Manuscript

Avinashilingam Institute for Home Science and Higher Education for Women

(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)
Re-accredited with 'A+' Grade by NAAC. Recognised by UGC Under Section 12B
Coimbatore - 641 043, Tamil Nadu, India

Bachelor's Degree Examination – March 2021
I Semester

Class : I UG **Time : 3 Hours**
Major : Mathematics **Max. Marks: 100**

18BMAI01 Mathematical Statistics I

Part A **10 x 1=10**
Choose the correct answer

1. In throwing of n dice the exhaustive number of cases is
   a. 6^n b. 6^{n-1} c. 6^{n+1} d. 6

2. Consider tossing of an unbiased coin thrice. Let X denote the number of heads in the outcome, the sample space n(s) =
   a. 7 b. 6 c. 8 d. 4

3. Let A,B & C be the three exhaustive and mutually exclusive events associated with an experiment and let P(B) = 3/2 P(A), P(C) = 1/3 P(B) then P(A) is
   a. 3/2 b. 2/3 c. 1 d. 1/3

4. If A_1, A_2 are mutually exclusive events, then $P(A_1 \cup A_2)$ =
   a. $P(A_1)+P(A_2)$ b. $P(A_1).P(A_2)$
   c. $P(A_1) - P(A_2)$ d. $P(A_1)-P(A_2)+P(A_1 \cap A_2)$

5. If X is a normal variate with mean 30 and S.D 5 , then $p(26 \le X \le 40)$ =
   a. 0.4772 b. 0.2881 c. 0.5 d. 0.7653

6. In a binomial distribution mean is 2.4 and variance is 1.44. Then the probability of success p is
   a. 0.6 b. 0.4 c. 0.3 d. 0.7

7. A continuous random variable X has a p.d.f f(x) = $kx^2e^{-x}; 0 \le x \le \infty$, then the value of k is
   a. ½ b. 1/3 c. ¼ d. 1/5

8. A continuous random variable X has a p.d.f f(x) = $3x^2$; $0 \le x \le 1$ if, $P(X \le a) = P(X > a)$ then the value of a is
   a. ½ b. ¼ c. $1/\sqrt{4}$ d. $\sqrt{\frac{1}{2}}$

9. If M_x(t) = 1+ $\frac{t}{a}+\frac{t^2}{a^2}+\frac{t^3}{a^3}+$..... then the first moment about the origin is
   a. $1/a^2$ b. 1/a c. t/a d. $1/a^3$

10. The density function of a random variable X is given by f(x) = k x(2-x), $0 \le x \le 2$ then k =
    a. 3/5 b. 2/4 c. 3/4 d.1/2

Part B **5 x 6 = 30**

Answer ALL questions

Each answer should not exceed 400 words or two pages

11.a. $P(A\cup B)=\frac{5}{6}$, $P(A\cap B)=\frac{1}{3}$, $P(\overline{B})=\frac{1}{2}$. Are the events A and B are independent.

(or)

11.b. A is known to hit the target in 2 out of 5 shots. B is known to hit the target in 3 out of 4 shots. Find the probability of the target being hit when the both try?

12.a. State and prove the multiplication law of probability.

(or)

12.b. State the Baye's Theorem.

13.a. If X and Y are independent random variable with variances 2 and 3 respectively. Find the variance of (3X + 4Y).

(or)

13.b. If $f(x)=\begin{cases} k(x-1)^3 ; 1\le x\le 3 \\ 0 \quad\quad ,otherwise \end{cases}$; find k.

14.a. State the properties of distribution function Define distribution function.

(or)

14.b. A continuous random variable X follows the probability law $f(x)=Ax^2$; $0\le x\le 1$, determine A and find the probability of X lies between 0.2 and 0.5

15.a. State the properties of Moment Generating Function.

(or)

15.b. Find the m.g.f mean and variance of the distribution whose p.m.f is

$$p(x)=\begin{cases} q^x p, & x=0,1,2..... \\ 0, & otherwise \end{cases}$$

Part C **5 x 12 = 60**

Answer ALL questions

Each answer should not exceed 800 words or four pages

16.a. From a group containing 4 singers, 6 players and 8 dancers, 3 persons are selected at random. Compute the probabilities of selecting

i. One singer and two players ii. None is a player iii. All are dancers.

(or)

16.b. From a bag containing 5 white balls and 6 green balls, 3 balls are drawn with replacement. What is the chance that,

i. All are of same colour. ii. They are alternatively of different colours.

17.a. In a bolt factory, machines A, B and C manufacture respectively 25%, 35% and 40% of the total. Of their output 5, 4, 2 percent are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machines A, B and C?

(or)

17.b. In 1989 there were three candidates for the position of principal – Mr. Chatterji, Mr.Ayangar and Dr.Singh – whose chances of getting the appointment are in the proportion 4 : 2 : 3 respectively. The probability that Mr. Chatterji, if selected, would introduce co-education in the college is 0.3. The probabilities of Mr. Ayangar and Dr.Singh doing the same are respectively 0.5 and 0.8. What is the probability that there was co-education in the college in 1990?

18.a. A discrete random variable X has the probability function given below:

Values of X, x	0	1	2	3	4	5	6	7
P(X)	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

Find i. The value of k

ii. $P(X<6)$, $P(X\geq 6)$ & $P(0<X<4)$

iii. The distribution function of X.

(or)

18.b. Let X be a continuous RV with p.d.f $f(x)=\begin{cases} ax & 0\leq x\leq 1 \\ a & 1\leq x\leq 2 \\ -ax+3a & 2\leq x\leq 3 \\ 0 & otherwise \end{cases}$

i. Determine 'a'

ii. Compute P(X≤1.5)

19.a. A continuous random variable X has p.d.f $f(x)=kx^2e^{-x}$, $x\geq 0$. Find k, r^{th} raw moment, mean and variance.

(or)

19.b. Let X be a random variable with distribution F given by

$$F(x)=\begin{cases} 1-e^{-\lambda x}, & 0\leq x<\infty \\ 0 & otherwise \end{cases}$$

Find the p.d.f of X. Determine the mean and variance of the distribution.

20.a. A random variable X has the probability function

$$f(x)=\frac{1}{2^x},\quad x=1, 2, 3,.....$$

Find its i. M.G.F, ii. Mean.

(or)

20.b. Find the moment generating function (M.G.F) of the distribution:

$$f(x)=\begin{cases} K\ e^{-Kx}, & x>0 \\ 0 & otherwise \end{cases}$$

Hence find i. Mean ii. Variance iii. μ_3' iv. μ_4'

*****