B.E. / B.Tech./ M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Third Semester

Computer Science and Engineering

(Common to Information Technology and M.Tech. - Computer Science and Engineering)

20BSMA304 - STATISTICS AND LINEAR ALGEBRA

Regulations - 2020

(Use of Statistics tables is permitted)

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K–Level	CO

1. Which is not a measure of central tendency? — 1, K1, CO1
   (a) Mean   (b) Median   (c) Mode   (d) Range

2. Normal distribution is symmetric about ---? — 1, K1, CO1
   (a) Mean   (b) Standard deviation   (c) Variance   (d) Covariance

3. The choice of one-tailed test and two-tailed test depends upon: — 1, K1, CO2
   (a) Null hypothesis   (b) Alternative hypothesis
   (c) Composite hypotheses   (d) None of these

4. Student's t-test is applicable only when: — 1, K1, CO2
   (a) $n \leq 30$ (b) $n > 30$ (c) $n \neq 30$ (d) None of these

5. Consider the following two subsets of vector space — 1, K2, CO3
   $S_1 = \{(x_1, x_2), x_1 + x_2 > 0\}$ and $S_2 = \{(x_1, x_2), x_1^2 + x_2^2 \leq 1\}$, then
   (a) S_1 be a subspace of $V_2(R)$ but not S_2 (b) S_2 be a subspace of $V_2(R)$ but not S_1
   (c) Both are be a subspace of $V_2(R)$ (d) Neither S_2 nor S_1 is a subspace of $V_2(R)$

6. If $S = \{v_1, v_2, \ldots, vn\}$ is a set of vectors in a finite dimensional vector space V, then S is called a basis for V if: — 1, K2, CO3
   (a) S spans V   (b) S is linearly independent (c) either (a) or (b)   (d) both (a) and (b)

7. Let $T : R5 \rightarrow R3$ be the linear transformation defined by — 1, K1, CO4
   $T(x_1, x_2, x_3, x_4, x_5) = (x_1 + x_2, x_2 + x_3 + x_4, x_4 + x_5)$. Find the nullity of the standard matrix for T.
   (a) 5   (b) 3   (c) 2   (d) 1

8. A matrix that is both symmetric and upper triangular must be a — 1, K2, CO4
   (a) diagonal matrix   (b) non-diagonal but symmetric
   (c) both (a) and (b)   (d) none of the above

9. If the inner product between the vectors vanishes then what will be the angle between them? — 1, K2, CO5
   (a) 45   (b) 90   (c) 90   (d) 0

10. The Gram-Schmidt process orthogonalizes vectors by subtracting _____. — 1, K2, CO5
    (a) taking square roots   (b) projections   (c) the y-components   (d) the x-components

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. What is the kurtosis of Normal distribution? — 2, K1, CO1

12. If X is a normal random variable with mean 3 and variance 9, find the probability that X is between 2 and 5. — 2, K2, CO1

13. What is the angle between the regression lines? — 2, K1, CO1

14. What are Type1 and Type 2 errors? — 2, K1, CO2

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   ***13709***

No.	Question	Marks	K	CO
15.	What are the assumptions on which small sample test(students t-test) is based?	2	K1	CO2
16.	What are the applications of chi-square test?	2	K1	CO2
17.	Define vector space.	2	K1	CO3
18.	Is $\{(1,4,-6), (1,5,8), (2,1,1), (0,1,0)\}$ is a linearly independent subset of R^3 ?	2	K2	CO3
19.	Find the matrix [T] whose linear operator $is\, T(x, y) = (5x + y, 3x - 2y)$	2	K2	CO4
20.	Write the conditions for a matrix A to be diagonalizable.	2	K2	CO4
21.	In C ([0,1]), let $f(t) = t$, $g(t) = e^t$, then evaluate $<f, g>$.	2	K2	CO5
22.	State Triangle inequality in inner product space.	2	K2	CO5

PART - C ($6 \times 11 = 66$ Marks)
Answer ALL Questions

23. a) (i) For a distribution Karl Pearson's coefficient of skewness is 0.64, standard deviation is 13 and mean is 59.2 Find mode and median. — 6 — K3 — CO1

    (ii) A car hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the proportion of days on which (i) some demand is refused (ii) neither car is used. — 5 — K3 — CO1

OR

    b) Obtain the correlation coefficient for the following. — 11 — K3 — CO1

X	22	26	29	30	31	31	34	35
Y	20	20	21	29	27	24	27	31

24. a) (i) In a random sample of 400 persons from a large population 120 are females. Can be it said that males and females are in the ratio 5:3 in population. Use 10% level of significance. — 6 — K3 — CO2

    (ii) A sample of 26 bulbs gives a mean life of 990 hours with a SD of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Is the sample not up to the standard? — 5 — K3 — CO2

OR

    b) The theory predicts that the proportion of beans in the whole group A,B,C,D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the 4 groups were 882,313,287,118. Does the experimental result support the theory? — 11 — K3 — CO2

25. a) Let V denote the set of ordered pairs of real numbers. If (a_1, a_2) and (b_1, b_2) are elements of V and $c \in R$, $define\ (a_1, a_2) + (b_1, b_2) = (a_1 + b_1, a_2 + b_2)\ and\ (a_1, a_2) = (ca_1, ca_2)$. Is V a vector space over R with these operations? Justify your answer. — 11 — K3 — CO3

OR

    b) Determine the following set is a linearly independent (or) linearly dependent $\{x^3 + 2x^2, -x^2 + 3x + 1, x^3 - x^2 + 2x - 1\} in\, P_3(R)$. — 11 — K3 — CO3

26. a) Let $T: R^3 \rightarrow R^3$ be a linear transformation defined by $(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$. Evaluate a basis and dimension of null space N(T) and range space R(T) and range space R(T). Also verify dimension theorem. — 11 — K3 — CO4

OR

    b) Check whether A= $\begin{pmatrix} 2 & 2 & -7 \\ 2 & 1 & 2 \\ 0 & 1 & -3 \end{pmatrix}$ is diagonalizable or not using modal matrix. — 11 — K3 — CO4

27. a) Let R^3 have the Euclidean inner product. Use the Gram –Schmidt process to transform the basis (u_1, u_2, u_3) into an orthonormal basis, where $u_1 = (1, 1, 1), u_2 = (0, 1, 1)$ and $u_3 = (0, 0, 1)$. **11 K3 CO5**

OR

b) Let V be the vector space of polynomial with inner product given by $<x, y> = \int f(t)g(t)dt$. Let $f(t) = t + 2$ and $g(t) = t^2 - 2t - 3$, find (i) $<f, g>$ (ii) $\|f\|$ (iii) $\|g\|$. **11 K3 CO5**

28. a) (i) Let V and W be the vector spaces and $T: V \rightarrow W$ be linear. Then prove that N(T) and R(T) are subspaces of V and W respectively. **6 K3 CO4**

   (ii) State and prove Cauchy-Schwarz inequality in an inner product space. **5 K3 CO5**

OR

b) (i) Let $T: R^2 \rightarrow R^3$ defined by $(a_1, a_2) = (a_1 + a_2, 0, 2a_1 - a_2)$. Find the basis for N(T) and compute N(T). **6 K3 CO4**

   (ii) Let T:$P_2(R) \rightarrow P_3(R)$ be defined by $T(f(x)) = 2f'(x) + 3\int_0^x f(t) \, dt$. Determine whether T is one-one or not. **5 K3 CO5**