likelihood estimate of the channel coefficient h is,

Select one:

- $\frac{1}{4}+\frac{1}{4}j$
- $-\frac{1}{4}-\frac{1}{4}j$ ✔
- $\frac{1}{4}j$
- $-\frac{1}{2}$

Your answer is correct.

The correct answer is: $-\frac{1}{4}-\frac{1}{4}j$

Question **10**

Correct

Mark 1.00 out of 1.00

Flag question

The Fisher information $I(h)$ for estimation of a parameter h given the likelihood $p(\bar{\mathbf{y}};h)$ is

Select one:

- $\frac{1}{E\left\{\left(\frac{\partial}{\partial h}\ln p(\bar{\mathbf{y}};h)\right)^2\right\}}$
- $E\left\{\left(\frac{\partial}{\partial h}\ln p(\bar{\mathbf{y}};h)\right)^2\right\}$ ✔
- $E\left\{\frac{\partial}{\partial h}p(\bar{\mathbf{y}};h)\right\}$
- $E\left\{\left(\frac{\partial}{\partial h}p(\bar{\mathbf{y}};h)\right)^2\right\}$

Your answer is correct.

The correct answer is: $E\left\{\left(\frac{\partial}{\partial h}\ln p(\bar{\mathbf{y}};h)\right)^2\right\}$