Week 8 Assignment
The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

1) Given below is the spectral density function $\gamma_{vv}(\omega)$ of a stationary process $v[k]$

$$\gamma_{vv}(\omega) = \frac{1}{2\pi (1.81 + 1.8 \cos 2\omega)}.$$ 

Which of the following is an appropriate representation for $v[k]$ with $\sigma_v^2 = 1$?

a. $v[k] = \frac{1}{1 + 0.9q^{-2}} e[k]$

b. $v[k] = \frac{1}{1 - 0.9q^{-2}} e[k]$

c. $v[k] = \frac{1}{1 + 0.9q^{-1}} e[k]$

d. $v[k] = \frac{1}{1 - 0.9q^{-1}} e[k]$

No, the answer is incorrect.
Score: 0
Accepted Answers:

2) Which of the following best represents the filtering characteristics of the process $v[k]$ Question 1?

(a) [Diagram]

(b) [Diagram]

(c) [Diagram]

No, the answer is incorrect.
Score: 0
Accepted Answers:

3)
3. For the spectral density function of a stationary process \( v[k] \) given in Question 1, PACF of \( v[k] \) at lag \( l = 2 \) is __________.
   a. 0
   b. \(-0.9\)
   c. 0.9
   d. None of the above

   No, the answer is incorrect.
   Score: 0
   Accepted Answers: 
   \( b \)

4. Consider the fluid level measurement example given in class. Suppose we change the assumed model to

   \[ y[k] = c_1 + c_2 e[k], \quad e[k] \sim \mathcal{N}(0, \sigma^2_e) \]

   choosing a least squares optimization function, which one of the following statements are TRUE?
   a. \( c_1 \) can be estimated uniquely but \( c_2 \) cannot be
   b. \( c_2 \) can be estimated uniquely but \( c_1 \) cannot be
   c. Both \( c_1 \) and \( c_2 \) can be estimated uniquely
   d. Neither \( c_1 \) nor \( c_2 \) can be estimated uniquely

   No, the answer is incorrect.
   Score: 0
   Accepted Answers: 
   \( a \)

5. Given a single observation \( y \) of an exponential white-noise process with p.d.f. \( f(y) = \) the log-likelihood function \( L(\theta = \lambda; y) \) is __________
   a. \( \lambda e^{-\lambda y} \)
   b. \(-\lambda y \)
   c. \( \log(y) - \lambda e^{-\lambda y} \)
   d. \( \log(\lambda) - \lambda y \)

   No, the answer is incorrect.
   Score: 0
   Accepted Answers: 
   \( d \)
6. Suppose we re-define the parameter $\theta$ for the problem in Question 5 as $\theta = \frac{1}{\lambda}$, then the Fisher’s Information of $\theta$ contained in $N$ observations of the exponential white noise process is ____________

   a. $I(\theta) = -N\theta^2$
   b. $I(\theta) = -N\lambda^2$
   c. $I(\theta) = \frac{N}{\lambda^2}$
   d. $I(\theta) = \frac{N}{\theta^2}$

   Accepted Answers: 
   d

No, the answer is incorrect.
Score: 0

7. A constant signal of unknown amplitude $A$ is observed by two different, but independent sensors whose variances are (known to be) $\sigma^2$ and $4\sigma^2$, respectively. Suppose a total of $N = N_1 + N_2$ observations, with $N_1$ and $N_2$ from sensor 1 and sensor 2, respectively, obtained. Given that $N_1, N_2 \geq 2$ (assume that sensor errors are Gaussian white), $N_1$ and $N_2$ such that the Fisher’s information (about $A$) in the appended data is maxized.

   a. $N_1 = N - 2, N_2 = 2$
   b. $N_1 = 2, N_2 = N - 2$
   c. $N_1 = N_2 = N/2$
   d. None of the above

   Accepted Answers: 
   a

No, the answer is incorrect.
Score: 0

8. For a periodic random process with $N_p = 5$, which of the following statements is correct?

   a. $E(v[k+5] - v[k])^2 = 0$
   b. $\sigma_{v}[l+15] = \sigma_{v}[l]$
   c. $\sigma_{v}[10] = \sigma_{v}[0]$
   d. All of the above

   Accepted Answers: 
   d

No, the answer is incorrect.
Score: 0
9. For the time series given in w8.q9.Rdata, suppose we estimate the p.s.d of \( v[k] \) by a time-series model and using the expression (i.e., Eq. 10 in course notes on spectral representations of random processes) for the p.s.d. Which is the appropriate sketch of the p.s.d?

![Sketches](image)

(a) ![Sketch](image) (b) ![Sketch](image) (c) ![Sketch](image)

No, the answer is incorrect.
Score: 0
Accepted Answers:
- a
- b
- c

10. Generate a single realization consists of \( N = 100 \) observations for the given MA(1) process and compute the sample mean.

\[ v[k] = e[k] + 0.4e[k - 1], \quad e[k] \sim \mathcal{N}(0, 1) \]

Repeat this process for 10000 times. The variability of the sample mean is (approximate)

- a. 0.02
- b. 0.2
- c. 0.4
- d. 1

No, the answer is incorrect.
Score: 0
Accepted Answers:
- a