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Reg. No. : ..............................

Name : ..................................



# Third Semester B.Sc. Degree Examination, March 2022

## First Degree Programme under CBCSS

## Statistics

## Complementary Course for Mathematics

## ST 1331.1 – STATISTICAL DISTRIBUTIONS

## (2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Define binomial distribution.

2. Obtain the mean of Poisson distribution.

3. Give a discrete distribution whose mean greater than variance.

4. Give a discrete distribution which posses lack of memory property.

5. Describe continuous uniform distribution.

6. Give the probability density function of exponential distribution with mean $\theta$.

7. Define t-statistic.

8. Write down the probability density function of standard normal distribution.

P.T.O.

9. Define parameter.

10. Write down the moment generating function of binomial distribution.

(10 × 1 = 10 Marks)

## SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Find the moment generating function of Poisson distribution.

12. Find the characteristics function of geometric distribution.

13. Find the mean and variance of Bernoulli distribution.

14. If X follows Poisson distribution such that $P(X=2)=3\ P(X=4)$. Find the value of the parameter.

15. Find the mean deviation about mean of uniform $(a, b)$ distribution.

16. A binomial distribution has a double mode at $X=1$ and at $X=2$. Find the mean of $X$ (Given number of trials is 5.)

17. Let $X \sim u(0,1)$. Find the distribution of $Y=-2\log X$.

18. Describe Chebychev's inequality.

19. State Lindberg-Levy central limit theorem.

20. Describe chi-square distribution and mention one of its applications.

21. Obtain the characteristics function of exponential distribution and hence find its mean and variance.

22. Obtain the mean and variance of geometric distribution.

(8 × 2 = 16 Marks)

## SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. Show that Poisson distribution is a limiting form of binomial distribution.

24. Obtain the third central moment of binomial distribution.

25. Describe lack of memory property of exponential distribution.

26. Obtain the mode of normal distribution.

27. If $X$ is the number secured in a throw of a fair die, show that Chebychev's inequality gives

    $P\{|X-\mu|>2.5\}\leq 0.47$, ($\mu$ is the mean of $X$), while the actual probability is zero.

28. Let $X_i$ assume that values $i$ and $-i$ with equal probabilities. Show that the law of large numbers cannot be applied to the independent variable $X_1, X_2, \ldots$.

29. Discuss the additive property of chi-square distribution.

30. Establish the relation between F and chi-square distributions.

31. If $X$ and $Y$ are independent gamma variates with parameters $\lambda$ and $\mu$ respectively, obtain the distribution of $\dfrac{X}{Y}$.

**(6 × 4 = 24 Marks)**

## SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. (a) Obtain the recurrence relation of probabilities of binomial distribution.

    (b) Fit a binomial distribution for the following data :

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| x : | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| p(x) : | 7 | 6 | 19 | 35 | 40 | 23 | 7 | 1 |

33. (a) Explain under what conditions and how the binomial distribution can be approximated to normal distribution.

(b) For a normal distribution with mean $\mu$ and variance $\sigma^2$. Show that the mean deviation about mean is $\sigma.\sqrt{2/\pi}$.

What will be the mean deviation about median?

34. (a) If $F(n_1, n_2)$ represents an $F$ variate with $n_1$ of $n_2$ degrees of freedom. Prove that $F(n_2, n_1)$ is distributed as $\frac{1}{F(n_1, n_2)}$. Deduce that $P\{F(n_1, n_2) \geq c\} = P\left\{f(n_2, n_1) \leq \frac{1}{c}\right\}$.

(b) If $\chi_1^2$ and $\chi_2^2$ are two independent $\chi^2$ variates with $n_1$ and $n_2$ degrees of freedom respectively, P.T $\chi_1^2 / \chi_2^2$ follows beta distribution of second kind with $\left(\frac{n_1}{2}, \frac{n_2}{2}\right)$.

35. (a) State and prove weak law of large numbers.

(b) Two unbiased dice are thrown. If X denote the sum of numbers showing up, prove that $P\{|X - 7| \geq 3\} < \frac{35}{34}$. Also compare this with actual probability.

**(2 × 15 = 30 Marks)**

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