B.Tech. DEGREE EXAMINATION, NOVEMBER 2023
Fifth Semester

18MAB304T – PROBABILITY AND APPLIED STATISTICS
(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

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

		Marks	BL	CO

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. The probability mass function of X is   1   3   1

X	0	1	2
P(x)	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{1}{12}$

   then the mean
   (A) 1   (B) 6/5
   (C) 5/6   (D) 2

2. If the probability density function of X is $f(x) = kx^2, 0 < x < 3$, then k=   2   5   1
   (A) 1   (B) 1/2
   (C) 1/3   (D) 1/9

3. If X is a random variable which can take only non negative values, then   1   1   1
   (A) $E(X^2) = [E(X)]^2$ (B) $E(X^2) \geq [E(X)]^2$
   (C) $E(X^2) \leq [E(X)]^2$ (D) $E(X^2)$

4. The first two moments about the origin are 2, 5 respectively, then the variance   1   5   1
   of the random variable is
   (A) 4   (B) 3
   (C) 2   (D) 1

5. If the standard deviation of the Poisson distribution is 2 then the pmf is   1   2   2
   (A) $\dfrac{e^{-2}2^x}{x!}$ (B) $\dfrac{e^2 2^x}{x!}$
   (C) $\dfrac{e^{-4}4^x}{x!}$ (D) $\dfrac{e^4 4^x}{x!}$

6. The mean and variance of a binomial distribution are 4 and 4/3 respectively.   1   5   2
   Find $P(X \geq 1) \ of \ n = 6$.
   (A) $\dfrac{725}{729}$ (B) $\dfrac{726}{729}$
   (C) $\dfrac{727}{729}$ (D) $\dfrac{728}{729}$

7. If X is uniformly distributed over (0,3) then the mean is   1   1   2
   (A) 3/2   (B) 2/3
   (C) 2   (D) 3

8. If the parameter of the exponential distribution is 2, then the variance of the   1   1   2
   distribution is
   (A) 1/4   (B) 1/2
   (C) 2   (D) 4

9. What is the main objective of estimation theory?   1 1 3
   - (A) To find the true value of a parameter
   - (B) To minimize the mean squared error of an estimator
   - (C) To maximize the sample size
   - (D) To calculate the p-value

10. Which of the following is not a point estimator?   1 1 3
    - (A) Sample mean
    - (B) Sample variance
    - (C) Maximum likelihood estimation
    - (D) Confidence interval

11. Which of the following is a method for constructing confidence intervals?   1 1 3
    - (A) Maximum likelihood estimation
    - (B) Bootstrap resampling
    - (C) Hypothesis testing
    - (D) Regression analysis

12. A _____ is a subset of a _____.   1 1 3
    - (A) Sample, population
    - (B) Population, sample
    - (C) Statistic, parameter
    - (D) Parameter, statistic

13. If the critical region is evenly distributed then the test is referred as?   1 1 4
    - (A) Two tailed
    - (B) One tailed
    - (C) Three tailed
    - (D) Zero tailed

14. Type II errors is also called as   1 1 4
    - (A) Producer risk
    - (B) Consumer risk
    - (C) Labour risk
    - (D) Management risk

15. The value set for α is known   1 2 4
    - (A) The level of rejection
    - (B) The level of acceptance
    - (C) The level of significance
    - (D) Error

16. If we apply t-test for difference between means then the degree of freedom is   1 1 4
    - (A) $v = n_1 + n_2 - 1$
    - (B) $v = n_1 + n_2 - 2$
    - (C) $v = n_1 + n_2 - 3$
    - (D) $v = n_1 + n_2 - 4$

17. If $b_{yx} < 1$, then b_{xy} is   1 3 5
    - (A) Same sign
    - (B) Opposite sign
    - (C) Either same or opposite sign
    - (D) Nothing can be decided

18. In a one-way ANOVA, what is the null hypothesis?   1 4 5
    - (A) There are no difference among the means
    - (B) There is a significant difference among the group means
    - (C) The sample size is too small to draw conclusions
    - (D) The data is normally distributed

19. In simple linear regression, what is the purpose of the regression equation $(y = mx + b)$?   1 2 5
    - (A) To calculate the correlation
    - (B) To predict the dependent variable (y) based on the independent variable (x)
    - (C) To calculate the standard error of the residuals
    - (D) To calculate the slope of the independent variable

20. The regression co-efficients are b_2 and b_1 then the correlation co-efficient r is   1 1 5
    - (A) b_1 / b_2
    - (B) b_2 / b_1
    - (C) $b_1 \cdot b_2$
    - (D) $\pm\sqrt{b_1 \cdot b_2}$

Marks   BL   CO

PART – B (5 × 4 = 20 Marks)
Answer ANY FIVE Questions

21. Two persons A and B appear in an interview for two vacancies for the same post. The probability of a A's selection is 1/7 and that of B's selection is 1/5. What is the probability that: (i) both of them will be selected (ii) none of them will be selected?

