Problem Set #5.0, Fall 2002
EECE–340, Probability and Statistics
Department of E.E.C.E
University of New Mexico
Assigned: 10/30, Due: 11/08

Instructions

Make use of Fourier transform table, DTFT tables, Z-transform tables as the need may arise. You may make use of MATLAB as you see fit. The intent of this problem set is to make you proficient in the use of these tables. They will also be posted on the course webpage.

Problem 1.0

A discrete positive valued random variable X has a probability mass function of the form:
$$p_x[k] = (1 - \alpha)\alpha^k, \quad k = 0, 1, 2, \ldots \infty.$$

With respect to this random variable:

1. Determine the PDF and CDF associated with the random variable X.

2. Determine the mean and variance of this random variable using just the mass function.

3. Determine the characteristic function $\Psi_x(e^{j\omega})$ associated with this random variable.

4. Determine the mean and variance of this random variable from the characteristic function $\Psi_x(e^{j\omega})$.

Problem 2.0

A discrete-time random variable X has a characteristic function $\Psi_x(e^{j\omega})$ of the form:
$$\Psi_x(e^{j\omega}) = \frac{(1 - \rho)^2}{1 - 2\rho \cos \omega + \rho^2}, \quad \omega \in [-\pi, \pi].$$

With respect to this random variable:

1. Determine the probability mass function $p_x[k]$ associated with this random variable and the corresponding PDF. Plot the mass function for $\rho = 0.5$.

2. Determine the mean and variance of this random variable X from the characteristic function.

3. Determine the mean and variance of this random variable from the mass function.

Problem 3.0

A random variable X is uniformly distributed in the interval $[0, 1]$. With respect to this random variable:

1. Determine the PDF and CDF associated with this random variable X.

2. Determine the mean and variance of this random variable from the PDF of the random variable.

3. Determine the characteristic function $\Psi_x(j\omega)$ associated with this random variable. . Plot the magnitude of the characteristic function.