



A Charutar Vidya Mandal's Institution
V.P. & R.P.T.P. SCIENCE COLLEGE
(AUTONOMOUS) (Grant-in-Aid)
Affiliated to Sardar Patel University
VALLABH VIDYANAGAR-388120



Bachelor of Science (Semester II) External Examination - 2025

US02MISTA01: Descriptive Statistics for Bivariate Data

Date: 09-04-2025 (Wednesday)

Time: 02:00 p.m. to 3.30 pm (1.5 HRS.)

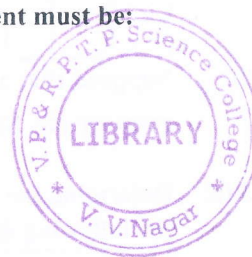
Total marks: 25

Note: (i) Q.2 and 3, each sub question is of 5 marks (ii) Graph paper will be provided on request

Q.1 Write the most appropriate answer from the following multiple -choice questions.

[05]

- (1) If one regression coefficient is greater than one, then the other coefficient must be:
 - (a) Greater than the first one.
 - (b) Equal to one.
 - (c) Less than one.
 - (d) Equal to zero.
- (2) If the correlation coefficient $r = \pm 1$, then the two regression lines:
 - (a) Are perpendicular to each other.
 - (b) Coincide.
 - (c) Are parallel to each other.
 - (d) Do not exist.
- (3) Which of the following represents the normal equations for fitting a straight line $Y = a + bX$ to a given dataset?
 - (a) $\sum Y = an + b\sum X$ and $\sum XY = a\sum X + b\sum X^2$.
 - (b) $\sum X = an + b\sum Y$ and $\sum XY = a\sum Y + b\sum Y^2$.
 - (c) $\sum Y = a\sum X + bn$ and $\sum X^2 = a\sum X + b\sum Y$.
 - (d) $\sum XY = an + b\sum X$ and $\sum Y^2 = a\sum X + b\sum XY$.
- (4) Which transformation is used to convert the nonlinear equation $Y = aX^b$ into a linear form for applying the least squares method?
 - (a) Taking the square root on both sides.
 - (b) Differentiating both sides with respect to X.
 - (c) Taking the reciprocal of both variables.
 - (d) Taking the natural logarithm on both sides.
- (5) If Spearman's rank correlation coefficient ρ is 0.75, what does this imply about the relationship between the two variables?
 - (a) There is a weak negative relationship between the variables.
 - (b) There is a strong positive association based on the closeness of ranks.
 - (c) The variables have no relationship since the value is not exactly 1.
 - (d) The correlation suggests a perfect linear relationship between the variables.



- Q.2 (a) The following pairs of observations were recorded during an experimental study on cosmic rays. [06]
Using the method of least squares, determine the optimal values of a and b for the equation:
 $R = a + bC$ that best fits the given data. Estimate the most probable value of R when $C = 20.7$

C	14	15	16	17	18
R	24.1	20.5	14	7.3	5

- (b) What is a rank correlation coefficient? Derive Spearman's rank correlation formula when there are no tied ranks. [04]

OR

- Q.2 (a) Fit an equation of the form $Y = ab^X$ to the following data [06]

X	2	3	4	5	6
Y	144	172.8	207.4	248.8	298.6

- (b) Suppose that x and y are independent random variables with standard deviations σ_x and σ_y respectively. Show that correlation coefficient between x and $x + y$ is $\frac{\sigma_x}{\sqrt{\sigma_x^2 + \sigma_y^2}}$ [04]

- Q.3 (a) Determine the most probable price in city A corresponding to a price of Rs. 70 in city B, using the following data: [04]

Category	CITY A	CITY B
Average Price	67	65
Standard Deviation	3.5	2.5

The correlation coefficient between the commodity prices in the two cities is 0.8.

- (b) Given the regression equations $X = 4Y + 5$ and $Y = kX + 4$, which represent the regression of X on Y and Y on X respectively, show that $0 < 4k < 1$. Additionally, if $k = \frac{1}{16}$, determine the mean values of the two variables and compute their correlation coefficient. [06]

OR

- Q.3 (a) The regression lines of Y on X and X on Y are respectively $Y = aX + b$ and $X = cY + d$ show that, [06]

(i) Arithmetic means are $\bar{X} = \frac{bc+d}{1-ac}$, $\bar{Y} = \frac{ad+b}{1-ac}$

(ii) Correlation coefficient between X and Y is $\sqrt{ac}$

(iii) The ratio of standard deviation between X and Y is $\sqrt{\frac{c}{a}}$

- (b) The following data on the fuel consumption y of a car at various speeds x . Fuel consumption is measured in mpg, and speed is measured in miles per hour. [04]

Speed	30	40	50	60	70
Fuel	68.4	63.6	60.5	55.4	50.6

Fit a least squares regression line to predict fuel consumption of car at speed 65 miles per hour.

