Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2026

Fourth Semester

Department of Artificial Intelligence and Data Science

MA3391 / UMAT24402 – PROBABILITY AND STATISTICS

Statistical tables can be permitted

Regulations – 2021/2024

Duration : 3 Hrs ***Maximum : 100 Marks***

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

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	A fair coin was tossed two times. Given that the first toss resulted in heads, find the probability that both tosses resulted in heads?	L2	1	2
2.	Let X be a uniformly distributed random variable over (0,1). Determine the moment generating function.	L2	1	2
3.	A discrete random variable X has the probability distribution given below x: 0.5, 1, 1.5, 2 P(x): 2k, 3k, 3k, 2k Find the value of k.	L3	2	2
4.	If X and Y are independent random variables, show that they are uncorrelated.	L2	2	2
5.	Data pertaining to height of 5 school students are given as 149, 150, 151, 138, 148 cms. Obtain a point estimate for the mean μ.	L2	3	2
6.	Write the properties of maximum likelihood estimators.	L1	3	2
7.	Write the advantages of nonparametric test.	L1	4	2
8.	Define Kolmogorov-Smirnov Test.	L1	4	2
9.	List the control charts for attributes.	L1	5	2
10.	Find the lower and upper control limits for np-chart when n=100 and $\bar{p}$=0.096.	L2	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	For a certain binary, communication channel, the probability that a transmitted '0' is received as a '0' is 0.95 and the probability that a transmitted '1' is received as '1' is 0.90. If the probability that '0' is transmitted is 0.4. Find the probability that (i) '1' is received (ii) '1' was transmitted given that a '1' was received.	L2	1	8
		i	A random variable 'X' has the following probability function X: 0, 1, 2, 3, 4, 5, 6, 7, 8 P(x): a, 3a, 5a, 7a, 9a, 11a, 13a, 15a, 17a	L3	1	8
		i				

Determine the value of 'a'.
Find $P(X < 3), P(X \geq 3), P(0 < X < 3)$

Or

b	i	Find the moment generating function of Poisson distribution. Also find its mean and variance.	L2	1	8
	ii	In a test of 2000 electric bulbs. It was found that the life of a particular make was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for i) more than 2150 hours ii) less than 1950 hours iii) more than 1920 hours and less than 2160 hours.	L3	1	8
12.	a	i	Let X and Y be discrete random variable with probability function $f(x,y) = \begin{cases} k(2x+y), & x = 1,2; y = 1,2 \\ 0, & otherwise \end{cases}$, where k is a constant. • What is the value of k? • Find the marginal PMFs of X and Y • Are X and Y independent?	L3	2	16

Or

b	i	From the following data, find the two regression equations, correlation coefficient between the marks in economics and statistics and the most likely marks statistics when marks in economics are 30	L3	2	16

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

13.	a	i	Let X be exponentially distributed with parameter λ. Using maximum likelihood estimation, find an estimate for the parameter λ.	L2	3	8
		ii	If 83 male students are randomly chosen and yield an average of 6.6 hours of sleep with a standard deviation of 1.8 and 65 females are randomly selected with an average of 6.9 hours of sleep with a standard deviation of 1.5. Construct a 95% confidence interval for the difference between the two mean sleep hours for males and females.	L3	3	8

Or

b	i	Let $x_1, x_2, \ldots . x_n$ is a random sample from a normal population $N(\mu, 1)$. Show that $t = \frac{1}{n}\sum_{i=1}^{n} x_i^2$ is an unbiased estimator of $\mu^2 + 1$	L2	3	8
		ii	It is desired to determine whether there is less variability in the silver plating done by Company 1 than in that done by Company 2. If independent random samples of size 12 of the two companies' work yield s_1=0.035 mil and s_2=0.062 mil, test the null hypothesis $\sigma_1^2 < \sigma_2^2$ at the 0.05 level of significance.	L3	3	8
14.	a	i	A certain injection administered to each of 10 patients resulted in the following increases of blood pressure: 1, 1, 2, 3, 4, 4, 6, 7, 7, 10. Can it be concluded that the injection will be, in general, Using sign test accompanied by increase in B.P.?	L3	4	8
		ii	Suppose that in a study of sedimentary rocks, the following diameters (in millimeters) were obtained for two kinds of sand.	L3	4	8

			Sand I: 0.63 0.47 0.17 1.36 0.35 0.51 0.49 0.45 0.18 0.84 0.43 0.32 0.12 0.40 0.20 **Sand II**: 1.13 1.01 0.54 0.48 0.96 0.89 0.26 1.07 0.39 1.11 0.88 0.58 0.92 0.53 0.46 Use the U test at the 0.01 level of significance to test the null hypothesis that the two samples come from identical populations against the alternative hypothesis that the populations are not identical.			
			Or			
	b	i	Test whether the following two samples have been drawn from the same population, using Rank sum test: Sample I : 134, 146, 104, 119, 124, 161, 107, 113, 94 Sample II : 70, 101, 118, 85, 107, 132, 94, 97	L3	4	8
		i	Test for the randomness of the following set of 26	L3	4	8
		i	Observations : 24, 35, 12, 50, 60, 70, 68, 49, 80, 25, 69, 28, 28, 31, 37, 34, 54, 75, 45, 95, 75, 26, 43, 57, 94, 48.			
15.	a	i	Construct a control chart for defectives for the following data: Sample No : 1 2 3 4 5 6 7 8 9 10 No inspected : 90 65 85 70 80 80 70 95 90 75 No of defectives : 9 7 3 2 9 5 3 9 6 7	L3	5	8
		i	10 tape-recorders were examined for quality control test. The number of	L3	5	8
		i	defects in each tape-recorder is recorded below. Draw the appropriate control chart and comment on the state of control. No of units : 1 2 3 4 5 6 7 8 9 10 No of defects : 2 4 3 1 1 2 5 3 6 7			
			Or			
	b	i	10 samples each of size 50 were inspected and the number of defectives in the inspection were 2, 1, 1, 2, 3, 5, 5, 1, 2, 3. Consider a p-char and np-chart for each sample. Assuming special causes for out-of control points, find the revised control limits.	L3	5	16

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