BACHELOR OF SCIENCE (CBCS-2018 COURSE)
F. Y. B. Sc. Sem-II : WINTER- 2022
SUBJECT : STATISTICS : DISCRETE PROBABILITY & PROBABILITY DISTRIBUTIONS-II

Day : Wednesday — Time : 02:00 PM-05:00 PM

Date : 21-12-2022 — **W-18338-2022** — Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable calculator is allowed.

Q.1 Attempt **ANY TWO** of the following: **(12)**

a) Suppose x and y are two discrete r.v.s. then
$\text{var}(ax+by) = a^2\,\text{var}(x) + b^2\,\text{var}(y) + 2ab\,\text{cov}(x,y)$

b) State and prove lack of memory property of geometric distribution.

c) Suppose x_1, x_2, x_3 are three discrete r.v.s. with means 10, 20 and 40 and s.d.s 2, 4 and 6 respectively. Further $\rho(x_1,x_2) = \frac{1}{4} = \rho(x_1,x_3)$ and $\rho(x_2,x_3) = \frac{1}{2}$.

Find **i)** $E(4x_1 + 2x_2 - 3\times 3)$ **ii)** $\text{var}(3x_1 - 2x_2 + x_3)$
iii) $\text{var}(x_3 - x_2 - x_1)$ **iv)** $\text{cov}(2x_1 + 3, 4 - 3x_2)$
v) $\rho(3x_2 - 3,\ x_3 + 1)$ **vi)** $\rho(4 + x_2,\ 5 - 2x_3)$

Q.2 Attempt **ANY TWO** of the following: **(12)**

a) Derive M.G.F. of Poisson distribution and coefficient of Skewness and Kurtosis.

b) Define (r,s)[th] row moments (μ'_{rs}) of a discrete bivariate distribution of *(x,y)*.
Hence show $\mu'_{10} = E(x)$ $\mu'_{01} = E(y)$, $\mu'_{11} = E(xy)$

c) Obtain mean and variance of geometric distribution.

Q.3 Attempt **ANY TWO** of the following: **(12)**

a) Let *(x,y)* be a discrete bivariate r.v. with the following p.m.f.

x \ y	**0**	**1**	**2**	**3**
0	k	3k	2k	4k
1	2k	6k	4k	8k
2	3k	9k	6k	12k

i) Find k **ii)** Are x and y independent? **iii)** $P(x + y \leq 1)$
iv) $P(x^2 + y^2 \leq 4)$

P.T.O.

b) For the following joint probability distribution of (x,y) compute $\rho(x,y)$ the correlation coefficient between x & y.

x \ y	0	1	2
0	1/4	0	1/4
1	1/8	1/8	1/4

c) If $x \rightarrow$ Poisson (m) such that $P(x=0)=\frac{1}{2}$, find $E(x)$ and $var(x)$.

Q.4 Attempt **ANY THREE** of the following: **(12)**

a) Find the recurrence relation between the probabilities of Poisson distribution. State its use.

b) Following are the marginal p.m.f. of x and y.

x	1	2	3
$P(x)$	0.3	0.3	0.4

y	1	2	3
$P(y)$	0.1	0.6	0.3

Assuming x and y to be independent. Obtain the joint probability distribution of x and y.

c) Prove that

i) $\text{cov}(ax, by) = ab \quad \text{cov}(x, y)$

ii) $\text{cov}(x+c,\ y+d) = \text{cov}(x, y)$

iii) $\text{cov}(x, x) = \text{var}(x)$

d) Let $x \rightarrow$ poisson (m) such that $P(x=2)=\frac{3}{4}P(x=1)$. Find $P(x=0)$ and the most probable value of x.

Q.5 Attempt **ANY THREE** of the following: **(12)**

a) Show that all the cumulants of poisson distribution are equal to the parameter m.

b) State four real life situations in which geometric distribution can be applied.

c) Define conditional probability distribution of x given $y = yj$.

d) Suppose x and y are two discrete r.v.s with joint probability distribution $\{(xi, yj, pij);\ I = 1 \ldots m; j = 1 \ldots n\}$.

e) Two beads are selected at random without replacement from a bowl containing 4 blue, 1 red and 2 black beads. Let x denote the number of red beads drawn. Y denote the number of black beads drawn:

i) Find the joint p.m.f. of (x,y)

ii) Obtain the marginal p.m.fs of x and y.

iii) Calculate $P(x < y)$

f) Show that all the cumulants of poisson distribution are equal to the parameter m.

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