K22U 2819

Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree (CBCSS – Supplementary) Examination, November 2022
(2016 – 18 Admissions)
COMPLEMENTARY COURSE IN STATISTICS FOR GEOGRAPHY/ PSYCHOLOGY CORE
3C 03 STA : Probability and Distribution Theory

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 40

Instruction : *Use of **calculators** and **statistical** tables are **permitted**.*

PART – A

(Short Answer)

Answer **all** the **6** questions. **(6×1=6)**

1. Define random experiment.
2. One ticket is drawn at random from a bag containing 30 tickets numbered from 1 to 30. Find the probability that it is a multiple of 3 or 5.
3. Define probability mass function (pmf).
4. Write down the pmf of a Poisson distribution whose mean is 2.
5. If $X \sim N(0, 1)$ and $p(X < 1) = 0.84$. Find $p(|X| < 1)$.
6. Define sampling distribution of a statistic.

PART – B

(Short Essay)

Answer **any 6** questions. **(6×2=12)**

7. A bag contains 7 white and 9 black balls. Two balls are drawn in succession at random. What is the probability that one of them is white and the other is black ?
8. Define distribution function of a random variable and give its properties.

P.T.O.

9. With the usual notations, find p for a binomial distribution, if n = 6 and $4P(X = 4) = P(X = 2)$.

10. Let X is the total number of heads obtained when two unbiased coins are thrown. Obtain E(X).

11. Find the variance of binomial distribution.

12. Define chi-square statistic. Write down its density function.

13. Let X be a continuous random variable with pdf, $f(x) = \begin{cases} k(x - x^2), & 0 < x < 1, \\ 0, & \text{otherwise}, \end{cases}$ where k is a constant. Determine that value of k.

14. State the relation between Chi-square and F-distribution.

PART – C

(Essay)

Answer **any 4** questions. **(4×3=12)**

15. Define the concept of conditional probability and independence of events.

16. Suppose a discrete random variable X has the following pmfs: $p_X(1) = \frac{1}{2}, p_X(2) = \frac{1}{4}, p_X(3) = \frac{1}{8}, p_X(4) = \frac{1}{8}$. Find the distribution function of X and obtain $P(1 < X \le 3)$.

17. Derive the mean and variance of Poisson distribution.

18. Define mathematical expectation. If the random variable X takes the values 0, 1, 2, 3 with respective probabilities 0.1, 0.5, 0.2, 0.2, then find E(X) and V(X).

19. If X_1, X_2, X_3 and X_4 are independent observations from a univariate normal population with mean zero and unit variance then find the distribution of $\frac{3X_4^2}{X_1^2 + X_2^2 + X_3^2}$.

20. Show that the square of a t variate with n degrees of freedom is F(1, n).

PART – D
(Long Essay)

Answer **any 2** questions. **(2×5=10)**

21. From a city population, the probability of selecting

    i) a male or a smoker is $\frac{7}{10}$,

    ii) a male smoker is $\frac{2}{5}$, and

    iii) a male, if a smoker is already selected is $\frac{2}{3}$.

    Find the probability of selecting :

    a) a non-smoker and

    b) a smoker, if a male is first selected.

22. A random variable X has the following probability function.

X	– 2	– 1	0	1	2	3
P(X)	0.1	k	0.2	2k	0.3	k

Find the value of k and calculate the mean and variance.

23. The hourly wages of 1000 workers are normally distributed around a mean of Rs. 700 and with a standard deviation of Rs. 50. Estimate the number of workers whose hourly wages will be

    i) between Rs. 690 and Rs. 720,

    ii) more than Rs. 750 and

    iii) less than Rs. 630.

24. Fit a binomial distribution to the following data and calculate the theoretical frequencies.

x	0	1	2	3	4
f	28	62	46	10	4