

HOMEWORK #5

Due Date: Dec. 3rd, 2011

Q1 Solve problem 9.2 from the textbook.

Q2 Solve problem 9.8 from the textbook.

Q3 Let $X(t)$ be an iid process. Prove that $X(t)$ is stationary.

Q4 Let $X(n)$ be Bernouli process (taking the values of 0 & 1 with equal probability). Define the process $Y(n) = (-1)^n X(n)$. Is $Y(n)$ iid? Is it stationary? Is it wide-sense stationary?

Q5 A random process is iid with samples $X(n) \sim \mathcal{N}(\mu, 1)$. It is desired to remove the mean of this process by forming the new process

$$Y(n) = X(n) - X(n-1)$$

Is $Y(n)$ still iid with zero-mean?

Q6 Let $X(n)$ and $Y(n)$ be zero-mean jointly Gaussian and jointly wide-sense stationary processes. Define the process $Z(n)$ by

$$Z(n) = X(n)Y(n)$$

1. What do we mean by saying that $X(n)$ and $Y(n)$ are jointly Gaussian processes?
2. What do we mean by saying that $X(n)$ and $Y(n)$ are jointly wide-sense stationary?
3. Is $X(n)$ stationary? why?
4. Is the process $Z(n)$ Gaussian?
5. Find the mean of the process $Z(n)$. Find the autocorrelation of $Z(n)$. (Express your answer in terms of the 1st and 2nd order statistics of $X(n)$ and $Y(n)$. You might find relationship (7-61) in the textbook useful)
6. Is $Z(t)$ wide-sense stationary?

Q7 Let $X(n)$ be a WSS and zero mean Gaussian random process with $R_{xx}(\tau) \neq 0$. Define the process $Y(t) = X^2(t)$.

1. Is $X(t)$ identically distributed ? Why?
2. Is $Y(t)$ identically distributed ? Why?
3. Is $X(t)$ and independent Process? Why?

4. Is $Y(t)$ an independent Process? Why?
5. Find the pdf of $Y(t)$.
6. Find the joint pdf of $Y(t_1)$ and $Y(t_2)$ for $t_1 \neq t_2$.
7. Is $Y(t)$ WSS? Why?
8. Do you expect $Y(t)$ to be stationary? Why?