

OKLAHOMA STATE UNIVERSITY
SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING



ECEN 4503
Random Signals and Noise
Spring 2002



Midterm Exam #2

Choose any four out of five problems,
Please specify

1) _____; 2) _____; 3) _____; 4) _____;

Name : _____

Student ID: _____

E-Mail Address: _____

Problem 1:

If the difference $W = X - Y$ is formed, develop the probability density function for the random variable W in terms of the statistically independent, probability densities of X and Y .

Problem 2:

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

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

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

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

Problem 3:

The random variables X and Y are of discrete type, statistically independent, with

$$F_X(x) = \sum_i P(X = i)u(x - i) = \sum_i a_i u(x - i), \text{ and}$$

$$F_Y(y) = \sum_i P(Y = i)u(y - i) = \sum_i b_i u(y - i).$$

Find an expression for the $F_Z(z)$ if $Z = X + Y$.

Problem 4:

Let $X_k, k = 1, 2, \dots, K$ be statistically independent Poisson random variables, each with its own mean b_k . Show that the sum $X = X_1 + X_2 + \dots + X_K$ is also a Poisson random variable with mean $b = b_1 + b_2 + \dots + b_K$.

Problem 5:

Gaussian random variables X_1 and X_2 , for which $\bar{X}_1 = 2$, $\sigma_{X_1}^2 = 9$, $\bar{X}_2 = -1$, $\sigma_{X_2}^2 = 4$, and $C_{X_1, X_2} = -3$, are transformed to new random variables Y_1 and Y_2 according to

$$Y_1 = -X_1 + X_2,$$

$$Y_2 = -2X_1 - 3X_2.$$

Find a) $\overline{X_1^2}$, b) ρ_{X_1, X_2} , and c) $\sigma_{Y_1}^2$.