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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, October 2019

First Degree Programme Under CBCSS

Complementary Course for Mathematics

ST 1331.1 – PROBABILITY DISTRIBUTIONS AND THEORY OF ESTIMATION

(2014-17 Admissions)

Time : 3 Hours Max. Marks : 80

Use of Statistical Table and Calculator is Permitted

SECTION – A

Answer **all** questions Each question carrie **1** marks

1. Write the moment generating function of Binomial distribution.
2. Give an example of statistical distribution whose mean and standard deviation are same.
3. State the additive property of Poisson distribution.
4. Define convergence in probability.
5. What is meant by standard error?
6. Write the variance of Chi square distribution with 10 degrees of freedom.
7. If a random variable X-$F_{(m,n)}$ identify the distribution of 1/X.
8. Write Cramer—Rao inequality.
9. What is meant by point estimation?
10. Write an example of a statistic which is not unbiased but consistent. **(10 × 1 = 10)**

P.T.O.

SECTION – B

Answer any **8** questions. Each question carries **2** Marks.

11. If X is a random variable with continuous distribution function F. Then show that F ~ Uniform [0,1]

12. Let X be a Poisson random variable with mean 1. Compute P $(X \geq 2)$

13. Derive the mean of Beta I distribution.

14. Define hypergeometric random variable.

15. State weak law of large numbers.

16. State Lindberg — Levy central limit theorem.

17. Distinguish between parameter and statistic.

18. Define t statistic. Write an example for t statistic.

19. Explain the principle of least squares.

20. What is meant by minimum variance unbiased estimator?

21. Define sufficiency of an estimator. Write an example for sufficient statistic.

22. Let $x_1, x_2, \cdots x_n$ be a random sample from population with mean μ. Show that the sample mean is an unbiased estimator of μ. **(8 × 2 = 16)**

SECTION – C

Answer any **6** questions. Each question carries **4** Marks.

23. Let X and Y be independent Poisson random variables with respective means μ_1 and μ_2. If P(X=1) = P(X=2) and P(Y = 2) = P(Y=3) find the variance of X + 2Y.

24. Let X and Y be independent and identically distributed geometric random variables.

    Show that the conditional distribution of X given X+Y is uniform.

25. Prove that the odd order moments about mean of Normal distribution are zero.

26. Derive that lack of memory property of exponential distribution.

27. Let X_n assumes the values $\frac{1}{\sqrt{n}}$ and $-\frac{1}{\sqrt{n}}$ with respective probabilities $\frac{2}{3}$ and $\frac{1}{3}$, Check whether the weak law of large numbers holds good for the sequence $\{X_n\}$ of independent random variables.

28. Derive the sampling distribution of the sample mean of a random sample drawn from Normal distribution.

29. Establish the relationship between Chi square, t and F distributions.

30. Let X be random variable with probability density function $f(x) = (1+\theta)x^0, \theta > 0, 0 < x < 1$, Derive the maximum likelihood estimator of θ.

31. Explain the method of moments. Write its properties. **(6 × 4 = 24)**

SECTION – D

Answer any **2** questions. Each question carries **15** Marks.

32. (a) Derive the mode of Binomial distribution.

(b) Fit a Poisson distribution for the following data and calculate the expected frequencies

Values	0	1	2	3	4	5
Frequency	95	75	44	18	2	1

33. Define normal distribution state its properties. Find the MGF of normal distribution.

34. (a) Derive Chebyshev's inequality.

(b) Let X be a random variable with probability density function $f(x)=\begin{cases}\frac{1}{2\sqrt{3}}, & -\sqrt{3}<x\sqrt{3}\\ 0, & otherwise\end{cases}$. Determine the upper bound of P $\left(|X|\geq\frac{3}{2}\right)$ using Chebyshev's inequality.

35. (a) Explain the method of interval estimation.

(b) Consider a random sample from exponential distribution with mean θ. Show that sample mean is an unbiased estimator of θ also prove that the variance of the estimator coincides with Cramer — Rao lower bound. **(2 × 15 = 30)**