

ECE 302 Homework 11
COMER

Topics: Random processes

1. A discrete-time random process X_n is defined by $X_n = s^n$ for $n \geq 0$, where s is randomly selected uniformly from the interval $(0, 1)$.
 - (a) Sketch some sample paths of the process.
 - (b) Find the cdf of X_n .
 - (c) Find the joint cdf of X_n and X_{n+1} .
 - (d) Find the mean and autocovariance functions of X_n .
2. A random process is defined by $Y(t) = g(t - T)$, where $g(t) = u(t) - u(t - 1)$ and T is a uniformly distributed random variable in the interval $(0, 1)$.
 - (a) Find the pmf of $Y(t)$.
 - (b) Find the mean function $m_Y(t)$ and autocovariance function $C_{YY}(t_1, t_2)$.
3. Let $X(t)$ be defined by $X(t) = A \cos \omega t + B \sin \omega t$, where A and B are iid random variables and ω is a constant frequency. Under what conditions is $X(t)$ wide-sense stationary?
4. A discrete-time random process X_n is defined as follows. A fair coin is tossed; if the outcome is heads then $X_n = 1$ for all n ; otherwise, $X_n = -1$ for all n . Is X_n a wide-sense stationary random process? Does the answer change if the coin is biased?
5. Consider a random process $D(t) = X(t) - X(t - d)$, where $X(t)$ is a WSS process and $d > 0$ is a real number. If $D(t)$ is passed through a LTI system with impulse response $h(t)$, find the mean and autocorrelation function of the output of the system in terms of $R_X(\tau)$ and $h(t)$.