M.Sc. I year, Sem II, CC-08, Distribution Theory
Question Bank (Model Questions)

Objective Questions

(1) Out of Geometric, Gamma and Exponential distribution which donot have reproduction property?

(a) Geometric only **(b)** Geometric and Exponential **(c)** Gamma and Exponential **(d)** Exponential only

(2) If $F(x, y)$ is the joint distribution function of X and Y then which one of the following is not correct?

(a) $F(\infty, y) = F(y)$ **(b)** $F(\infty, -\infty) = 0$ **(c)** $F(\infty, \infty) = 0$ **(d)** $F(\infty, \infty) = P(X \leq x)$

(3) For large m and n, the mean of the number of runs under H_0 is

(a) $\frac{mn}{m+n}$ **(b)** $\frac{mn}{m+n} - 1$ **(c)** $\frac{m+n}{mn} + 1$ **(d)** $\frac{m+n+2mn}{m+n}$

(4) The ration of two independent standard normal variates is

(a) Normal **(b)** Gamma **(c)** Beta of Second Kind **(d)** Cauchy

(5) If $X \sim Gamma(a, n)$ then the distribution of $2\,X$ is

(a) $Gamma(2\,a, n)$ **(b)** $Gamma(a/2, n)$ **(c)** $\chi^2_{2\,n}$ **(d)** χ^2_n

(6) If X and Y two independent random variable having their densities $f(x) = \frac{1}{6}\,x^3\,e^{-x}, \quad 0 < x < \infty$ and $f(y) = \frac{1}{\sqrt{\pi\,y}}\,e^{-y}, \quad y > 0$. The distribution of $X + Y$ is

(a) $Gamma(7/2)$ **(b)** $Gamma(9/2)$ **(c)** χ^2_4 **(d)** None of these

(7) If X and Y are two Poisson variates such $X \sim P(1)$ and $Y \sim P(2)$, the probability $P(X + Y < 3)$ is
(a) e^{-3} **(b)** $3\,e^{-3}$ **(c)** $4\,e^{-3}$ **(d)** $8.5\,e^{-3}$

(8) The distribution in which the probability at each successive draw varies is
(a) Hypergeometric distribution **(b)** Geometric distribution **(c)** Binomial distribution **(d)** Discrete uniform distribution

(9) The joint pdf of X and Y is $f(x,\,y) = A\,x^3\,y^3, \quad 0 \leq x,\,y \leq 2$. The value of A is

(a) $\frac{1}{4}$ **(b)** $\frac{1}{8}$ **(c)** $\frac{1}{16}$ **(d)** $\frac{1}{32}$

(10) The inequality $f(E(X)) \leq E(f(X))$ where f is convex is known as ....inequality
(a) Jonsen **(b)** Markov **(c)** holder **(d)** Liepnouff

(11) $t' = \dfrac{X}{\sqrt{Y/n}}$ is non-central t statistic if for independent X and Y

(a) $X \sim N(\mu,\, 1)$ and $Y \sim$ central χ^2 with n df **(b)** $X \sim N(\mu,\, \sigma^2)$ and $Y \sim$ central χ^2 with n df **(c)** $X \sim N(\mu,\, 1)$ and $Y \sim$ non central χ^2 with n df **(d)** $X \sim N(0,\, 1)$ and $Y \sim$ non central χ^2 with n df

(12) The mean of $X_{(r)}$ for sample of size n from $U(0,\, 1)$ is

(a) $\dfrac{1}{n}$ **(b)** $\dfrac{1}{n+1}$ **(c)** $\dfrac{r}{n}$ **(d)** $\dfrac{r}{n+1}$

Short Questions

(1) If $X \sim N(0, 1)$. Find the distribution of $Y = X^2$.

(2) If $(X_1, X_2, ..., X_n) \sim U(0, \theta)$. Find the distribution of $X_{(r)}$.

(3) Show that if X and Y are two independent Random variable the $V(a\,X + b\,Y) = a^2 V(X) + b^2 V(Y)$.

(4) Describe the method of transformation for obtaining the distribution of a function of random variable.

(5) If X_1 and X_2 are independent $N(0, 1)$ variates then show that $X_1 + X_2$ and $X_2 - X_1$ are independently distributed.

(6) A random variable X has the following probability distribution.

$X = x$	0	1	2	3	4	5	6	7
$P(X = x)$	0	k	2 k	2 k	3 k	k^2	$2\,k^2$	$7\,k^2 + k$

(i) Find k. **(ii)** Evaluate $P(X < 6), P(X \geq 6), P(0 < X < 5)$

(7) Determine the value of the constant k such that $f(x)$ as defined below is a pdf and also find Mean and Variance of X. f(x) = k x (1-x); $0 < x < 1$

(8) For the joint probability density $f(x,\, y) = 4\,x\,y\,e^{-(x^2+y^2)}$ for $x \geq 0,\; y \geq 0$. Show that X and Y are independent.

(9) Show that negative Binomial distribution is a compound distribution of Poisson and Gamma distribution.

(10) Find the mean and variance of a zero-truncated bionomial distribution.

Long Questions

(1) If X_1 and X_2 are independent $N(0,1)$ variates, show that $X_1 + X_2$ and $X_2 - X_1$ are independently distributed and also identify their distribution.

(2) If X_1 and X_2 are independent Gamma variates, then show that (X_1+X_2) and $\frac{X_1}{(X_1+X_2)}$ are independently distributed.

(3) Define order statistics and find the joint distribution of r^{th} and s^{th} order statistics. Hence find the distribution of range.

(4) Define non-central Chi-square distribution and obtain its distribution. Also find its mean and variance.

(5) Define non-central F statistic and obtain its distribution. Also find its mean and variance.

(6) Obtain the asymptotic distribution of sample median from a random sample from $U(0,\ 1)$ population.