

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

First Semester

M.E. Big Data Analytics

24PBDMA101 - MATHEMATICS FOR DATA SCIENCE

Regulations - 2024

(Use of *Statistical Table* is permitted)

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

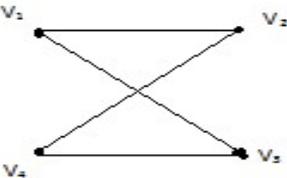
Answer ALL Questions

	Marks	K- Level	CO
1. Let R be a relation on a set A and let I_A denote the identity relation on A. Then R is anti symmetric if and only if (a) $R = R^{-1}$ (b) $R \cup R^{-1} \subseteq I_A$ (c) $R \cap R^{-1} \subseteq I_A$ (d) None of above	1	K1	CO1
2. A vertex of degree one is called _____ vertex (a) Isolated (b) Pendent (c) Perpendicular (d) Simple	1	K1	CO1
3. In how many different ways can five men and five women sit around a table? (a) 0! (b) 10! (c) 0 (d) 9!	1	K2	CO2
4. The mean of a Normal distribution is _____ (a) $\lambda + \lambda^2$ (b) μ^2 (c) λ (d) μ	1	K1	CO2
5. Which of the following is the probability calculus of beliefs, given that beliefs follow certain rules? (a) Bayesian probability (b) Frequency probability (c) Frequency inference (d) Bayesian inference	1	K1	CO3
6. Which of the following is the degrees of freedom of chi square distribution? (a) n+1 (b) n (c) 2n (d) n-1	1	K1	CO3
7. In a Bayesian network, what do the nodes represent? (a) Rules (b) Probabilities (c) Random variables (d) Neural Layers	1	K1	CO4
8. The value of Karl Pearson's coefficient of correlation ranges between: (a) 0 and +1 (b) -1 and +1 (c) -1 and 0 (d) $-\infty$ and ∞	1	K1	CO4
9. In any vector space V, the additive identity is _____ (a) Distinct (b) Same (c) Unique (d) All the above	1	K1	CO5
10. Rank T + null T = _____ (a) dim V (b) ker V (c) rank V (d) null V	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. Find the adjacency matrix of the following graph	2	K2	CO1
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12. In a class of 30 students, 18 play football, 12 play basketball, and 6 play both. How many students play only football?	2	K2	CO1
13. How many permutations are there in the word MISSISSIPPI?	2	K2	CO2
14. The mean of a binomial variate X is 20 and S.D. is 4. Find the parameters of the distribution.	2	K2	CO2

15. The demand for a product on each of 20 days was as follows, (in units). 3, 12, 7, 17, 3, 14, 9, 6, 11, 10, 1, 4, 19, 7, 15, 6, 9, 12, 12, 8. Calculate the mean 2 K2 CO3
16. Write down the formula of test statistics 't' to test the significance of difference between the means. 2 K1 CO3
17. What are the two main components of a Bayesian network? 2 K1 CO4
18. State the interpretation of $r = 0$, $r = 1$, and $r = -1$. 2 K1 CO4
19. State the necessary and sufficient condition for a subset of a vector space to be subspace. 2 K1 CO5
20. Prove that the transformation T is linear if and only if $T(cx + y) = cT(x) + T(y)$. 2 K2 CO5
21. Write any two applications of χ^2 test. 2 K1 CO3
22. Define Karl Pearson's coefficient of correlation. 2 K1 CO4

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) (i) Define types of relation with examples. 6 K2 CO1
 (ii) Let R be the relation on the set $A = N \times N$, where N is the set of all natural numbers, defined by $(x, y)R(u, v)$ if and only if $xv = yu$. Show that R is an equivalence relation. 5 K3 CO1

OR

- b) Prove that a simple graph with 'n' vertices and 'k' components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. 11 K3 CO1

24. a) A random variable X has the following probability function: 11 K3 CO2

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

Find the value of

- (i) k.
 (ii) $P[X < 6], P[X \geq 6]$.
 (iii) the minimum value of c for $P[X \leq c] > \frac{1}{2}$.

OR

- b) The number of monthly breakdown of a computer is a random variable having Poisson distribution with mean 1.8. Determine the probability that this computer will function for a month 11 K3 CO2
 (i) Without a breakdown
 (ii) With only one breakdown
 (iii) With at least one breakdown.

25. a) Assume that the expectation of the measurement is equal to 3.5, regardless of what the type of treatment that the patient received. We take the standard deviation of the measurement for patients that receive an active magnet to be equal to 3 and for those that received the inactive we take it to be equal to 1.5. Assume that the distribution of the measurements is normal and there are 29 patients in the first group and 21 in the second. Find the interval that contains 95% of the sampling distribution of the statistic. 11 K3 CO3

OR

- b) Two random samples gave the following results:

11 K3 CO3

Samples	Size	Sample mean	Sum of squares of deviation from the mean
1	10	15	90
2	12	14	108

Examine whether the samples come from the same population.

26. a) A person has undertaken a job. The probability of completing the job on time if it rains is 0.44, and the probability of completing the job on time if it does not rain is 0.95. If the probability that it will rain is 0.45, then determine the probability that the job will be completed on time. 11 K3 CO4

OR

- b) Calculate the coefficient of correlation between age of husband and age of wife from the following data: 11 K3 CO4

Husband age	17	20	22	27	21	29	26	30	28	30
Wife age	22	27	28	28	29	30	31	34	25	36

27. a) Test whether $(1, -2, 5)$ is a linear combination of $(1, 1, 1)$, $(1, 2, 3)$, $(2, -1, 1)$. 11 K3 CO5

OR

- b) Let $T: R^2 \rightarrow R^3$ is a linear transformation such that $T(1, 1) = (1, 0, 2)$, $T(2, 3) = (1, -1, 4)$. Then find 11 K3 CO5
- T
 - $T(2, 5)$, $T(8, 11)$
 - Rank T
 - Is T one to one and onto?

28. a) Find the moment generating function, mean and variance of a random variable for Poisson distribution. 11 K3 CO2

OR

- b) Find the moment generating function, mean and variance of a random variable for Binomial distribution. 11 K3 CO2