LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **ADV. ZOO., MATHS, PLANT BIO.& PHY.**

FOURTHSEMESTER – APRIL 2017

ST 4209 / ST 4201 / ST 4206 - MATHEMATICAL STATISTICS

Date: 29-04-2017 Dept. No. Max. : 100 Marks
09:00-12:00

SECTION - A

Answer all the questions. **(10 X 2 = 20)**

1. If And B are independent events P (A) =0.4, P (B) =0.5 find P (AUB).
2. Show that $P(A \cap \overline{B}) = P(A) - P(A \cap B)$
3. Define Moment Generating function.
4. What are the types of random variables?
5. Write the pdf and mgf of gamma distribution.
6. Define discrete uniform distribution and write its mean and variance.
7. Define joint probability mass function
8. Write the applications of Student's t distribution.
9. Name any two methods of Estimation.
10. Define null and alternative hypothesis.

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 $P(A \cap \overline{B}) = P(A).P(\overline{B})$

12. Let X is a continuous random variable with p.d.f.

$$f(x) = \begin{cases} ax & 0 \le x \le 1 \\ a & 1 \le x \le 2 \\ -ax + 3a & 2 \le x \le 3 \\ 0 & elsewhere \end{cases}$$

 i) Determine the constant a ii) Compute P(X≤1.5)

13. State and prove Chebyshev ' s inequality.
14. Derive the M.G.F. of exponential distribution and hence find mean and variance.
15. Find the mean and variance of Poisson distribution.
16. A two dimensional random variable (X,Y) have a Bivariate distribution given by

 P(X=x,Y=y)=$\frac{2x \ \ + y}{27}$ for x=0,1,2 and y=0,1,2

 Find the marginal distribution of X and Y and find the conditional distribution of x=1 given y=1.

17. For testing H_0: θ=1 Vs H_1: θ=2 an observation is taken from a uniform distribution (0, θ) and the region of rejection {x>0.7}. Find the probabilities of Type I and Type II errors.

18. Define the following i) unbiasedness ii) consistency iii) MP Test iv) UMP Test

SECTION- C

Answer any two questions. **(2 X 20 = 40)**

19. a) i) State and prove addition theorem on probability for two events.

ii) A coin is tossed twice. What is the conditional probability that both coins show heads given that the first one shows head? **(8)**

b) Let X be a discrete random variable with following distribution function

X	1	2	3	4	5
P(X)	k	2k	3k	k	5k

Find i) value of k ii) $P(X<4)$ iii) $P(1<X\leq 4)$ iv) $P(X>2)$ **(12)**

20. a) Find the mean and variance of beta distribution of first kind **(8)**

b) X be normally distributed with mean 8 and standard deviation 4 find

i) $P(5\leq X\leq 10)$ ii) $P(10\leq X\leq 15)$ iii) $P(X\geq 15)$ iv) $P(X\leq 5)$ **(12)**

21. a) Define student's t-statistic and Derive its p.d.f. **(10)**

b) The joint probability density function of a two-dimensional random variable (X,Y) is given by

$$f(x,y) = \begin{cases} 2 & 0 < x < 1, 0 < y < x \\ 0 & elsewhere \end{cases}$$

(i) Find the marginal density functions of X and Y

(ii) Find the conditional density function of Y given X = x and conditional density function of X given Y = y.

(iii) Check for independence of X and Y. **(10)**

22. a) Explain the methods of maximum likelihood and method of moments and state the properties. **(12)**

b) If $X_1, X_2, \ldots, X_n$ is a random sample from normal distribution with mean θ and variance 1, find the maximum likelihood estimator of θ. **(8)**

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