# Tutorial - III

1. The R.V. X denotes the number of trials (Bernoulli) needed to obtain the first success. S.T. pmf $f(x) = (1-p)^{x-1} p$, $0<p<1$, $x=1,2,3,\ldots$ Also S.T. $F(x) = 1-q^{(x)}$. (Geometric distribution)

2. Find the mean of R.V. X, the number of trials needed to obtain a zero when generating a series of random digits. [10]

3. Find value of c, that makes $f(x) = ce^{x}$, $x=1,2,3,\cdots$ a pdf. Find moment generating fun for X, using which find $E[X]$ & $E[X^2]$.

4. Suppose that X is Hypergeometric with $N=20$, $r=3$ & $n=5$. What are the possible values for X? What is $E[X]$ & $\text{var} X$?

5. Define gamma random variable X with parameter $\alpha$ & $\beta$. Find $E[X]$ variance X if $m_x(t) = (1-\beta t)^{\alpha}$, $t < 1/\beta$ is moment generating fn for X.

6. Find density fn & cumulative fn for a random variable X distributed uniformly over (30,40).

7. The joint density for (X, Y) is given by $f_{xy}(x,y) = \frac{1}{n^2}$, $x=1,2,3,\ldots,n$, $y=1,2,3,\ldots,n$.
   (i) Verify $f_{xy}(x,y)$ satisfies the conditions necessary to be a density.
   (ii) Find marginal densities for X & Y.
   (iii) Are X & Y independent?
   (iv) Find $\text{Cov}(X,Y)$

8. Economic conditions cause fluctuations in the prices of raw commodities as well as in finished products. Let X denotes the price paid for a barrel of crude oil by the initial carrier, & let Y denotes the price paid by the refinery purchasing the product from the carrier. Assume that the joint density for (X, Y) is given by $f_{xy}(x,y) = C$, $20 < x < y < 40$. Answer the following:

(i) Find the value of c that makes this a joint density for a two-dimensional random variable.

(ii) Find the value of probability that the carrier will pay at least $25 per barrel and the refinery will pay atmost $30 per barrel for the oil.

(iii) Find the probability that the price paid by the refinery exceeds that of the carrier by atleast $10 per barrel.

(iv) Find the marginal densities for X & Y.

(v) Find the probability that the price paid by the carrier is at least $25.

(vi) Find the probability that the price paid by the refinery is atmost $30.

(vii) Are X & Y independent? Explain.

(viii) From a physical standpoint, should cov(X,Y) be +ve or -ve?

(ix) Find E[X], E[Y], E[XY] & cov(X,Y)

(x) Find E[Y-X].