Unit 12 - Week 7: Fourier Transforms, DFT and Periodogram

Week 7 Assignment

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

Due on 2018-03-17, 23:59 IST

1) *1 point*

Consider the periodic signal $x[k] = \{2, -2, 0, 1\}$ starting from $k = 0$ with fourier representation as:

$$x[k] = \sum_{n=0}^{N-1} c_n e^{j2\pi kn/N}$$

The values of c_3 and $\int_{-\pi}^{\pi} |X(\omega)|^2 d\omega$ are _____.

- $c3 = \frac{2+3j}{4}, 18\pi$
- $c3 = \frac{2-3j}{4}, 18\pi$
- $c3 = \frac{2+3j}{4}, 9$
- $c3 = \frac{2-3j}{4}, 9$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$c3 = \frac{2-3j}{4}, 18\pi$

2) *1 point*

Suppose a signal $x[k]$ has a Fourier transform:

$$X(\omega) = \frac{1}{1 - ae^{-j\omega}}$$

The Fourier transform of $x[2k+1]$ is _____.

- $\frac{e^{\frac{jw}{2}}}{1-ae^{\frac{-jw}{2}}}$
- $\frac{e^{\frac{jw}{2}}}{1-ae^{-jw}}$
- $\frac{e^{jw}}{1-ae^{\frac{-jw}{2}}}$
- $\frac{e^{jw}}{1-ae^{-jw}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{e^{\frac{jw}{2}}}{1-ae^{\frac{-jw}{2}}}$$

3) *1 point*

Consider a MA process as given below:

$$v[k] = 0.6e[k-1] + e[k], \quad e[k] \sim \mathcal{N}(0,1)$$

The p.s.d for the process is:

- $1.36 + 1.2\cos\omega$
- $\frac{1}{2\pi}(1.36 + 1.2\cos\omega)$
- $\frac{1}{2\pi}(1.36 + 1.2\cos 2\omega)$
- $\frac{1}{2\pi}(1 + 0.6\cos\omega)$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{1}{2\pi}(1.36 + 1.2\cos\omega)$$

4) *1 point*

For the following discrete-time periodic signal

$$x[k] = \cos(2\pi f_0 k)$$

The value of the energy spectral density function $S_{xx}(f)$ at $f = 0.2$ is _____

- 0
- 0.25
- -0.25
- It is an ill-posed problem

No, the answer is incorrect.
Score: 0

Accepted Answers:
It is an ill-posed problem

5) *1 point*

Given a process $y[k] = G(q^{-1})x[k]$, where $x[k] = 0.5^k$ is an energy signal and

$$G(q^{-1}) = \frac{1}{(1-1.1q^{-1})(1-0.1q^{-1})}$$

Which of the following statements is TRUE? (FRF - Frequency Response Function)

- Value of the FRF at $w = \frac{\pi}{3}$ is 0.34 − 0.93i
- Energy density does not exist for the output signal y[k].
- The FRF does not exist.
- Both (a) and (b).
- Both (b) and (c).

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both (b) and (c).

6) 1 point

The theoretical ACVF at lag l of a random process $v[k]$ is

$$\sigma_{vv}[l] = \begin{cases} 1.36, & l = 0 \\ 0.6, & |l| = 1 \\ 0.1, & |l| = 2 \\ 0, & \text{otherwise} \end{cases}$$

The expression for its spectral density $\gamma_{vv}(\omega)$:

- $\frac{1}{2\pi}(1.36+1.2cos(w)+0.2cos(2w))$
- $\frac{1}{2\pi}(1.36+0.6cos(w)+0.1cos(2w))$
- $(1.36+1.2cos(w)+0.2cos(2w))$
- $(1.36+0.6cos(w)+0.1cos(2w))$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{2\pi}(1.36+1.2cos(w)+0.2cos(2w))$

7) 1 point

The spectral density of a stationary random process $v[k]$ is

$$\gamma(\omega) = 2\pi(1.61 + 1.6\cos(2\omega))$$

Which one of the following is an appropriate representation of $v[k]$?

- AR(1) process
- AR(2) process
- MA(1) process
- MA(2) process

No, the answer is incorrect.
Score: 0

Accepted Answers:
MA(2) process

8) 1 point

The noisy measurements of a periodic signal $y[k]$ is given in `w7_q8.RData`.

$$y[k] = \sum_{i=1}^{m} \left(a_i \sin(2\pi f_i k) + b_i \cos(2\pi f_i k) \right) + e[k]$$

where m is the number of periodic components present in the signal. Using `R`, est a_i, b_i and f_i.

- y[k] = 1.16 sin(0.4πk) + 3.78 cos(0.4πk) + e[k]
- y[k] = −1.88 sin(0.6πk) − 0.58 cos(0.6πk) + e[k]
- y[k] = 3.78 cos(0.4πk) + 1.16 sin(0.4πk) − 1.88 sin(0.6πk) − 0.58 cos(0.6πk) + e[k]
- y[k] = 3.78 cos(0.3πk) − 1.88 sin(0.3πk) + e[k]

No, the answer is incorrect.
Score: 0

Accepted Answers:
y[k] = 3.78 cos(0.4πk) + 1.16 sin(0.4πk) − 1.88 sin(0.6πk) − 0.58 cos(0.6πk) + e[k]

9)

For the data given in `w7_q9.RData`, the total number of periodic components pre

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1

1 point

10) *0 points*

Consider the series given in `w7_q10.RData`. Which of the following is/are TRU

- [ ] A sinusoid of appropriate frequency is enough to model the series
- [ ] A sinusoid of appropriate frequency is not enough to model the series
- [ ] There are more than one periodic components present in the series
- [ ] None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
A sinusoid of appropriate frequency is not enough to model the series
There are more than one periodic components present in the series

Previous Page End