# F.Y.B.SC. SEM – II (CBCS - 2016 COURSE) : WINTER - 2017

## SUBJECT : STATISTICS : DISCRETE PROBABILITY & PROBABILITY DISTRIBUTIONS – II

Day : **Friday**
Date : **03/11/2017**

**W-2017-0563**

Time : **03.00 PM TO 06.00 PM**
Max. Marks : 60

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**N.B.:**

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of statistical tables and **CALCULATOR** is allowed.

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**Q.1 A)** Choose the correct alternative for: **[06]**

**i)** If X ~ Poisson (m) then,
**a)** Mean = Variance **b)** Mean > Variance
**c)** Mean < Variance **d)** Mean = 2 Variance

**ii)** The second central moment of Poisson distribution with mean 4 is ______.
**a)** 4 **b)** 12 **c)** 16 **d)** 64

**iii)** If x = number of candidates required to interview for the post of an officer then x follows:
**a)** Binomial distribution **b)** Poisson distribution
**c)** Bernoulli distribution **d)** Geometric distribution

**iv)** If Cov (X, Y) = – 10, then Cov (3X + 2, 10 – 5 Y) is _______.
**a)** –10 **b)** 10 **c)** 20 **d)** 150

**v)** If (X, Y) is a discrete bivariate r.v. with joint p.m.f.

$$p(x,y)=\frac{k}{x+y};\quad x=0,1;\quad y=1,2$$

The value of k is _________.

**a)** $\frac{3}{7}$ **b)** $\frac{7}{3}$ **c)** 1 **d)** $\frac{2}{7}$

**vi)** If X ~ Geometric (0.25) taking values 1, 2, …….., then mean is ________.
**a)** 0.5 **b)** 0.25 **c)** 4 **d)** $\frac{1}{4}$

**B)** State whether the following statements are true or false: **[06]**

**i)** Var (X – Y) = Var (X) – Var (Y) – 2 Cov (X, Y).

**ii)** Marginal probability distribution of X is a univariate probability distribution.

**iii)** If X and Y are independent Poisson r.v.s then X – Y is also Poisson random variable.

**iv)** Poisson distribution is symmetric.

**v)** Geometric distribution is symmetric.

**vi)** The joint distribution function of bivariate discrete r.v.s lies between 0 and 1.

**Q.2** Attempt **ANY THREE** of the following: **[12]**

**a)** State and prove additive property of Poisson distribution.

**b)** Let X and Y have joint probability distribution given by.

| (X, Y) | (1, 1) | (1, 2) | (1, 3) | (2, 1) | (2, 2) | (2, 3) |
|---|---|---|---|---|---|---|
| p(x, y) | $\frac{2}{15}$ | $\frac{4}{15}$ | $\frac{3}{15}$ | $\frac{1}{15}$ | $\frac{1}{15}$ | $\frac{4}{15}$ |

Find marginal probability distribution of X and Y.

**P.T.O.**

c) For (X, Y) a bivariate discrete r.v., $\sigma_x^2 = 9,\ \sigma_y^2 = 4,\ Cov\,(X,Y) = 4$.
Find: **i)** Var (2X – 3Y) **ii)** ρ(X, Y).

**d)** State and prove lack of memory property of a geometric distribution.

**Q.3** Attempt **ANY FOUR** of the following:

**a)** If X follows Poisson (m) such that P(X = 1) = P (X = 2), find the probability mass function of X.

**b)** If the probability that a certain test yields positive reaction is equal to 0.4. What is probability that less than 3 negative reaction occur before the first positive one?

**c)** State the properties of joint distribution function of a two dimensional discrete r.v.s.

**d)** Let X and Y be two discrete r.v.s with $\sigma_x^2 = 9,\ \sigma_y^2 = 16,\ Var\,(2X - Y) = 51$.
Find Cov (X, Y).

**e)** Prove that Cov (X, X + Y) = Var (X) + Cov (X, Y).

**Q.4** Attempt **ANY TWO** of the following:

**a)** State the probability mass function (p.m.f.) of Poisson distribution with parameter m. Give four real life examples where Poisson distribution is expected.

**b)** The joint p.m.f. of (X, Y) is given below:

| X \ Y | –1 | 0 | 1 | 2 |
|---|---|---|---|---|
| –2 | 1/9 | 1/27 | 1/27 | 1/9 |
| 1 | 2/9 | 0 | 1/9 | 1/9 |
| 3 | 0 | 0 | 1/9 | 4/27 |

Compute : **i)** P(X > 0) **ii)** P(X < 0, Y > 0) **iii)** P(X is odd).

**c)** Obtain conditional mean and variance of X given Y = –3 for the following joint probability distribution.

| X \ Y | 1 | 2 | –3 |
|---|---|---|---|
| 0 | 0.1 | 0.2 | 0.3 |
| 1 | 0.1 | 0.1 | 0.2 |

**Q.5** Attempt **ANY TWO** of the following:

**a)** Let X be a discrete random variable with p.m.f.
$P(x) = pq^x \quad x = 0, 1, 2, \ldots\ldots,\ 0 < p < 1,\ q = 1 - p$
$= 0 \quad$ otherwise
Find E(X) and Var (X).

**b)** Suppose $X_1$, $X_2$, $X_3$ are three independent discrete r.v.s. with means 10, 20, and 40 and s.d.s 2, 4 and 6 respectively.
Find : **i)** $E(4X_1 + 3X_2 + X_3)$ **ii)** $Var(3X_1 + 2X_2 - 4X_3)$.

**c)** Let X and Y be two discrete r.v.s having joint probability distribution:

| X \ Y | –2 | 0 | 2 |
|---|---|---|---|
| –1 | 0.1 | 0.2 | 0.1 |
| 0 | 0.2 | 0.1 | 0.1 |
| 1 | 0.1 | 0.1 | 0 |

Find: **i)** P(X + Y ≤ 1) **ii)** P(X = 0 | Y = 0) **iii)** F(0, 2).

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