1. Consider a random variable (RV) $Y\_{1}$ given by $Y\_{1}=\sqrt{X\_{1}^{2}+X\_{2}^{2}}$

where $X\_{1}$ and $X\_{2}$ are two independent Gaussian RVs. Both have zero mean and unit variance. In this problem you are required to find the pdf of $Y\_{1}$ using two methods:

1. Using the method described in section 5.4 under one function case (See example 5.4-2).
2. Using the Jacobian method presented in section 5.4 under multiple function case. Here you need to add an auxiliary RV denoted by $Y\_{2}$ with another transformation function. Then, find the joint pdf of $Y\_{1}$ and $Y\_{2}$ using the Jacobian method. The desired pdf is the marginal pdf $f\_{Y\_{1}}(y\_{1})$.
3. Two independent Gaussian RVs $X\_{1}$ and $X\_{2}$ with zero means and unit variances are linearly transformed to generate two correlated Gaussian RVs $Y\_{1}$ and $Y\_{2}$ with zero mean and variances $σ\_{Y\_{1}}^{2}$ and $σ\_{Y\_{2}}^{2} $and correlation coefficient equals$ ρ$. If the transformation matrix is $T=\left[\begin{matrix}α\_{11}&0\\α\_{21}&α\_{22}\end{matrix}\right] ,$ what are the values of $α\_{11}$, $α\_{11},$ and $α\_{22}$?
4. What is the correlation coefficient of bivariate Gaussian RVs $X\_{1}$ and $X\_{2}$ if you know that a linear transformation, *T*, generates two independent Gaussian RVs $Y\_{1}$ and$ Y\_{2}$, both with zero mean and unit variance, where $T=\left[\begin{matrix}\sqrt{2}&1\\1&1\end{matrix}\right]$.
5. Consider the experiment of throwing a die to define three random processes. Explain your answers.
6. Let  where *R* is exponentially distributed with *a*=0 and *b*=10.

a) Derive the expressions of both the cdf and the pdf of *X*(*t*).

b) What is the expression of the pdf when cos(*ωt*)=0?

1. $X[n]$={$X\_{1} X\_{2} ... X\_{n}$} is a discrete-time random process that consists of a sequence of independent and identically distributed (i.i.d.) RVs $X\_{i}$, where $X\_{i}$ is a RV representing the outcome of the process at time instant $n\_{i}$. The i.i.d. assumption means that all RVs $X\_{i}$ have the same distribution. The process $X[n] $formed by the sequence $X\_{1}, X\_{2}, ... X\_{k}$ is referred to as an i.i.d. random sequence. Is $X[n]$ a stationary random process? Show your work.
2. Consider the sum process S[n$]=\sum\_{i=1}^{n}X\_{i}$, where $\{X\_{1} X\_{2} ... X\_{n} \}$ is an i.i.d. random sequence. Is S[n$]$ a stationary random process?