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
- 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.
- 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 $\sigma^2$. For this scenario, what is the maximum likelihood estimate $\hat{h}$ of the unknown parameter $h$.

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

$$\left( \prod_{k=1}^{N} y(k) \right)^{\frac{1}{N}}$$
Consider the wireless sensor network (WSN) estimation scenario described in lectures with each observation \( y(k) \), 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 \( \sigma^2 \). For this scenario, what is the variance of the maximum likelihood estimate \( \hat{h} \) of the unknown parameter \( h \)?

- \( \sigma^2 \)
- \( \frac{\sigma^2}{N} \)
- \( \frac{\sigma}{N} \)
- \( N\sigma^2 \)

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
None of the above

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 \( \theta \) and variance \( \sigma^2 \) each. What is the maximum likelihood estimate \( \hat{h} \)?

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

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
\( \hat{h} \)
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 \( \theta \) and variance \( \sigma^2 \) each. What is mean of the maximum likelihood estimate \( \hat{h} \)?

- \( h + \frac{\theta}{N} \)
- \( \frac{h}{N} + \theta \)
- \( h + \theta \)
- \( h \)

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 \( \theta \) and variance \( \sigma^2 \) each. What is variance of the maximum likelihood estimate \( \hat{h} \)?

- \( \sigma^2 + \theta^2 \)
- \( \frac{\sigma^2}{N} + \theta^2 \)
- \( \frac{\sigma^2}{N} \)
- \( \frac{\sigma^2}{N} + \theta \)

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 \( \theta \) and variance \( \sigma^2 \) each. What is the distribution of the maximum likelihood estimate \( \hat{h} \)?

- Uniform
- Exponential
- Rayleigh
- None of the above

No, the answer is incorrect.
Score: 0
1) 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 i.i.d. Gaussian with mean \( \theta \) 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 \( \frac{1}{\ln N} \) of the unknown parameter \( h \) is greater than 99.9%? Let \( Q \) denote the Gaussian Q function introduced in the lectures.

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
\((8Q^{-1}(5 \times 10^{-4}))^2\)