

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



U.G. DEGREE EXAMINATION – ALLIED

THIRD SEMESTER – APRIL 2023

18UST3AL01 – MATHEMATICAL STATISTICS - I

Date: 10-05-2023

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION - A

Answer all the questions.

(10 x 2 = 20)

1. If A and B are independent events $P(A) = 0.4$, $P(B) = 0.5$ find $P(A \cup B)$.
2. State Multiplication theorem for two independent events and dependent events.
3. Find the expectation of the outcome a die when thrown.
4. Define Moment Generating function.
5. Define gamma distribution with one parameter.
6. Write any two properties of normal distribution.
7. Define Karl Pearson's coefficient of correlation and write its properties.
8. State the applications of Student's t distribution.
9. Define Order statistics.
10. What is convergence in probability?

SECTION- B

Answer any FIVE questions.

(5 x 8 = 40)

11. (a) State and prove Bayes' theorem .

(b) If A and B are independent events, prove that $P(A \cap \bar{B}) = P(A) \cdot P(\bar{B})$

12. Let X be a random variable with the following probability distribution

x	-1	0	1
P(X=x)	0.2	0.3	0.5

Find $E(x)$ and $E(x^2)$ and using the laws of expectation, evaluate $E(3x+1)^2$.

13. State and prove Chebyshev's inequality.
14. Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y):

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

15. State and prove the lack of memory property of Geometric distribution.
16. Derive the Mean and variance of gamma distribution with one parameter.
17. Derive the distribution function of t distribution.
18. Derive the probability density function of first order statistic.

SECTION- C

Answer any two questions.

(2 x 20 = 40)

19. i) State and prove addition theorem on probability for two events. (4)
ii) Two random variables X and Y have the following joint probability density function,

$$f(x, y) = \begin{cases} 2 - x - y, & 0 \leq x < 1 \\ & 0 \leq y < 1 \\ 0, & \text{otherwise} \end{cases}$$

Summarize the results of,

- (i) The marginal probability density function of X and Y
- (ii) Conditional density function of X and Y
- (iii) Variance of X and Y

(16)

20. (i) Derive the Mean and variance of beta distribution of First kind. (10)

(ii) If X is $N(30, 52)$ find (i) $P(26 < X < 40)$

(ii) $P(X > 42)$

(iii) $P(X < 28)$ (10)

21. Derive the Pdf of chi square distribution and hence derive its mean and variance.

22. State and prove the central limit theorem.

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