O K L A H O M A   S T A T E   U N I V E R S I T Y

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

ECEN 4503
Random Signals and Noise
Spring 2007

Midterm Exam #2

For all students, choose any four out of five problems.
Please specify which four listed below to be graded
:
1)_____; 2)_____; 3)_____; 4)_____;

Name : ______________________________

E-Mail Address:_______________________________________

Problem 1:
A random variable X is uniformly distributed on $(0, 6)$. If X is transformed to a new random variable $Y = 2(X - 3)^2 - 4$, find a) the probability density function of Y and b) $\bar{Y}$.

Problem 2:

Find a value of the constant b so that the function

$$f_{X,Y}(x,y) = bxy^2 \exp(-2xy)u(x-2)u(y-1)$$

is a valid joint density function.

Problem 3:

The random variables *X* and *Y* are statistically independent with exponential densities

$f_X(x) = \alpha e^{-\alpha x} u(x)$, and

$f_Y(y) = \beta e^{-\beta y} u(y)$.

Find the probability density function of the random variable $W = \max(X, Y)$.

Problem 4:

Two random variables *X* and *Y* are defined by $\overline{X} = 0$, $\overline{Y} = -1$, $\overline{X^2} = 2$, $\overline{Y^2} = 4$ and $R_{XY} = -2$.
Wo new random variables *U* and *V* are are

$$\begin{aligned} U &= 2X + Y \\ V &= -X - 3Y \end{aligned}.$$

Find $\overline{U}$, $\overline{V}$, R_{UV}, and σ_U^2.

Problem 5:

Zero-mean Gaussian random variables X_1, X_2, and X_3 having a covariance matrix

$$[C_X] = \begin{bmatrix} 4 & 2.05 & 1.05 \\ 2.05 & 4 & 2.05 \\ 1.05 & 2.05 & 4 \end{bmatrix}$$

are transformed to new random variables

$$Y_1 = 5X_1 + 2X_2 - X_3$$
$$Y_2 = -X_1 + 3X_2 + X_3 \, .$$
$$Y_3 = 2X_1 - X_2 + 2X_3$$

Find the covariance matrix of Y_1, Y_2, and Y_3.