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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester B.Sc Degree Examination, April 2025

STA2CJ101 – Bivariate Data Analysis

(FYUGP 2024 Admission)

Time: 2 hours

Max. Marks : 70

(Use of Scientific Calculator is permitted)

Course Outcome Mapping Scheme

Q.NO	1	2	3	4	5	6	7	8	9	10
COS	CO2	CO2	CO4	CO3	CO2	CO3	CO1	CO2	CO1	CO3
Q.NO	11	12	13	14	15	16	17	18	19	20
COS	CO3	CO2	CO1	CO2	CO2	CO1	CO2	CO3	CO2,CO3	CO4

PART-A

[All questions can be attended. Each question carries 3 marks]

1. Distinguish between partial and multiple correlation coefficient
2. Describe direct and inverse correlation.
3. Discuss the term independence of attributes
4. Comment on the coefficient of correlation between two variables X and Y , if the angle between the regression lines (i) 0^0 and (ii) 90^0 .
5. If $r_{12} = r_{23} = r_{13} = r$, find the value of $r_{12.3}$
6. State and establish any two properties of regression coefficients
7. What is a scatter diagram and what role does it play in regression theory
8. The coefficient of correlation between X and Y is 0.60. Their covariance is 4.80 and variance of X is 9. Find the standard deviation of Y .
9. Explain the principle of least squares
10. Define regression analysis and explain why there are two regression lines

(Maximum Mark= 24)

PART-B

[All questions can be attended. Each question carries 6 marks]

11. If $\sigma_x = 6, \sigma_y = 10$ and $Cov(x,y) = -30$, find the correlation between X and Y . Comment on the same. Also find the regression coefficients.

12. Give any two merits of rank correlation coefficient. Calculate the rank correlation coefficient between the educational status (X) and age at marriage (Y)

Rank of $(X,Y) = (1,5), (2,4), (4, 1), (5,3), (3,2)$

13. Derive the normal equations for fitting a second degree polynomial

14. From the data relating to the yield of bark (X_1) height (X_2) and thickness (X_3) of 18 cinnamon plants, the following yields were obtained $r_{12} = 0.77$, $r_{13} = 0.72$ and $r_{23} = 0.52$

Find the partial correlation coefficient $r_{12.3}$ and multiple correlation coefficient $R_{1.23}$.

15. Show that Pearson's coefficient of correlation is invariant under linear transformation

16. Fit a straight line to the following data

X	1	4	3	7	5	10
Y	9	12	7	10	12	8

17. Write down the properties of partial and multiple correlation coefficient

18. Form two regression equations from the following data

Age of husband	25	30	40	42	50	28	34	27
Age of wife	24	26	32	39	46	22	30	23

(Maximum Mark= 36)

PART-C
[Each question carries 10 marks. Answer any one Question]

19. (a) Show that Karl Pearson's coefficient of correlation is independent of change of origin and scale

(b) Given the regression line to be $2x + 18y = 326$ and $x + 2y = 33$. Find mean of x and y. Also find correlation coefficient between x and y.

20. (a) What do you understand by association of attributes. Discuss the methods by which it is measured

(b) Find if A and B are independent, positively associated or negatively associated in each of the following cases

(i) N = 1000, (A) = 470, (B) = 620 and (AB) = 320

(ii) (A) = 490, (AB) = 294, (α) = 570 and (αB) = 380

(iii) (AB) = 256, (αB) = 768, ($A\beta$) = 48 and ($\alpha\beta$) = 144

(1x10= 10 Marks)

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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester B.Sc Degree Examination, April 2025

ACT2MN101(P) – Actuarial Mathematics II

(FYUGP 2024 Admission)

Time: 2 hours   Max. Marks : 70

(Use of Scientific Calculator and Actuarial table are permitted)

PART – A
All questions can be attended.
Each question carries **Three** mark.
Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	What is a life table?	CO1	1	3
2	What is the force of mortality?	CO1	2	3
3	What is a whole life assurance contract?	CO2	1	3
4	How does a term assurance contract differ from a whole life contract?	CO2	2	3
5	Derive a simple relationship between $\bar{a}$ and a_x.	CO3	2	3
6	What are deferred assurance benefits?	CO3	2	3
7	What is a life annuity contract?	CO4	1	3
8	What are joint life functions?	CO4	2	3
9	Assuming that both lives are independently subject to AM92 mortality, calculate $\mu_{38:30}$	CO5	3	3
10	Calculate $_3q_{\overline{50:50}}$ assuming that the two lives are both independently subject to AM92 Ultimate mortality.	CO5	3	3