22. If X has the probability distribution

x	−1	0	1	2
p(x)	0.3	0.1	0.4	0.2

Find (i) $E(2X+1)$ (ii) $V(2X+1)$

23. Below you are given the values obtained from a random sample of observations taken from an infinite population 32, 34, 35, 39
    - (i) Find a point estimator μ, is this unbiased estimator of μ? Explain
    - (ii) Find a point estimator for σ^2, explain.

24. If a random variable 'X' has the m.g.f $Mx(t) = \dfrac{3}{3-t}$. Find the S.D 'x'

25. If the probability that an applicant for driving license will pass the round test on any given trail is 0.8, what is the probability he/ she pass the test (i) on 4th trail (ii) less than 4th table.

26. A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160cm. can it be reasonably regarded that in the population, the mean height is 165 cm, and the S.D is 10cm.

27. In an art competition, two judges accorded the following ranks to the 10 participants. Find the correlation using spearman's rank correlation.

Judge X	1	2	3	4	5	6	7	8	9	10
Judge Y	6	2	9	7	1	4	8	3	10	5

PART – C (5 × 12 = 60 Marks)
Answer ALL Questions

28. a.i. The chances of x, y and z becoming managers are 4:3:2. The probability that bonus scheme will be introduced if x, y and z become manager 0.3 and 0.5 and 0.8 respectively.(I) what is the probability that the bonus scheme would be introduced? (II) if it is introduced. What will be the probability that will be Z,

ii. A random variable X has the following probability distribution

X:	−2	−1	0	1	2	3
P(X)	0.1	K	0.2	2K	0.3	3K

    - (I) Find K
    - (II) P(− 2 < X < 2)
    - (III) Mean and variance

(OR)

b. The density function of a continuous random variable X is given by

$$f(x)\begin{cases} ax & ,0 \le x \le 1 \\ a & ,1 \le x \le 2 \\ 3a - ax & ,2 \le x \le 3 \\ 0 & ,otherwise \end{cases}$$

    - (i) Find the value of 'a'. (ii) Find the C.D.F of X.

29. a. Fit a binomial distribution for the following:

X	0	1	2	3	4	5	6	7	8
f	2	6	24	63	64	50	36	10	1

b. In a normal distribution, 7% of the items are under 35 and 89% are under 63. What are the mean and SD of the distribution?

    12   4   2

30. a. If X_1, X_2 are the two random observations drawn from a population with mean θ and variance σ^2 verify whether the following statistic (estimator) are unbiased and consistent for θ.

    12   3   2

    (i) $t_1 = \dfrac{3x_1 + x_2}{4}$

    (ii) $t_2 = \dfrac{2x_1 + 3x_2}{10}$

(OR)

b. Find the most likely estimator of

    12   3   2

$$f(x, \theta) = \frac{1}{\theta} e^{-\frac{x}{\theta}} x \geq 0, \theta \geq 0$$

31. a. The nicotine contents in milligrams in tow samples of tobacco were found to be as follows

    12   1   4

Sample A	24	27	26	21	25	-
Sample B	27	30	28	31	32	36

Can it be said that two samples come from normal populations.

(OR)

b. Given the following contingency table for hair colour and eye colour. Find the value of chi square. Is there good association between the two.

    12   1   4

		Hair colour			
		Fair	Brown	Black	Total
	Blue	15	5	20	40
Eye colour	Grey	20	10	20	50
	Brown	25	15	20	60
	Total	60	30	60	150

32. a. The following data relates to the ages of husbands and wives:

    12   1   5

Age of husbands	26	29	31	33	35	34	38	39	41	45
Age of wives	22	26	27	31	38	19	29	36	35	46

    (i)   Find the regression equations.
    (ii)   Find the age of the husband if the wife's age is 30.
    (iii)   Find the wife's age when the husband's age is 32.

(OR)

b. A tea company appoints four salesmen A, B, C and D and observes their sales in three seasons-summer, winter and monsoon. The out sales in 1000 of units given below.

    12   1   5

Seasons	A	B	C	D
Summer	38	40	41	39
Winter	45	42	49	36
Monsoon	40	38	42	42

Test whether there is a significant difference among seasons and among salesmen using ANOVA.

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