D2BST2301 (PAGES 2) **Reg.No..............................**

Name: ....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2024

(Regular/Improvement/Supplementary)

STATISTICS: COMPLEMENTARY COURSE FOR MATHEMATICS & CS

GSTA2C02T: PROBABILITY THEORY

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.

(Ceiling 20 Marks)

1. What is sample space? A coin is tossed until a head appears, write down the sample space.
2. State empirical definition of probability.
3. A problem is given to two students and their chances of solving it are 1/2 and 1/3 respectively. What is the probability that the problem will be solved?
4. A can hit a target four times in 5 shots, B, three times in 4 shots, C two times in 3 shots. Calculate the probability that only one will hit the target.
5. Let X be a random variable with p.d.f $f(x)=kx^2(1-x); 0<x<1.$ Find the value of k.
6. If X has the pdf $f(x)=\begin{cases} 1, & 0\leq x\leq 1 \\ 0, & otherweise \end{cases}$

   Obtain the distribution of - 2logX .
7. If $f(x)=\frac{1}{2^x}$, $x=1,2,3,...$

   Show that E(2^X) does not exists.
8. What are the properties of moment generating function?
9. What do you mean by conditional probability function.
10. For any two random variables X and Y, show that E(E(X|Y)) = E(X).
11. If X is a random variable with pdf f(x), Prove that $E(X^2)\geq[E(X)]^2$.
12. What are the properties of distribution function?

SECTION B: Answer the following questions. Each carries *five* marks.

(Ceiling 30 Marks)

13. Twenty-five books are placed at random in a shelf. Find the probability that a particular pair of books shall be

    (i) Always together (ii) Never together.
14. State and prove addition theorem on probability for two events.

(PTO)

15. Find p.d.f of a random variable with distribution function F(x) = $1-e^{-x}$, x > 0.

16. Define raw moments and central moments. Obtain the relation between raw moments and central moments.

17. Two dice are thrown. X represents the sum of the two numbers that come up. Determine E(X) and V(X).

18. Find the mean of Y = X^2 + 1 if X has probability function.

x :	0	1	2	3
P(x) :	0.1	0.2	0.3	0.4

19. Find the m.g.f for $f(x)=\frac{1}{8}(1+x), 2<x<4.$

SECTION C: Answer any *one* question. Each carries *ten* marks.

20. (a) State and prove Bayes' theorem.

(b) The probabilities of X, Y and Z becoming managers are 4/9, 2/9 and 1/3 respectively. The probabilities that the Bonus Scheme will be introduced if X, Y and Z becomes managers are 3/10, 1/2 and 4/5 respectively.

(i) What is the probability that Bonus Scheme will be introduced?

(ii) If the Bonus Scheme has been introduced, what is the probability that the manager appointed was X?

21. The p.d.f of two random variables (X, Y) is given by $f(x,y)=\begin{cases} 2\ , & 0<x<y<1 \\ 0\ , & elsewhere \end{cases}$

Find the marginal distributions. Also find the conditional mean and variance of X given Y = y.

(1 x 10 = 10 Marks)