PART – B
All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Suppose that in a particular life table: $l_x = 100 - x$ for $0 \le x \le 100$. Calculate the curtate expected future lifetime of a newborn life.	CO1	3	6

12	In a certain population, the force of mortality equals 0.025 at all ages. Calculate: (i) the probability that a new-born baby will survive to age 5 (ii) the probability that a life aged exactly 10 will die before age 12 (iii) the probability that a life aged exactly 5 will die between ages 10 and 12	CO1	3	6
13	A life assurance policy pays a benefit of £20,000 at the end of the policy year of death of a life now aged exactly 55, provided that death occurs after exact age 60. Calculate the expected present value of this benefit assuming that the effective annual rate of interest is 4% and mortality follows the AM92 Ultimate table.	CO2	3	6
14	A whole life assurance contract, under which the sum assured of £40,000 is payable immediately on death, is issued to a life aged exactly 35. Using AM92 Select mortality and an interest rate of 6% pa effective, calculate: (i) the expected present value of the benefits (ii) the variance of the present value of the benefits.	CO2	3	6
15	A 50-year-old woman purchases a deferred annuity to provide herself with an income of £15,000 pa, paid annually in advance from age 70 until death. Calculate the expected present value of the benefits from this deferred annuity, using PFA92C20 mortality, and an interest rate of 4% pa effective.	CO2	3	6
16	Derive the following expressions for a whole life immediate annuity in arrears. a) Present value b) Expected present value c) Variance of present value	CO4	5	6

17	(i) Explain what it means for the joint life status 50 : 60 to fail within the next 10 years. (ii) Calculate the probability that the event described in part (i) occurs, assuming the two lives are independent with respect to mortality and: (a) The mortality of each life follows the ELT15 (Females) table (b) Each life is subject to a constant force of mortality of 0.025 pa.	CO5	6	6
18	Derive the mean and variance of joint life assurance functions.	CO5	5	6

PART - C
Answer any *one* question.
Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	Calculate the following probabilities using AM92 mortality: i) $\quad _2p_{[42]}$ ii) $\quad _2p_{42}$ iii) $\quad _3q_{[40]+1}$ iv) $\quad _{2\|}q_{[41]+1}$	CO1	4	10
20	An endowment assurance contract with a term of 10 years pays a sum assured of £100,000 immediately on death and a sum of £50,000 on survival for 10 years. Calculate the expected present value and variance of this contract. Basis: Mortality: $\mu_x = 0.03$ throughout Rate of interest: 5% per annum	CO2	5	10

1 x 10 = 10 Marks

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester B.Sc Degree Examination, April 2025

STA2MN101(P) – Probability Theory – I

(FYUGP 2024 Admission)

Time: 2 hours   Max. Marks : 70

(Use of scientific calculator and statistical tables are permitted)

Course Outcome Mapping Scheme

Q.NO	1	2	3	4	5	6	7	8	9	10
COS	CO1,CO2	CO1	CO1	CO3	CO3	CO6	CO6	CO5	CO5	CO5
Q.NO	11	12	13	14	15	16	17	18	19	20
COS	CO1	CO3	CO3	CO3	CO6	CO4	CO5	CO5	CO3	CO6

PART A

All questions can be attended. Each question carries 3 Marks.

Maximum Marks that can be scored in this part is 24 Marks

1. Define discrete random variable and probability density function.
2. Show that $V(X - Y) = V(x) + V(Y)$ when X and Y are independent.
3. State any three properties of expectation.
4. Define Poisson distribution with parameter m and find its moment generating function?
5. Find mean and variance of exponential distribution with parameter Θ?
6. Explain coefficient of determination.
7. What is the principle of least squares?
8. Distinguish between parameter and statistic with example.
9. Explain the terms (1) standard error (2) degrees of freedom
10. Define F and t distribution.

PART B
All questions can be attended. Each question carries 6 marks.
Maximum Marks that can be scored in this part is 36 marks.

11. Define row and central moment and establish the relation between them.
12. Find the mean, variance and moment generating function of Binomial distribution with parameter n and p

13. State and prove additive property of normal distribution $N(\mu,\sigma)$
14. Define rectangular distribution. Find its mean and variance.
15. Define correlation. Explain the different types of correlation.
16. The equation of two regressionlines are as follows $25x - 6y - 7 = 0$ and $9x - 4y = -15$. Obtain the mean values of X and Yand the correlation coefficient?
17. Define sampling distribution and derive the sampling distribution of sample mean from a normal population.
18. Find mean, variance and moment generating function of chi-square distribution with n degrees of freedom.

