LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRSTSEMESTER – APRIL 2018

17/16UST1MC02 / ST 1503 - PROBABILITY AND RANDOM VARIABLES

Date: 26-04-2018 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

Section-A

Answer ALL the questions **(10x2=20)**

1. Define sample space with an example.
2. State the axioms of probability.
3. What is the probability that no head occurs when two coins are tossed.
4. Define classical probability.
5. Define independent events and dependent events.
6. Find the probability that all the vowels come together in a random arrangement of the letters of the word 'COMMERCE'.
7. Define conditional probability.
8. State multiplication theorem of probability.
9. Define random variable.
10. State any two properties of mathematical expectations.

Section –B

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

11. Prove that $P(\overline{A}) = 1 - P(A)$
12. State and prove Chebyshev's inequality.
13. An MBA applies for a job in two firms X and Y. The probability of his being selected in firm X is 0.7 and being rejected in Y is 0.5. The probability of his application being accepted by Company X is 0.6 and by Company Y is 0.4. What is probability that he will be selected in one of the firms?
14. The odds that person X speaks the truth are 3:2 and the odds that person Y speaks the truth are 5:3. In what percentage of cases are they likely to contradict each other on an identical point.
15. State and prove multiplication law of probability for two events. Extend the result for three events.
16. A consignment of 15 record players contains 4 defectives. The record players are selected at random one by one and examined. Those examined are not put back. What is the probability that the 9^{th} one examined is the last defective?
17. Define distribution function. Also, state its properties.
18. A random variable X has the following probability function:

$X=x$	0	1	2	3	4	5	6	7
$p(x)$	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

(i) Find k and evaluate $P(X < 6), P(0 < X < 5)$.

(ii) If $P(X \geq a) > 1/2$, find the minimum value of 'a'

(iii) Determine the distribution function of X.

Section-C

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

19. (a) A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers of the purchase department, 2 officers of the sales department and 1 chartered accountant. Find the probability of forming the committee in the following manner:

    (i) There must be one from each category.

    (ii) It should have at least one from the purchase department.

    (iii) The chartered accountant must be in the committee.

    (b) One shot is fired from each of three guns. E_1, E_2, E_3 denote the events that the targets is hit by the first, second and third guns respectively. If $P(E_1) = 0.5$, $P(E_2) =0.6$ and $P(E_3) = 0.8$ and E_1, E_2, E_3 are independent events, find the probability that

    (i) exactly one hit is registered

    (ii) at least two hits are registered.

20. (a) A problem in Statistics is given to three students A, B and C whose chances of solving it are 1/2 , 3/4 and 1/4 respectively. What is the probability that the problem will be solved if all of them try independently?

    (b) A and B alternately cut a pack of cards and the pack is shuffled after each cut. If A starts and the game is continued until one cuts a diamond, what are the respective chances of A and B first cutting a diamond?

21. (a) State and Prove Baye's theorem.

    (b) An urn contains 5 white and 5 black balls. 4 balls are drawn from this urn and put into another urn. From this second urn a ball is drawn and is found to be white. What is the probability of drawing a white ball again at the next draw from the second urn.

22. (a) Show that E(X+Y) = E (X)+E(Y).

    (b) The diameter of an electric cable, say X, is assumed to be a continuous random variable with pdf $f(x) = 6x(1-x), 0 \leq x \leq 1$.

    (i) Check that $f(x)$ is pdf.

    (ii) Determine a number b such that $P(X < b) = P(X > b)$

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