Homework #8
Due Su 11/23

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

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

   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 $\Theta = \Phi$.