PART C
Answer any one questions and carries 10 Marks

19. In a test on 2000 electric bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and SD of 60 hours. Find the number of bulbs likely to burn for
    i)More than 2150 hours
    ii) Less than 1950 hours
    iii) More than 1950 hours but less than 2160 hours.

20. Calculate linear correlation coefficient for the data given below

X:	1	5	4	6	2	3	8	6	2	6
Y:	2	10	8	8	5	3	13	10	6	11

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FAROOK COLLEGE (AUTONOMOUS). KOZHIKODE

Second Semester B.Sc Degree Examination, April 2025

STA2MN105(P) – Introduction to probability

(FYUGP 2024 Admission)

Time: 2 hours　　　　　　　　　　　　　　　　　　Max. Marks : 70

(Use of scientific calculator is permitted)

PART – A
All questions can be attended.
Each question carries **Three** mark.
Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	Distinguish between positive and negative correlation	CO1	1	3
2	Write down the sample space of the random experiment of tossing of a coin until the head appears	CO3	5	3
3	List any three properties of regression coefficients	CO2	2	3
4	Define a discrete random variable	CO4	1	3
5	What are the limitations of rank correlation method	CO1	4	3
6	When do two regression lines coincide?	CO2	2	3
7	Define mutually exclusive events. Also give an example.	CO3	1	3
8	Draw a scatter diagram for zero correlation	CO1	3	3
9	Define distribution function of a random variable	CO4	1	3
10	State addition theorem for two events	CO3	1	3

PART – B
All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Describe the merits and limitations of Karl Pearson's coefficient of correlation	CO1	1	6

| 12 | Given the bivariate data:

| X | 1 | 5 | 3 | 2 | 1 | 1 | 7 | 3 |
Y	6	1	0	0	1	2	1	5	 Fit a regression line of Y on X and hence predict Y if X=5.	CO2	5	6
13	A random variable can take only two values, 0 and 1, each with probability ½. Find its distribution function. Also sketch its graph	CO5	3	6
14	Two unbiased dice are thrown. What is the probability of getting 'sum of the numbers shown is less than 5'	CO3	2	6
15	Define correlation and regression. What are the differences between correlation and regression.	CO2	2	6
16	Define continuous random variable with example. What is a density curve. If X be a continuous random variable with $f(x) = cx^3$, $0 < x < 1$. Find c.	CO5	3	6
17	If A and B are independent events in the sample space, show that A^c and B are also independent events	CO3	4	6
18	Ten competitors in a beauty contest are ranked by three judges in the following order 	I	1	6	5	10	3	2	4	9	7	8
II	3	5	8	4	7	10	2	1	6	9
III	6	4	9	8	1	2	3	10	5	7 | Use the rank correlation coefficient to determine which pair of judges has the nearest approach to common tastes in beauty.	CO1	5	6

PART - C
Answer any *one* questions.
Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	A random variable X has the following p.m.f. 	CO5	5	10

For question 19:

A random variable X has the following p.m.f.

X	-2	-1	0	1	2	3
$P(X = x)$	5k	3k	3k	9k	k	17k

Find

i) k

ii) $P(X \leq 1), P(X = 3)$ and $P(X > 0)$. $P(-2 \leq X < 2)$,

   $P(-1 < X \leq 3)$

iii) Find the distribution function

		COs	Knowledge Level(KL)	Marks
20	Given the following data: Variance of X = 9 Regression equations: 4X − 5Y + 33=0 20X − 9Y −107=0 i)Find the mean values of X and Y ii) The standard deviation of Y iii) The coefficient of correlation between X and Y.	CO2	4	10

1 x 10 = 10 Marks

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester B.Sc Degree Examination, April 2025

STA2FM104 – Statistical Sampling and Probability Theory

(FYUGP 2024 Admission)

Time: 1.5 hours

Max. Marks : 50

(Use of Scientific Calculator is permitted)

Course Outcome Mapping Scheme

Q.NO	1	2	3	4	5	6	7	8	9	10
COS	CO3	CO1	CO2	CO3	CO3	CO3	CO3	CO4	CO4	CO5
Q.NO	11	12	13	14	15	16	17			
COS	CO3	CO3	CO3	CO5	CO4	CO2	CO5			

