b. A coin is tossed 10 times. Find the probability of getting between 4 and 7 heads using 12 3 2 1

(i) The binominal distribution

(ii) The normal approximation of the binomial distribution

30. a. In normal $N\left(\mu,\sigma^2\right)$, find the MLE of 12 3 3 2

(i) μ when σ^2 is known

(ii) σ^2 when μ is known

(iii) the simultaneous μ and σ^2

(OR)

b. State and prove sufficient conditions for consistency 12 2 3 2

31. a. Theory predicts that the proportion of beans in four groups A, B, C, D should be 9:3:3:1. In an experiment among 1600 beans, the number of four groups were 882, 313, 287, 118. Does the experiment support theory? 12 3 4 2

(OR)

b. Two random samples gave the following data: 12 3 4 3

	Size	Mean	Variance
Sample 1	8	9.6	1.2
Sample 2	11	16.5	2.5

Can we conclude that the two samples have been drawn from the same normal population?

32. a. In order to determine whether there is significant difference in the durability of 3 makes of computers, samples of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows. 12 3 5 2

Makes		
A	B	C
5	8	7
6	10	3
8	11	5
9	12	4
7	4	1

In view, what conclusion can you draw?

(OR)

b. Calculate the correlation coefficient between X and Y using the data 12 3 5 2

X	65	67	66	71	67	70	68	69
Y	67	68	68	70	64	67	72	70

* * * * *

Reg. No.															

B.Tech. DEGREE EXAMINATION, JUNE 2023

Fifth Semester

18MAB304T – PROBABILITY AND APPLIED STATISTICS

(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

(Statistical tables are required)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

Marks BL CO PO

1. If A and B are mutually exclusive events, then $P(A\cup B)=$ 1 1 1 1
   (A) $P(A)+P(B)-P(A\cap B)$ (B) $P(A)+P(B)$
   (C) $P(A)$ (D) $P(A)P(B)$

2. If $P(A)>P(B)$, then 1 1 1 1
   (A) $P(A/B)>P(B/A)$ (B) $P(A/B)<P(B/A)$
   (C) $P(A/B)=P(B/A)$ (D) $P(A/B)-P(B/A)<0$

3. The first four moments about $X=4$ are 1, 4, 10, 45, then the mean is 1 1 1 2
   (A) 3 (B) 5
   (C) 0 (D) 26

4. If X and Y are independent then $M_{X+Y}(t)=$ 1 1 1 2
   (A) $M_X(t)+M_Y(t)$ (B) $M_X(t)-M_Y(t)$
   (C) $M_X(t)M_Y(t)$ (D) $M_X(t)/M_Y(t)$

5. If X has m.g.f $M_X(t)=\frac{3}{3-t}$ then $Var(X)=$ 1 1 2 2
   (A) $\frac{1}{9}$ (B) $\frac{1}{3}$
   (C) $\frac{2}{9}$ (D) $\frac{1}{6}$

6. If X is a binomial variate with parameter (n,p), then the SD of X is 1 2 2 1
   (A) npq (B) np
   (C) $\sqrt{npq}$ (D) $\sqrt{np}$

7. The limiting case of binomial if n-large, p-small is _______distribution. 1 2 2 2
   (A) Normal (B) Poisson
   (C) Uniform (D) Exponential

8. The time required to repair a machine is exponentially distributed with mean 2, then the probability that the repair exceeds 2h 1 2 2 1
   (A) $\frac{1}{e^2}$ (B) $\frac{1}{e}$
   (C) e (D) e^2

