SASTRA
DEEMED TO BE UNIVERSITY

School of Arts, Sciences, Humanities & Education
First CIA – April 2022
Course Code: MAT244
Course Name: Statistical Modeling
Duration: 90 Minutes Max Marks: 50

Answer all the questions. **PART A** **10 x 2 = 20 Marks**

1.	Define point estimation and interval estimation with example.
2.	Define the properties *p* & *d* of ARIMA(p,d,q) model.
3.	Elucidate Multiple correlation coefficients.
4.	Given $r_{12} = 0.80$, $r_{23} = -0.56$, $r_{31} = -0.40$. Find ω & ω_{12}.
5.	What is time series analysis?
6.	List any 4 properties of multiple correlation.
7.	We have $r_{12} = 0.82$, $r_{23} = -0.57$, $r_{13} = 0.42$. Find $R_{2.31}$
8.	What is a smoothing forecasting model?
9.	Explain Auto correlation coefficient with distances 'k' apart.
10.	Write the formula to find the regression equation of X_2 on X_1 and X_3, explaining each notation used.

Answer all the questions. **PART B** **3 x 10 = 30 marks**

11. A student counted the number of words in an essay she had written, recording the total every 10 lines.

No. of lines(x)	10	20	30	40	50	60	70	80
No. of	75	136	210	291	368	441	519	588

words(y)									

a. Find the formula to convert the lines to words. (7)

b. How many words (approximately) has she written if she writes i) 65 lines ii) 100 lines iii)1000 lines.(3)

12. From the following data, obtain the multiple correlation coefficients $R_{1.23}$ and $R_{3.12}$.

X1	2	5	7	11
X2	3	6	10	12
X3	1	3	6	10

13. The number of visitors to a cycle track and the number of drinks sold by a café at the location are recorded in the table below.

	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
No. of visitors	32	45	39	43	58	84	65
Drinks sold	17	20	23	7	24	49	38

a. Draw a scatter diagram for the above data.(2)

b. Find Karl Pearson's correlation coefficient.(5)

c. If 12 additional drinks were sold on Thursday, what would be the change in the correlation coefficient? Comment on your result.(3)

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Second CIA – June 2022
Course Code: MAT244
Course Name: Statistical Modeling
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Use of statistical tables is permitted

Answer all the questions. **PART A** **10 x 2 = 20 Marks**

1.	Define a parameter space.
2.	Name the characteristics of a good estimator.
3.	Explain the sufficient condition for consistency.
4.	How do you calculate the efficiency of an estimator which is not the most efficient estimator?
5.	Define the invariance property of a sufficient estimator.
6.	Write the necessary and sufficient condition for a distribution to admit sufficient statistic.
7.	List the assumptions of ANOVA.
8.	List any two regularity conditions.
9.	Distinguish between simple statistical hypothesis and composite statistical hypothesis.
10.	What is a critical region and when is it called the most powerful critical region?.

Answer any three questions. **PART B** **3 x 10 = 30 marks**

11.	Four brands A, B, C, D of flashlight batteries are to be compared by testing each brand in five flashlights. Twenty flashlights are randomly selected and divided randomly into four groups of five flashlights each. Then each group of flashlights uses a different brand of battery. The lifetimes of the batteries, to the nearest hour,

	are as follows. Preliminary data analyses indicate that the independent samples come from normal populations with equal standard deviations.

A	B	C	D
42	28	24	20
30	36	36	32
39	31	28	38
28	32	28	28
29	27	33	25

At the 5% significance level, does there appear to be a difference in mean lifetime among the four brands of batteries?

12. State and prove Neyman Pearson Lemma.

13. A random sample X_1, X_2, X_3 of size 3 is drawn from a normal population with unknown mean μ and variance σ^2. Consider the following estimators to estimate μ:

i. $T_1 = X_1 + X_2 - X_3$

ii. $T_2 = 2X_1 + 3X_3 - 4X_2$

iii. $T_3 = \frac{\lambda X_1 + X_2 + X_3}{3}$

where λ is such that T_3 is an unbiased estimator of μ. Find λ. Are T_1&T_2 unbiased? State giving reasons, the estimator which is the best among the three.

14. Let p be the probability that a coin will fall head in a single toss in order to test $H_0: p = \frac{1}{2}$ against $H_1: p = 3/4$. The coin is tossed 5 times and H_0 is rejected if more than heads are obtained. Find the size of the critical region and the power of the test.

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Answer all the questions. PART A 5 x 2 = 10 Marks

1. Explain linear & multiple correlation.
2. Explain Type I & Type II error.
3. Write any 2 differences between parametric and non-parametric tests.
4. Find the likelihood function for a random sample of size n from a Normal population with mean μ and variance σ^2
5. Write the syntax of 'nested functions'.

Answer the following PART B 2 x 15 = 30 marks

11. 10 competitors in a beauty contest were ranked by 3 judges X, Y, Z as follows:

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

Which pair of judges has the nearest approach to common tastes in beauty?

(OR)

12.	Define a likelihood function. When is it called a Maximum Likelihood function? Find the Maximum Likelihood Estimator for the parameter λ of a Poisson distribution on the basis of a sample of size n.
13.	On a commuter train, the conductor wants to see whether the passengers entering a train enter in a random manner. He observes the first 25 people, with the following sequence of males (M) and females (F). F F F M M F F F F M F M M M F F F F M M F F F M M Test for randomness at $\alpha = 0.05$
	(OR)
14.	i) Create a matrix A with 26 English alphabets with 2 rows, byrow true, and with row and column names. ii) Write an R program to calculate the LCM and GCD of two numbers. (5 + 10)

Answer the following. PART C **1 x 10 = 10 marks**

15.	A research is conducted about the IQ level of the students of different departments in a school. Data of the IQ test result in terms of percentage is recorded. Is there any significant difference between the different departments of studies?

Science	Arts	Commerce
45	40	80
50	70	70
60	50	45
78	69	70