LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

FIRST SEMESTER – **APRIL 2019**

16/17/18UST1MC02 /ST 1503 / ST 1501– PROBABILITY AND RANDOM VARIABLES

Date: 05-04-2019 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART - A

Answer ALL the questions. **[10x2 = 20]**

1. State the axiomatic definition of probability.
2. Give the number of elements in the Sample Space when four coins are tossed.
3. Two balls are drawn at random from a bag containing 4 Red & 6 White balls. Find the probability of getting a ball of each color.
4. Define Conditional Probability
5. Define mutual independence of n events.
6. Find *k* such that $f(x) = kx(1-x),, 0 \le x \le 1$ is a probability density function.
7. Define the cumulative probability distribution function of random variable.
8. Define a Bernoulli trial.
9. Define a discrete random variable.
10. If E(X) = 5 & V(X) = 10 then find E(4X+3) & V(4X+3).

PART - B

Answer ANY FIVE questions. **[5x8 = 40]**

11. State and prove Baye's theorem.
12. State and prove addition theorem of probability for 'n' events.
13. If r.v. X has *pdf* $f(x) = 3x^2$; $0<x<1$, compute (a) *cdf* of X (b) $P\{X>0.5|X\le 0.75\}$
14. Prove that if A & B are independent events then A & B^c and A^c & B^c are also independent.
15. The probability that three students will not solve a problem are $\frac{2}{3}, \frac{3}{4}$ and $\frac{4}{5}$ respectively. If they try independently, compute the probability that (a) problem will be solved (b) exactly two of them will solve it.
16. An urn contains 6white and 4 red balls. If four balls are drawn at random from this urn and X denotes the number of white balls drawn, then compute E(X).
17. Show that E(XY) = E(X) . E(Y) when X and Y are independent.
18. Prove that $P[|X-7| \ge 3] \le \frac{35}{54}$, where X denotes the sum of numbers appearing on two unbiased dice when thrown.

PART - C

Answer ANY TWO questions. **[2x20 = 40]**

19. (a) Show that for any two events A and B, $P(A \cap B) \leq P(A) \leq P(B) \leq P(A) + P(B)$

(b) Five percent of patients suffering from a certain disease are selected for the new treatments have 50% chances of getting cured. The persons not selected for the new treatment have 30% chance of getting cured. A person is randomly selected from these patients after the completion of the treatment and is found to have recovered. What is the probability that the patient received the new treatment?

(a) State and prove Chebyshev's inequality.

(b) Let the pdf of a r.v. be $f(x) = kx(1 - x), 0 < x < 1$ Find the distribution function, mean and

variance.

20.(a) Let X denotes the number of heads in throwing a coin twice. Obtain F(x).

(b) A random variables has the following probability distribution:

X=x	1	2	3	4	5
p(x)	$2k^2$	k	$2k^2+3k$	k	$2k^2$

Determine (i) k (ii) Cumulative distribution function of X

(iii) smallest "a" Show $P[X \leq a] > \frac{1}{2}$ (iv) $P[X > 2]$.

21.(a) In a certain college 25% students failed in Mathematics, 15% failed in Chemistry and 10% failed in both. A student is selected at random, find the probability that the chosen student has (i) failed in Mathematics if the student has failed in Chemistry (ii) failed in Chemistry if the student has failed in Mathematics (iii) failed in neither Mathematics nor Chemistry. **(12)**

(b) In a class of 10 girls, 3 have blue eyes. Two girls are chosen at random. Find the probability that (i) both have blue eyes (ii) neither have blue eyes (iii) atleast one has blue eyes (iv) exactly one has blue eyes.

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