# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – STATISTICS

FIRST SEMESTER – APRIL 2010

**ST 1503 - PROBABILITY AND RANDOM VARIABLES**

Date & Time: 30/04/2010 / 9:00 - 12:00 Dept. No. Max. : 100 Marks

SECTION – A ( 10 X 2 =20 Marks)

Answer ALL the questions

1. Define Probability of an event.
2. For two independent events A and B , P(A)= 0.4 , P(B) = 0.5, find P(A∪B).
3. A problem in Statistics is given to three students whose chances of solving it are 1/3. 1 /4, 1/5 respectively. Find the chance that the problem will be solved.
4. There are 20 silk sarees and 50 cotton sarees in a shop. In how many ways a lady can choose one cotton saree and one silk saree?
5. Two coins are tossed. If $E_1$ is the event " head on first coin" , $E_2$ the event, " head on second coin" and $E_3$ the event , " the coins match, both are heads or both tails. Show that the three pair wise independent events are not independent.
6. Let A and B be two events such that P(A) = 0.4, P( A∪B) = 0.8 and P(B) = p. What is choice of p for which A and B are independent?
7. A bag contains 3 red and 5 green balls . Two balls are drawn at random without replacement. Find the probability that both balls drawn are green.
8. Four coins are tossed simultaneously. What is the probability of getting 2 heads and 2 tails.
9. The pdf of a continuous random variate X is given by $f(x) = k x^2( 1- x ), 0 < x < 1$

   $= 0$ , elsewhere

   Find the constant k.
10. Define mathematical expectation.

SECTION- B ( 5 X 8 = 40 Marks )

Answer any FIVE questions.

11. Using the Axioms of probability, prove the following:-

    (i) If $B \subset A$, then $P(A \cap \overline{B}) = P(A) - P(B)$

    (ii) If $B \subset A$, then $P(B) \leq P(A)$

    (iii) For any two events A and B, and $P(\overline{A} \cap B) = p(B) - p(A \cap B)$
12. From a random number table, a two digit number is selected at random. What is the probability that

(i) it is divisible by 4

(ii) it is divisible by 10

(iii) it is divisible by 10 or by 4

Note: Take 00 divisible by 10 as well as 4.

13. A, B and C go for bird hunting. A has record of 1 bird out of 2, B gets 2 out of 3 and C gets 3 out of 4. What is the probability that they will kill a bird at which all shoot simultaneously?
14. There are two identical boxes containing 4 White and 3 Black balls and 3 White and 7 Black balls. A box is chosen at random and a ball is drawn from it. Find the probability that the ball is Black.
15. If two dice are thrown, what is the probability that the sum is (a) greater than 8 and (b) neither 7 nor 11?
16. A bag contains 4 Red and 3 Blue balls. Two drawings of 2 balls are made. Find the chance that the first drawing gives 2 Red balls and the second drawing 2 Blue balls.
    (a) if the balls are returned to the bag after the first draw.
    (b) if the balls are not returned.
17. State and Prove Law of Total probability for 3 events.
18. a) Define: Probability mass function and Distribution function.

    b)In a continuous distribution whose relative frequency density is given by

    $f(x) = k \times (2 - x)$ , $0 \le x \le 2$,

    find the value of k.

SECTION – C [ 2 X 20 = 40 Marks ]

Answer any TWO questions

19. a) A purse contains 4 nickel coins and 9 copper coins, while another purse contains 6 nickel and 7 copper coins. A purse is chosen at random and a coin is drawn at random from it. What is the probability that it is a nickel coin?

    b) If $P(A) = 1/4$ , $P(B) = 2/5$ and $P(A \cup B) = 1/2$ , fins (i) $P(A \cap \bar{B})$ and (ii) $P(\bar{A} \cup \bar{B})$, where A, B are mutually exclusive.

20 a) An unbiased coin is tossed three times. Let A be the event " not more than one head " and let B be the event " at least one of the each face". Are A and B independent?

b) Three urns contain respectively 1 White and 2 Black balls; 3 White and I Black ball; 2 White and 3 Black balls. One ball is taken from each urn. What is the probability that among the balls drawn, there are 2 White and 1 Black?

21a) State and prove Baye's Theorem

b) There are two identical boxes containing 4 white and 3 red balls, and 3 white and 7 red balls. A box is chosen at random and a ball is drawn from it. Find the probability that the ball is red.

c) A class consists of 50 students out of which the number of girl students is 10. In the class 2 girls and 5 boys are rank holders in the previous examination. If a student is selected at random from the class and is found to be a rank holder, what is the probability that the student selected is a girl?

22 a)Two cards are drawn. i) successively with replacement

ii) simultaneously ( successively without replacement) from a well shuffled deck of 52 cards. Find the probability distribution of the number of aces.

b)If t is a non-negative real number, show that the function defined by

$$f(x) = e^{-t}\,(1- e^{-t})^{x-1}$$

Can represent a probability function of a discrete random variable X assuming the values 1,2,3,……..

Find expectation of X.

********** All the Best **********