# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **STATISTICS**

SECOND SEMESTER – **APRIL 2016**

**ST 2504 – DISCRETE DISTRIBUTIONS**

Date: 23-04-2016 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

**PART-A**

Answer **ALL** the questions: (10 x 2 = 20 marks)

1. When do we say that the two random variables X and Y are stochastically independent?
2. State any two properties of Joint distribution function.
3. Write down the conditions which satisfy the Bernoulli trials.
4. In a binomial distribution consisting of 5 independent trials, probabilities of 1 and 2 successes are 0.4096 and 0.2048 are respectively. Find the parameter 'p' of the distribution.
5. State the conditions in which the Poisson distribution is a limiting case of binomial distribution.
6. Write any 4 evidences for which Poisson distribution can be employed.
7. Define geometric distribution.
8. What is the value of 'r' when Negative binomial distribution converted in to a geometric distribution?
9. On what conditions the hyper geometric distribution tends to binomial distribution
10. Define Multinomial distribution.

**PART - B**

Answer any **FIVE** questions: (5 x 8 = 40 marks)

11. For the joint probability distribution of two random variables X and Y, find (i) $P(X\leq 1, Y=2)$ (ii) $P(X\leq 1)$ (iii) $P(Y \leq 3)$ and (iv) $P(X< 3, Y\leq 4)$

| Y / X | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1/32 | 2/32 | 2/32 | 3/32 |
| 1 | 1/16 | 1/16 | 1/8 | 1/8 | 1/8 | 1/8 |
| 2 | 1/32 | 1/32 | 1/64 | 1/64 | 0 | 2/64 |

12. A Multiple Choice test consists of 8 questions with 3 answers to each question ( of which only one is correct). A student answers each question by rolling a balanced die and checking the first answer if he gets 1 or 2, the second answer if he gets 3 or 4 and the third answer if he gets 5 or 6. To get a distinction, the student must secure atleast 75% correct answers. If there is no negative marking, what is the probability that the student secures a distinction?
13. Derive the MGF of binomial distribution. Hence find Mean and Variance.
14. Show that in Poisson distribution with unit mean, mean deviation about mean is (2/e) times the standard deviation.

15. Prove that the sum of independent Poisson variates is also a Poisson variate.

16. Fit a Poisson distribution to the following data:

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Freq. | 56 | 156 | 132 | 92 | 37 | 22 | 4 | 0 | 1 |

17. State and Prove the lack of Memory property of Geometric distribution.

18. Derive the MGF of Mulitnomial distribution.

## PART - C

Answer any **TWO** questions: (2 x 20 = 40 marks)

19. The joint probability distribution of X and Y is given below :

| X / Y | -1 | +1 |
|---|---|---|
| 0 | 1/8 | 3/8 |
| 1 | 2/8 | 2/8 |

Find the (i) E(X) and E (Y) (ii) E(XY) (iii) Covariance of X,Y (iv) the correlation between X and Y.

20. Obtain the recurrence relation of binomial distribution. Hence find Mean and variance.

21. (a) Prove that the Poisson distribution as a limiting case of a binomial distribution.

(b) Suppose that the number of telephone calls coming into a telephone exchange between 10 am and 11 am, say, $X_1$ is a random variable with Poisson distribution with parameter 2. Similarly the number of calls arriving between 11 am and 12 noon, say, $X_2$ has a Poisson distribution with parameter 6. If $X_1$ and $X_2$ are independent, what is the probability that more than 5 calls come in between 10 am and 12 noon ?

22. (a) Derive the mean and variance of Hyper geometric distribution.

(b) The trinomial distribution of two random variables X and Y is given by

$$f(x,y) = \frac{n!}{x!\,y!\,(n-x-y)} \times p^x q^y (1-p-q)^{n-x-y}$$

for x, y = 0,1,2,……..n and x+y <n, where $0 \leq p \leq 1$ and $0 \leq q \leq 1$.

(i) Find the marginal distribution of X and Y.

(ii) Find the conditional distribution of X and Y and obtain (a) E(YX=x) and (b) E(XY=y).

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