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NPTEL

reviewer2@nptel.iitm.ac.in ▼

Courses » Estimation for Wireless Communications – MIMO/OFDM Cellular and Sensor Networks

Announcements **Course** Ask a Question Progress

Unit 2 - Week 1 - Basics of Estimation, Maximum Likelihood (ML)

Assignment-1

The due date for submitting this assignment has passed. **Due on 2017-08-06, 23:59 IST.**
As per our records you have not submitted this assignment.

1) 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 *1 point*

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

No, the answer is incorrect.
Score: 0

Accepted Answers:
Likelihood Function

2) 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. The ML estimate given by the sample mean has the following property. *1 point*

- It is biased
- Gaussian distributed
- Variance decreases as $\frac{1}{N^2}$, where N is number of observations
- All of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Gaussian distributed

3) 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 noise samples $v(k)$ are IID Gaussian noise samples with zero mean and variance σ^2. For this scenario, what is the maximum likelihood estimate $\hat{h}$ of the unknown parameter h. *1 point*

- $\frac{1}{N}\sum_{k=1}^{N} y^2(k)$
- $\left(\prod_{k=1}^{N} y(k)\right)^{\frac{1}{N}}$
-

$min\,\{y(k), 1 \leq k \leq N\}$

None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
None of the above

4) 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 noise samples $v(k)$ are IID Gaussian noise samples with zero mean and variance σ^2. For this scenario, what is the **variance** of the maximum likelihood estimate $\hat{h}$ of the unknown parameter h ***1 point***

σ^2

$\frac{\sigma^2}{N}$

$\frac{\sigma}{N}$

$N\sigma^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{\sigma^2}{N}$

5) 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 noise samples $v(k)$ are IID Gaussian noise samples with zero mean and variance σ^2. For this scenario, what is the **mean** of the maximum likelihood estimate $\hat{h}$ of the unknown parameter h ***1 point***

h

Nh

$\frac{h}{N}$

$\frac{1}{N}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
h

6) Consider now a slightly modified version of the wireless sensor network (WSN) estimation scenario described in class with each observation $y(k) = h + v(k)$, for $1 \leq k \leq N$. Let the noise samples be IID Gaussian with mean θ and variance σ^2 each. What is the maximum likelihood estimate $\hat{h}$? ***1 point***

$\frac{1}{N}\sum_{k=1}^{N}(y(k)-\theta)^2$

$\frac{1}{N}\sum_{k=1}^{N}(y(k)-\theta)$

$\frac{1}{N}\sum_{k=1}^{N}(y(k)+\theta)$

$\frac{1}{N}\sum_{k=1}^{N} y(k)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{N}\sum_{k=1}^{N}(y(k)-\theta)$

7) Consider now a slightly modified version of the wireless sensor network (WSN) estimation scenario described in class with each observation $y(k) = h + v(k)$, for $1 \leq k \leq N$. Let the noise samples be IID Gaussian with mean θ and variance σ^2 each. What is **mean** of the maximum likelihood estimate $\hat{h}$? ***1 po***

$h + \frac{\theta}{N}$

$\frac{h}{N} + \theta$

$h + \theta$

h

No, the answer is incorrect.
Score: 0

Accepted Answers:
h

8) Consider now a slightly modified version of the wireless sensor network (WSN) estimation scenario described in class with each observation $y(k) = h + v(k)$, for $1 \leq k \leq N$. Let the noise samples be IID Gaussian with mean θ and variance σ^2 each. What is **variance** of the maximum likelihood estimate $\hat{h}$? ***1 point***

$\sigma^2 + \theta^2$

$\frac{\sigma^2}{N} + \theta^2$

$\frac{\sigma^2}{N}$

$\frac{\sigma^2}{N} + \theta$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{\sigma^2}{N}$

9) Consider now a slightly modified version of the wireless sensor network (WSN) estimation scenario described in class with each observation $y(k) = h + v(k)$, for $1 \leq k \leq N$. Let the noise samples be IID Gaussian with mean θ and variance σ^2 each. What is the distribution of the maximum likelihood estimate $\hat{h}$? ***1 point***

- Uniform
- Exponential
- Rayleigh
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
None of the above

10)Consider now a slightly modified version of the wireless sensor network (WSN) estimation scenario described in class with each observation $y(k) = h + v(k)$, for $1 \leq k \leq N$. Let the noise samples be IID Gaussian with mean θ and variance $\sigma^2 = -6dB$ i.e. $10\log_{10}\sigma^2 = -6$. What is the number of observations N required such that the probability that the maximum likelihood estimate $\hat{h}$ lies within a radius of $\frac{1}{16}$ of the unknown parameter h is greater than 99.9%? Let Q denote the Gaussian Q function introduced in the lectures. ***1 point***

- $(2\sqrt{2}Q^{-1}(\theta + 10^{-3}))^2$
- $(8Q^{-1}(5 \times 10^{-4}))^2$
- $8Q^{-1}(5 \times 10^{-4})$
- $\theta + 2Q^{-1}(5\sqrt{2} \times 10^{-4})$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$(8Q^{-1}(5 \times 10^{-4}))^2$

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