

THE KAVERY ENGINEERING COLLEGE
(An Autonomous Institution)

M.E/MCA DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

First Semester

Computer Science and Engineering

PAPT2411/MA4151 – Applied Probability and Statistics for Computer Science Engineers
(Common to Master of Computer Applications)

Regulations - 2021

Duration : 3 Hrs

Maximum Marks: 100

PART - A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks
1.	In $P_2(x)$ the inner product is given by $\langle p, q \rangle = a_0 b_0 + a_1 b_1 + a_2 b_2$. Find $\ q\ $, if $q(x) = 2x^2 - x + 1$.	UN	1	2
2.	Define the term subspace of a vector space.	RE	1	2
3.	Define geometric distribution.	UN	2	2
4.	The moment generating function of a random variable X is given by $M_X(t) = e^{3(e^t - 1)}$. Find $P(X = 1)$.	UN	2	2
5.	X and Y are independent random variables with variance 2 and 3. Find the variance of $3X + 4Y$.	UN	3	2
6.	Find the means of X and Y from the regression equations $5x - y = 22$ and $64x - 45y = 24$.	UN	3	2
7.	A sample of 900 members has a mean of 3.4 cms and S.D 2.61 cms. Is the sample from a large population of mean 3.25 and S.D 2.61 cms. Test at 5% level of significance.	AP	4	2
8.	Mention any two applications of T-distribution.	UN	4	2
9.	Define random vectors and matrices.	RE	5	2
10.	What are the objectives of principal components analysis.	RE	5	2

PART - B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)

Q.No	Questions	BLT	CO	Marks
11.	a Prove that the set of all n-tuples is a vector space over a field F.	AP	1	13
	Or			
	b Construct the QR decomposition of matrix $\begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$.	AP	1	13
12.	a i Find moment generating function, mean and variance of binomial distribution.	AP	2	7
	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 poisson variate with mean 1.5. Calculate the proportion of days on which (i) Neither car is used (ii) some demand is refused.	AP	2	6

Or

- b i Find moment generating function, mean and variance of exponential distribution. AP 2 7
- ii The weekly wages of 1000 workmen are normally distributed around a mean of Rs. 70 with a S.D of Rs. 5. Estimate the number of workers whose weekly wages will be (i) between Rs.69 and Rs.72 (ii) less than Rs.69. AP 2 6

13. a i The joint probability density function of the two-dimensional random variable is $f(x, y) = \begin{cases} \frac{8}{9}xy & , 1 < x < y < 2 \\ 0 & , \text{otherwise} \end{cases}$
 (i) Find the marginal density functions of X and Y .
 (ii) Find the conditional density function of Y given $X = x$. AP 3 6

- ii A sample of 12 fathers and their eldest sons have the following data about their heights in inches. Find the correlation coefficient. AP 3 7

Fathers	65	63	67	64	68	62	70	66	68	67	69	71
Sons	68	66	68	65	69	66	68	65	71	67	68	70

Or

- b

Marks in Economics	25	28	35	32	31	36	29	38	34	32
Marks in Statistics	43	46	49	41	36	32	31	30	33	39

 AP 3 13

From the above data, find

- (i) The two regression equations
 (ii) The coefficient of correlation between the marks in economics and statistics

The most likely marks in statistics when marks in economics are 30.

14. a Two random samples gave the following results AP 4 13

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

Test whether the samples come from the same normal population.

Or

- b Given the following contingency table for hair colour and eye colour. Find the value of χ^2 . Is there good association between the two. AP 4 13

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

15. a i Find the mean and covariance matrix for the two random variable X_1 & X_2 for the given joint probability function $P_{12}(X_1, X_2)$ is

X_2	0	1
X_1		
-1	0.24	0.06
0	0.16	0.14
1	0.40	0

- ii Suppose $\Sigma = \begin{pmatrix} 4 & 1 & 2 \\ 1 & 9 & -3 \\ 2 & -3 & 25 \end{pmatrix}$ obtain $V^{1/2}$ and ρ (Standard deviation).

Or

- b Suppose we have the following population of four observations made on three random variables X_1, X_2, X_3 . Find the three population principal components Y_1, Y_2, Y_3 .

X_1	X_2	X_3
1.0	6.0	9.0
4.0	12.0	10.0
3.0	12.0	15.0
4.0	10.0	12.0

PART – C (Marks 1*15 = 15)

Q.No	Questions	BLT	CO	Marks
16. a	The joint probability density function of two dimensional random variable (X, Y) is $f(x,y)=x+y$, $0 < x, y < 1$. Find the correlation coefficient between X & Y.	AP	2	15
Or				
b i	A factory production line is manufacturing bolts by using machines, A, B & C. Of the total output, machine A is responsible for 25%, machine B for 35% and machine C for the rest. It is known from previous experience with the machines that 5% of the output from machine A is defective, 4% from machine B and 2% from machine C. A bolt is chosen at random from the production line and found to be defective. What is the probability that it came from (a) machine A (b) machine B (c) machine C?	AP	2	8
ii	Before an increase in excise duty on tea, 800 people out of a sample of 1000 were consumers of tea. After the increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is significant decrease in the consumption of tea after the increase in duty.	AP	4	7