Homework #8
Due Th. 11/29

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 $\Theta$ 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
   \[ X(t) = A_0 \cos(\omega_0 t + \Theta) \quad Y(t) = A_1 \cos(\omega_1 t + \Phi) \]
   where $A_0, A_1, \omega_0, \omega_1$ are constants and r.v.’s $\Theta$ and $\Phi$ 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 $\Theta = \Phi$. 