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D 31839 **(Pages : 2)** **Name..................................**

Reg. No...............................

THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION NOVEMBER 2022

Statistics

STA 3C 03—PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Use of calculator and Statistical table are permitted.

Part A (Short Answer Type Questions)

Each question carries 2 marks.
Maximum marks that can be scored from this part is 20.

1. If X is a random variable following discrete uniform distribution over the numbers -1,0 and 1; find the variance of X.
2. For two independent Poisson random variables, $P(X = 0) = e^{-3}$, $P(Y = 0) = e^{-2}$. Find $P(X + Y = 2)$.
3. Write the p.d.f. of an exponential random variable with mean 0.2.
4. Obtain $P(|X - 5| < 3)$, where X follows $N(5, 3^2)$.
5. Point out one of the strengths and weaknesses of Chebyshev's inequality.
6. Define convergence in distribution.
7. State Weak Law of Large Numbers.
8. Define census and sampling.
9. A box contains 4 black balls and 6 white balls. 2 balls are taken at random one by one. What is the probability that all the balls taken are white : (i) If balls are taken without replacement ; (ii) With replacement.
10. Find the probability that the variance of a sample of size 12 taken from a normal population with mean 10 and variance 9 is greater than 10.28.
11. If X and Y are independent standard normal random variables, identify the probability distributions of (i) X^2 ; and (ii) $[X^2 + Y^2]$.
12. Define *t*-distribution.

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Part B (Short Essay/Paragraph Type Questions)

Each question carries 5 *marks.*
Maximum marks that can be scored from this part is 30.

13. Obtain the mode of X following B (n, p)

14. Show that the sum of independent exponential random variables with common parameter λ-follows gamma distribution.

15. State Chebyshev's inequality. Let X be a random variable following rectangular distribution over [5, 15]. Use Chebyshev's inequality to find an upper bound for $P(|X - 10| > 4.33)$.

16. State and prove Bernoulli's Law of Large numbers.

17. Using central limit theorem, obtain the probability distribution of the mean of a large sample of size n taken from rectangular distribution over [0, 5].

18. Explain systematic random sampling.

19. If F follow F (n_1, n_2), show that 1/F follow F(n_2, n_1)

Part C (Essay type Questions)

Answer any **one** *question.*
Each question carries 10 *marks.*
Maximum marks that can be scored from this part is 10.

20. (i) Define normal distribution. State any *four* of the properties of normal distribution.

    (ii) If the random variable X following N $\{\mu, \sigma^2)$, obtain the quartile deviation of X.

21. (i) Derive the (a) m.g.f. ; (b) mean ; and (c) variance of a random variable X following chi square distribution with n degrees of freedom.

    (ii) State and prove the additive property of chi-square distribution.

(1 × 10 = 10 marks)