LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – **APRIL 2022**

16/17/ 18UST1MC02 – PROBABILITY AND RANDOM VARIABLES

Date: 24-06-2022 Dept. No. Max. : 100 Marks
Time: 09:00 AM – 12:00 NOON

SECTION A

Answer any TEN questions **(10 X 2 = 20)**

1. What is meant by an impossible event?
2. Write down the three axioms of probability.
3. Give classical definition of probability.
4. Two unbiased dice are thrown. Find the probability that both the dice show the same number.
5. Define Conditional probability.
6. If A and B are independent events, then prove that A and $\bar{B}$ is also independent events.
7. State the multiplication law of probability.
8. What do you understand by Bernoulli Trials?
9. Define discrete random variables.
10. What is cumulative distribution function?

SECTION B

Answer any FIVE questions **(5 X 8 = 40)**

11. Define the following with illustrations
    a) Trial and events
    b) Exhaustive events
    c) Mutually exclusive events
    d) Independent events

12. a) Twelve balls are distributed at random among three boxes. What is the probability that the first box will contain 3 balls?
    b) If n biscuits be distributed among N persons, find the chance that the particular person receives $r\ (< n)$ biscuits. (4 + 4)

13. Data on the readership of a certain magazine show that the proportion of the male readers under 35 is 0.40 and over 35 is 0.20. If the proportion of readers under 35 is 0.70, find the proportion of the subscriber that are 'female over 35 years'. Also calculate the probability that a randomly selected male subscriber is under 35 years of age.

14. State and prove addition theorem of probability for two events. Extend the result for three events.

15. It is 8 : 5 against the wife who is 40 years old living till she is 70 and 4 : 3 against her husband now 50 living till the he is 80. Find the probability that
    a) Both will be alive
    b) None will be alive
    c) Only wife will be alive and

d) Only husband will be alive. (2+2+2+2)

16. State and prove addition theorem of Mathematical expectation
17. Two dice are rolled. Let X denote the random variable which counts the total number of points on the upturned faces, Construct a table giving non – zero values of the probability mass function and draw the probability chart. Also find the distribution function of X.
18. State any four properties of random variable and distribution function.

SECTION C

Answer any TWO questions **(2 X 20 = 40)**

19. a) A man took 4 spade cards from an ordinary pack of 52 cards. If he is given three more cards, find the probability p that at least one of the additional cards is also a spade.

    b) A problem in Statistics is given to three students A, B and C whose chances of solving it are ½ , ¾ and ¼ respectively. What is the probability that the problem will be solved if all of them try independently? (8 + 12)

20. a) State and Prove Baye's theorem.

    b) From a vessel containing 3 white and 5 black balls, 4 balls are transferred into empty vessel. From this vessel a ball is drawn and is found to be white. What is the probability that out of four balls transferred 3 are white and 1 is black? (8 + 12)
21. a) The diameter of an electric cable, say X, is assumed to be continuous random variable with p.d.f. : $f(x) = 6x(1-x), 0 \leq x \leq 1.$

    (i) Check that $f(x)$ is a p.d.f., and
    (ii) Determine a number b such that $P(X < b) = P(X > b)$ (4+4)

    b) Two dice are thrown. Let X_1 be the score on the first die and X_2 be the score on the second die. Let Y denote the maximum of X_1 and X_2., *i.e.*,$Y = \max(X_1, X_2)$.

    (iii) Write the joint distribution of Y and X_1, and
    (ii) Find the mean and variance of Y and covariance of (Y, X_1). (6+6)

    (8 + 12)

22. a) Write any ten properties of mathematical expectation.
    b) State and prove Chebychev's Inequality (10 + 10)

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