Part A
Each question carries 2 marks

1. Define population and sample.

2. Differentiate between variable and attribute.

3. Write short notes on data collection.

4. Distinguish between census and sample survey.

5. What is probability sampling?

6. What are the types of sampling?

7. Write shortly on objectives of the survey.

8. Write the sample space of tossing of 3 coins.

9. Define random experiment with example.

10. Describe classical definition of probability with suitable example.

(Maximum Mark = 16)

Part B
Each question carries 6 marks

11. Explain simple random sampling with and without replacement.

12. Explain briefly the principal steps of planning a survey.

13. Write short notes on various random sampling methods.

14. Define conditional probability. Give suitable example.

15. Define sample space and events and provide examples.

(Maximum Mark = 24)

16. What are the principle steps of preparing a questionnaire?

17. Explain different definitions of probability with examples.

$(1 \times 10 = 10)$

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester B.Sc Degree Examination, April 2025

STA2MN110(P) – Data Analysis Foundations in Statistics

(FYUGP 2024 Admission)

Time: 2 hours   Max. Marks : 70

(Use of scientific calculator is permitted)

PART – A

All questions can be attended.

Each question carries **Three** mark.

Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	Differentiate between seasonal variation and cyclical variation.	CO1	1	3
2	Define the semi-average method for measuring trends.	CO1	1	3
3	Write the general equation for the additive model in a time series.	CO1	1	3
4	Define an index number.	CO2	1	3
5	Draw a scatter diagram for the data: X = [1, 2, 3], Y = [3, 5, 7].	CO3	1	3
6	What is the difference between simple and multiple correlation?	CO3	2	3
7	How do you handle repeated ranks in Spearman's rank correlation?	CO3	1	3
8	Explain the use of principle of least squares in regression analysis.	CO3	1	3
9	Write an R code to calculate the sum of two numbers: 5 and 10, and store in a variable.	CO4	1	3
10	Which function is used in R to input data from an Excel file?	CO4	1	3

PART – B

All questions can be attended. Each question carries six marks.

Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Describe the graphic method of measuring trends and provide its advantages and disadvantages.	CO1	2	6
12	Apply the semi-average method to the following time series data and calculate the trend: Year: 2018, 2019, 2020, 2021, 2022 Values: 50, 55, 60, 65, 70	CO1	3	6
13	Differentiate between price index number and quantity index number with examples for each.	CO2	2	6
14	Describe the properties of regression lines and their significance.	CO3	2	6

15	A dataset shows that when X increases, Y decreases. Calculate and interpret the Pearson correlation coefficient for: <table><tr><td>X</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td></tr><tr><td>Y</td><td>50</td><td>40</td><td>30</td><td>20</td><td>10</td></tr></table>	CO3	3	6
16	For a bivariate data the mean value of X is 20 and the mean value of Y is 45. The regression coefficient of Y on X is 4 and that of X on Y is 1/9, find i. The coefficient of correlation ii. The standard deviation of X if the standard deviation of Y is 12. iii. The regression line of Y on X The regression line of X on Y	CO3	3	10
17	a) What is the purpose of the c() function in R? How do you use it to create a vector? b) Write R code to create a vector containing the numbers 10, 20, 30, 40, and 50, and calculate their sum.	CO5	2	6
18	a) Explain the difference between a data frame and a vector in R. b) Write R code to create a data frame with two columns: • Products: "Pen", "Pencil", "Eraser" • Prices: 5, 3, 2 Add a new column to calculate the total price for 10 units of each product.	CO5	2	6

PART - C

Answer any *one* question. Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	Construct Laspeyers, Paashe's, Bowley's, and Fishers Index numbers for the following data : <table><tr><th>Item</th><th>Base year price</th><th>Current year price</th><th>Base Year Quantity</th><th>Current Year Quantity</th></tr><tr><td>A</td><td>8</td><td>12</td><td>6</td><td>7</td></tr><tr><td>B</td><td>15</td><td>20</td><td>10</td><td>12</td></tr><tr><td>C</td><td>25</td><td>30</td><td>12</td><td>15</td></tr></table> Compare the results.	CO2	3	10
20	Calculate the two regression line equation for the data: <table><tr><td>X</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td></tr><tr><td>Y</td><td>7</td><td>10</td><td>13</td><td>16</td><td>19</td></tr></table> Apply the regression equation to predict the value of Y when X = 10 and value of X when Y = 25. Also find the correlation coefficient.	CO3	3	6

1 x 10 = 10 Marks