9. If $\hat{\theta}$ is the estimator of the parameter θ, then $\hat{\theta}$ is called unbiased if 1 1 3 2

(A) $E(\hat{\theta}) > \theta$ (B) $E(\hat{\theta}) = \theta$

(C) $E(\hat{\theta}) < \theta$ (D) $E(\hat{\theta}) \neq \theta$

10. In a normal distribution, the following property holds 1 1 3 2

(A) Mean>median>mode (B) Mean=median≠mode

(C) Mean=median=mode (D) Mean<median<mode

11. Estimation is possible only in a case of ________ 1 1 3 1

(A) Parameter (B) Sample

(C) Random sample (D) Population

12. A single value used to estimate a population value is called 1 1 3 2

(A) Interval estimate (B) Point estimate

(C) Level of confidence (D) Degrees of freedom

13. If the mean of the estimator is not equal to the population parameter, the estimator is 1 2 4 1

(A) Unbiased (B) Biased

(C) Positively biased (D) Negatively biased

14. If $t_{cal} < t_{table}$, then 1 2 4 2

(A) Reject H_0 (B) Accept H_1

(C) Neither accept H_0 nor reject H_0 (D) Accept H_0

15. As $n \to \infty$, χ^2 distribution becomes 1 2 4 2

(A) Exponential distribution (B) Uniform distribution

(C) Geometric distribution (D) Normal distribution

16. The degrees of freedom for the fitting of poisson with 10 observations is 1 1 4 1

(A) 10 (B) 9

(C) 8 (D) 7

17. The formula for the test statistic $\chi^2_{cal} =$ 1 1 5 1

(A) $\sum_{i=1}^{n}\left\{\frac{(O_i - E_i)^2}{E_i}\right\}$ (B) $\sum_{i=1}^{n}(O_i - E_i)^2$

(C) $\sum_{i=1}^{n}\left\{\frac{O_i - E_i}{E_i}\right\}$ (D) $\sum_{i=1}^{n} O_i$

18. If X and Y are independent then 1 1 5 1

(A) $\text{Covar}(X,Y) = 0$ (B) $\text{Covar}(X,Y) > 0$

(C) $\text{Covar}(X,Y) < 0$ (D) $\text{Covar}(X,Y) \neq 0$

19. The correction factor for ANOVA is 1 2 5 2

(A) $\frac{T}{N}$ (B) $\frac{T^2}{N}$

(C) $\frac{T}{N^2}$ (D) $\frac{T^3}{N}$

20. The regression coefficients are b_{xy} and b_{yx}, then the correlation coefficient is 1 2 5 2

(A) b_{xy} / b_{yx} (B) b_{yx} / b_{xy}

(C) $\pm\sqrt{b_{xy} b_{yx}}$ (D) $\pm\sqrt{b_{xy} / b_{yx}}$

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

Marks BL CO PO

21. If A and B are independent events, then prove that $\bar{A}$ and $\bar{B}$ are also independent. 4 2 1 2

22. A continuous random variable X has p.d.f $f(x) = \begin{cases} 3x^2, 0 \le x \le 1 \\ 0, \quad otherwise \end{cases}$. Find 'a' such that $P(X \le a) = P(X > a)$. 4 2 1 2

23. State and prove memoryless property for exponential distribution. 4 1 2 1

24. If T is an unbiased estimator for θ, show that T^2 is a biased estimator for θ^2 if $\text{var}(T) > 0$. 4 2 3 1

25. Show that for a random sample of size 100, drawn with replacement the standard error of sample proportion cannot exceed 0.05. 4 3 4 2

26. Construct the ANOVA table for two factors of classification. 4 2 5 1

27. The regression equations are $8x - 10y + 66 = 0$, $40x - 18y - 214 = 0$ calculate the mean of x and y. 4 2 5 2

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

Marks BL CO PO

28. a. A random variable X has the following probability function 12 3 1 2

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 the value of k

(ii) evaluate $P(X < 6), P(X \ge 6)$

(iii) if $P(X \le C) > \frac{1}{2}$ find the min value of C.

(iv) Find $P(1.5 < X < 4.5 / X > 2)$

(OR)

b. The CDF of continuous RV X is $F(x) = \begin{cases} 1 - (1+x)e^{-x}; x > 0 \\ 0; \quad x \le 0 \end{cases}$ 12 3 1 1

(i) Find the pdf $f(x)$

(ii) Mean and variance of X.

29. a. Buses arrive at a specified bus stop at 15 mins interval, starting at 7.00 AM. If a passenger arrives at the bus stop at a random time which is uniformly distributed between 7:00-7:30 AM. Find the probability that he waits for 12 3 2 2

(i) less than 5 mins

(ii) atleast 12 mins

(iii) atmost 6 mins for a bus

(OR)