

D 123298

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Name.....

Reg. No.....

SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2025

Statistics

STA2MN101—PROBABILITY THEORY I

(2024 Admission onwards)

Time : Two Hours

Maximum : 70 Marks

Section A*All Questions can be answered.**Each Question carries 3 marks.**(Ceiling: 24 marks)*

1. Mention any three properties of a probability mass function.
2. If the pmf, $f(x) = kx(x-1)$, for $x = 2, 3, 4$ and 5 . Obtain the value of k .
3. For two constants a and b , prove that for a random variable X , $E(aX + b) = aE(X) + b$.
4. Define raw moments and central moments of a random variable X .
5. Mean of a Poisson random variable X is 4 . Find $P(X = 2)$.
6. Mean and variance of a normal random variable X is 10 and 9 . Obtain $P(X > 13)$.
7. Define the coefficient of determination.
8. Define regression analysis.
9. Define a parameter. Give an example.
10. Define standard error.

(Ceiling 24 marks)

Section B*All Questions can be answered.**Each Question carries 6 marks.**Ceiling 36 marks.*

- 11 Identify the probability distribution of a random variable with its distribution function given as, $F_x(x) = 0$, if $x < 0$, 0.3 , if $0 \leq x < 2$, 0.7 , if $2 \leq x < 3$ and 1 , if $x \geq 3$. Also sketch the graph of the distribution function.
- 12 Ten unbiased coins are tossed simultaneously. Find the probability of getting (i) exactly 5 heads (ii) at most 4 heads.

Turn over

- 13 Define rectangular distribution. Explain why it is called so.
- 14 If X and Y are independent random variables following normal distribution $N(2,9)$ and $N(3,16)$ respectively, then find the probability distribution of (i) $X + Y$ and (ii) $X - Y$.
- 15 Define Pearson's coefficient of correlation. Calculate Pearson's coefficient of correlation between X and Y using the data $(X,Y) = (4, 9), (5, 12), (6, 15), (7, 18), (8, 20)$ and $(9, 24)$.
- 16 Define regression coefficients and establish that the two regression coefficients are always of same sign.
- 17 Define sampling distribution. If \bar{x} is the mean of the random sample of size 12 taken from $N(2, 9)$, obtain $P(\bar{x} > 0)$.
- 18 Define F distribution. State its properties and relation with chi square distribution.

(Ceiling 36 marks)

Section C

Answer any One.

Each Question carries 10 marks.

- 19 Define a normal distribution. Obtain the mean of X following $N(\mu, \sigma^2)$ Mention any five of the properties of normal distribution.
20. Define (i) chi-square distribution (ii) t -distribution (iii) Obtain the variance of X following Chi square distribution with n degrees of freedom.

(1 × 10 = 10 marks)