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63/1 (SEM-2) GE2/STSHG2026/STSRC2026

2025

STATISTICS

Paper : STSHG2026/STSRC2026

**(Descriptive Statistics and
Probability Theory)**

Full Marks : 60

Pass Marks : 24

Time : Three hours

**The figures in the margin indicate
full marks for the questions.**

1. Select the correct alternative from the given choices : **(any five)** 1×5=5
- (a) Two random variables X and Y are said to be independent if:
- (i) $E(XY) = 1$
 - (ii) $E(XY) = 0$
 - (iii) $E(XY) = E(X)E(Y)$
 - (iv) $E(XY) = \text{any constant value.}$

(b) If X and Y two independent variables and their expected values are \bar{X} and \bar{Y} respectively then

(i) $E\{(X - \bar{X})(Y - \bar{Y})\} = 0$

(ii) $E\{(X - \bar{X})(Y - \bar{Y})\} = 1$

(iii) $E\{(X - \bar{X})(Y - \bar{Y})\} = C$ (Constant)

(iv) All of the above

(c) If X is random variable with mean μ , then $E(X - \mu)^r$ is called

(i) Variance

(ii) r^{th} raw moment

(iii) r^{th} central moment ✓

(iv) None of the above

(d) The mean and variance and the value of n of a binomial distribution are 8, 4 and 16 respectively. Then, $P(X = 1)$ is equal to :

(i) ✓ $\frac{1}{2^{12}}$

(ii) $\frac{1}{2^4}$

(iii) $\frac{1}{2^6}$

(iv) $\frac{1}{2^8}$

(e) The moment generating function of bernouli distribution is :

(i) $(q + pe^t)^n$

(ii) $(q + pe^t)^{-n}$

(iii) $(q + pe^t)$ ✓

(iv) $(q + pe^{-t})$

(f) If X and Y are independent, the cumulative distribution $F_{x,y}(x,y)$ is equal to :

(i) $F_x(x).F_x(y)$

(ii) $P(X \leq x)P(Y \leq y)$

(iii) both (i) and (ii) ✓

(iv) $F_x(x) \geq F_y(y)$

(g) If the moment generating function $M_{x,y}(t_1, t_2)$ is $e^{\frac{1}{2}(t_1^2 + t_2^2)}$, then the variable X follows

(i) Standard normal bivariate distribution ✓

(ii) X^2 -distribution with 1 d.f

(iii) Cauchy distribution

(iv) Exponential distribution

(h) If (X, Y) is a bivariate discrete random variable the number of values with (XY) can taken in the $X - Y$ plane is

(i) infinite

(ii) finite

(iii) any number of values

(iv) specific values defined in (x, y) plan ✓

(i) Probability mass function for a binomial distribution with usual notations is :

(i)
$$\binom{n}{x} p^x q^{n-x}$$

$$(ii) \binom{n}{x} p^n q^x$$

$$(iii) \binom{n}{x} p^{n-x} q^x$$

$$(iv) {}^n c_x p^x q^{n-x}$$

(j) An approximate relation between M.D. about mean and S.D. of a normal distribution is :

$$(i) 5M.D. = 4S.D.$$

$$(ii) 4M.D. = 5S.D.$$

$$(iii) 3M.D. = 3S.D.$$

$$(iv) 3M.D. = 2S.D.$$

2. Answer **any five** from the following : 2×5=10

(a) Discuss different types of random variables with example.

(b) Define moment generating function.

(c) Mention **any one** property of cumulants generating function.

- (d) What are the advantages of characteristic function?
- (e) State weak law of large number (WLLN).
- (f) Mention *two* properties of Poisson distribution.
- (g) State gamma distribution.

3. Answer the following questions : **(any five)**
5×5=25

- (a) Define beta distribution of first kind and second kind.
- (b) Write *any five* properties of normal distribution.
- (c) Explain probability density function with an example.
- (d) A person is to continue shooting at the target until he hits the target 6 times. The probability that he hits the target on any shooting is 0.4. Calculate the probability that the number will have to shoot 9 times.
- (e) Mention all properties of distribution function.
- (f) Write a short note on transformation of one dimensional random variable.

- (g) Ten coins are thrown simultaneously. Find the probability of getting at least seven heads.
- (h) Define geometric distribution.
- (i) Find moment generating function (m.g.f) of binomial distribution.

4. Answer the following questions : *(any two)*
 $10 \times 2 = 20$

- (a) Define poisson distribution. Find the mean and variance of this distribution.
- (b) Find mean and variance of gamma distribution.
- (c) Let the r. v. X assume the value ' r ' with probability law $P(X = r) = q^{r-1} p$; $i = 1, 2, 3, \dots$. Find the m, g, f , of X and hence its mean and variance.
- (d) Derive binomial distribution from Bernoulli trials.