K17U 1053

Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (C.B.C.S.S. – Reg./Supple./Imp.) Examination, May 2017
COMPLEMENTARY COURSE IN STATISTICS
(for Mathematics/Comp. Science/Electronics Core)
2C02 STA : Probability Theory and Random Variables
(2014 Admn. Onwards)

Time : 3 Hours Max. Marks : 40

PART – A

Answer **all 6** questions. **(6×1=6)**

1. Define random experiment.
2. State the limitations of classical definition of probability.
3. Define conditional probability.
4. Define random variable.
5. Explain the independence of random variables.
6. Define marginal and conditional distribution.

PART – B

Answer **any 6** questions. **(6×2=12)**

7. Define the axiomatic definition of probability.
8. If A and B are any two events prove that
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

9. The probability that a boy will get a scholarship is 0.9 and that a girl will get is 0.8. What is the probability that at least one of them will get the scholarship ?

10. A bag contains 4 white and 3 black balls. Two balls are drawn at random one after another without the replacement. Find the probability that both balls drawn are black.

11. Define the distribution function. State the properties of the distribution function.

12. Given that $f(x)=k(\frac{1}{2})^x$ is the probability distribution of a random variable which can take on the values x = 0, 1, 2, 3, 4, 5, 6. Find the value of k.

13. A continuous random variable X has a p.d.f. $f(x)=3x^2, 0 \le x \le 1$. Find a and b such that $P(X \le a)=P(X > a)$.

14. If a random variable X has the density function $f(x)=\begin{cases} \frac{1}{4}, & -2 < x < 2 \\ 0 & \text{elsewhere} \end{cases}$.

Find $P\left[\,|x| > 1\right]$.

PART – C

Answer **any 4** questions. **(4×3=12)**

15. A problem in statistics is given to the three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that this problem will be solved if all of them try independently.

16. Two six faced unbiased dice are thrown. Find the probability distribution of the sum of the numbers shown.

17. A random variable X has the p.d.f. $f(x)\begin{cases} 2x & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$.

Find : i) $P\left(\frac{1}{4} < x < \frac{1}{2}\right)$

ii) $P\left(X > \frac{3}{4} \Big/ X > \frac{1}{2}\right)$.

18. If f_1 and f_2 are p.d.f'.s and $\theta_1 + \theta_2 = 1$, show that $g(x) = \theta_1 f_1(x) + \theta_2 f_2(x)$ is a p.d.f. $(0 < \theta_1, \theta_2 < 1)$.

19. For the following density function $f(x) = cx^2 (1 - x), 0 < x < 1$.
    1) Find the constant C.
    2) $P(X > 0.25)$
    3) $P(X < 0.5)$.

20. Two discreate random variables X and Y have

    $P(X = 0, Y = 0) = 2/3$ $P(X = 0, Y = 1) = 1/9$

    $P(X = 1, Y = 0) = 1/9$ $P(X = 1, Y = 1) = 5/9$

    1) Find the marginal distribution of X and Y.
    2) Examine whether X and Y are independent.

PART – D

Answer **any 2** questions. **(2×5=10)**

21. a) State and prove Baye's theorem.

    b) An urn contains four tickets marked with numbers 112, 121, 211, 222 and one ticket is drawn at random. Let A_i (i = 1, 2, 3) be the event that i^{th} digit of the number of the ticket drawn is 1. Discuss the independence of the events A_1, A_2 and A_3.

22. A random variable X has the following probability function :

Value of X	**x**	– 2	– 1	0	1	2	3
	P(x)	0.1	K	0.2	2K	0.3	K

    1) Find the value of K.
    2) Find the distribution function and draw the graph.

23. X and Y are two random variables having the joint density function

    $f(x, y) = \frac{1}{27}(x + y)$, where x and y can assume only the integer values 0, 1 and 2.

Find :

1) Marginal distribution of X and Y.
2) Conditional distribution of X given Y = 1.
3) Conditional distribution of Y given X = 1.

24. Two dimensional random variable (X, Y) have the joint density.

$$f(x, y) = \begin{cases} 8xy \ ; & 0 < x < y < 1 \\ 0 \ ; & \text{otherwise} \end{cases}$$

Find :

1) $P(X < \frac{1}{2} \cap Y < \frac{1}{4})$.
2) Find the marginal distribution of X and Y.
3) Find the conditional distributions.