LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – NOVEMBER 2012

# ST 1503/ST 1501 - PROBABILITY AND RANDOM VARIABLES

Date : 10/11/2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**PART – A**

**Answer ALL the questions: (10 x 2 = 20 marks)**

1. Give the empirical definition of probability. Mention any one of its limitations.

2. Define an event with reference to a random experiment. Give an example.

3. Define conditional probability. When does this probability become Zero?

4. When do we say that an event A is statistically independent with respect to an event B?

5. Distinguish between pair wise independence and mutual independence.

6. State multiplication law of probability for any two events. Hence, write down the law for

independent events.

7. Find the E(X) of X whose pdf is f(x) = , x >0.

8. Write down the importance of Chebyshev’s inequality.

9. Mention the advantages of generating functions.

10. If X is random variable with mean 0 and variance 25, give an upper bound for the

probability P (│X – μ│ > 25 ).

**PART – B**

**Answer any FIVE questions: (5x8=40 marks)**

11. Define Moment Generating Function (MGF). Show that MGF can be used to obtain the mean and

variance of a random variable.

12. State and prove the addition theorem for two events. Hence, show that probability of a sure

event is One.

13. For any two events A and B, show that

P (A∪B⎟ C ) = P (A⎟ C) + P (B⎟ C) – P (A∩B⎟ C)

14. If two dice are thrown, what is the probability that the ‘sum’ is (a) greater than 8 and (b) either 7 or 11

15. If X is random variable with pdf f(x)= , 2 ≤ x ≤4. Find the value of k. Hence find Standard

Deviation of X.

16. Sixty per cent of the employees of the XYZ Corporation are college graduates. Of these, ten per cent

are in sales. Of the employees who did not graduate from the college, eighty per cent are in sales.

(i) What is the probability that an employee selected at random is in sales?

(ii) What is the probability that an employee selected at random is neither in sales nor a

college graduate?

17. Illustrate through an example that pair-wise independence does not imply mutual independence.

18. The diameter of an electric cable is assumed to be a continuous random variable X with pdf f(*x*) = k

x(1-x) if 0 < *x* < 1 and 0, otherwise. (i) Find the value of k. (ii) Obtain the distribution function of X.

(iii) Determine the value of constant c such that P[X< c] = P[X>c].

**PART – C**

**Answer any TWO questions: (2x20=40 marks)**

19. (a) If two events A and B independent, show that their complements are independent of

each other.

(b) The probability of the wife who is 40 years old living till 70 is  and the probability of

the husband who is now 50 living till 80 is . Find the probability that

1. only one will be alive for 30 years (b) at least one will be alive for 30 years.

20. (a) State and prove Bayes theorem.

(b) Three identical urns contain the following proportion of balls.

Urn1 : 2black, 1white.

Urn2 : 1black, 2white.

Urn3 : 2black, 2white.

An urn is selected at random and a ball is drawn. This ball turns out to be white. What is the

probability of drawing a white ball again if the first white ball drawn is not replaced.

21. (a) State and Prove Chebyshev’s Inequality.

(b) If X is a random variable with pdf f(x) = , < x<, obtain an upper bound for the

probability P[│X – μ│ > ]. Compare it with the actual probability.

22. (a) For any three events A. B and C, such B, and P(A) >0, show that P (B⎟ A ) ≤ P (C⎟ A).

(b) If A and B are two events such that P(A) = and P(B) =, show that (i) P (A)   and

(ii)   P (A)

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