

Homework #8
Due Tu. 11/24

Note:

OW Oppenheim and Wilsky
SSS Schaum's Signals and Systems
SPR Schaum's Probability, Random Variables, and Random Processes

Be sure to show all your work for credit.

1. (SPR 4.87)

Let $Y = 2X + 3$. Find the pdf of Y if X is a uniform r.v. over $(-1, 2)$.

2. (SPR 4.92)

Let X denote the number of heads obtained when three independent tossings of a fair coin are made. Let $Y = X^2$. Find $E[Y]$ and $Var(Y)$.

3. (SPR 5.84)

Consider a random process $X(t)$ defined by

$$X(t) = Y \cos(\omega t + \Theta)$$

where Y and Θ are independent r.v.'s and are uniformly distributed over $(-A, A)$ and $(-\pi, \pi)$ respectively.

(a) Find the mean of $X(t)$.

(b) Find the autocorrelation function $R_X(t, s)$ of $X(t)$.

Hint: Be sure to look at Problem 5.20 to help on these problems.

4. (SPR 5.85)

Suppose that a random process $X(t)$ is wide-sense stationary with autocorrelation

$$R_X(t, t + \tau) = e^{-|\tau|/2}.$$

(a) Find the second moment of the r.v. $X(5)$.

(b) Find the second moment of the r.v. $X(5) - X(3)$.

5. (SPR 5.87)

Consider the random processes

$$X(t) = A_0 \cos(\omega_0 t + \Theta) \qquad Y(t) = A_1 \cos(\omega_1 t + \Phi)$$

where $A_0, A_1, \omega_0, \omega_1$ are constants and r.v.'s Θ and Φ are independent and uniformly distributed over $(-\pi, \pi)$.

(a) Find the cross-correlation function $R_{XY}(t, t + \tau)$ of $X(t)$ and $Y(t)$.

(b) Repeat (a) if $\Theta = \Phi$.