

3 (Sem-1/CBCS) STA HC 1

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STATISTICS

(Honours)

Paper : STA-HC-1016

(Descriptive Statistics)

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Answer the following as directed : 1×7=7

(a) Data taken from the publication,
Agricultural Situation in India will be
considered as

(i) primary data

(ii) secondary data

(iii) neither primary nor secondary data

(iv) None of the above

(Choose the correct option)

(2)

(b) The point of intersection of the 'less than' and 'more than' ogive corresponds to ____
(Fill in the blank)

(c) The algebraic sum of the observations of a series of individual observations from their mean is always zero.
(State True or False)

(d) The 25th percentile is same as ____ quartile.
(Fill in the blank)

(e) State the limits of correlation coefficient.

(f) In Paasche's index number, the weights taken are

(i) the base year quantities

(ii) the current year quantities

(iii) the base year price

(iv) None of the above

(Choose the correct option)

(g) If one regression coefficient is greater than unity, then the other must be ____ unity.

(Fill in the blank)

(3)

2. Answer the following questions : $2 \times 4 = 8$

(a) Distinguish between quantitative and qualitative data.

(b) The arithmetic mean of 10 observations were found to be 6. Later on it was found that a value was wrongly written as 4 instead of 5. Find the correct arithmetic mean.

(c) Define multiple correlation and partial correlation in case of a trivariate distribution.

(d) State time-reversal test and factor-reversal test used in index number.

3. Answer any *three* of the following : $5 \times 3 = 15$

(a) Write an explanatory note on box-plot. 5

(b) The first of the two samples has 100 items with mean 15 and standard deviation 3. If the whole group has 250 items with mean 15.6 and standard deviation $\sqrt{13.44}$, find the standard deviation of the second group. 5

- (c) The first four moments of a distribution about the value 4 of the variate are -1.5, 17, -30 and 108. Find the moments about mean and β_1 . Also find the moments about the origin. $2+1+2=5$

- (d) Show that, if X' and Y' are the deviations of the random variables X and Y from their respective means, then

$$r = 1 - \frac{1}{2N} \sum_{i=1}^n \left(\frac{X'_i}{\sigma_x} - \frac{Y'_i}{\sigma_y} \right)^2$$

where r is the product moment correlation coefficient, N is the total number of observations, σ_x and σ_y are the respective standard deviations of X and Y . Hence deduce that $r \leq 1$. $4+1=5$

- (e) What is price relative? Prove that Fisher's index number lies between Laspeyre's and Paasche's index numbers. $1+4=5$

4. Answer either (a) or (b) :

- (a) (i) Distinguish between nominal and ordinal data. 2
- (ii) Discuss about the graphical representation of statistical data. 5

- (iii) Prove that correlation coefficient is the geometric mean of regression coefficients. 3

- (b) (i) How, in your opinion, should an arithmetic mean change when all values of the variable are increased by the same amount? 1

- (ii) What do you mean by the method of least squares? Discuss the method to fit the equations of the types $y = ab^x$ and $y = ax^b$. $1+2+2=5$

- (iii) What is a chain-base index number? State briefly its advantages over a fixed-base index number. $1+3=4$

5. Answer either (a) or (b) :

- (a) (i) Explain how the median of a distribution can be located graphically. (Draw a rough sketch to demonstrate the same) 4
- (ii) Write a brief note on kurtosis. 3
- (iii) State the problems that arise in the construction of index number. 3

(6)

- (b) (i) Give the idea of cross-validation of data. 3
- (ii) Define cost of living index number (CLIN). Interpret the result—
“CLIN=120.5”. 1+1=2
- (iii) Define factorial moments. Express the first four factorial moments about origin in terms of raw moments. 1+4=5

6. Answer either (a) or (b) :

- (a) (i) What is skewness? Discuss the different relative measures of skewness. 1+3=4
- (ii) “Index numbers are economic barometers.” Elucidate. 2
- (iii) With usual notations of complete, partial and multiple correlation, prove that
 $1 - R_{1.23}^2 = (1 - r_{12}^2)(1 - r_{13.2}^2)$ 4
- (b) (i) Explain briefly the uses and limitations of index number. 5

(7)

- (ii) Prove that Spearman's rank correlation coefficient (ρ) is given by

$$\rho = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1)}$$

where d_i denotes the difference between the ranks of the i th individual. 5

Total number of printed pages-7

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2021

(Held in 2022)

STATISTICS

(Honours)

Paper : STA-HC-1016

(Descriptive Statistics)

Full Marks : 60

Time : Three hours

**The figures in the margin indicate
full marks for the questions.**

1. Answer the following as directed : $1 \times 7 = 7$

(a) The column headings of a statistical table are known as

(i) sub-titles

(ii) stubs

Contd.

(iii) reference notes

(iv) captions

(Choose the correct option)

- (b) If 5 is subtracted from each observation of a set, then the arithmetic mean of the new set of observations is reduced by _____.

(Fill in the blank)

- (c) The best measure of dispersion for comparison of two different series is coefficient of variation.

(State True or False)

- (d) With usual notations, if for two attributes A and B, $(AB) > \frac{(A)(B)}{N}$, the attributes are

- (i) independent
- (ii) positively associated
- (iii) negatively associated
- (iv) None of the above

(Choose the correct option)

- (e) Laspeyres price index number uses the _____ quantities as weights.

(Fill in the blank)

- (f) If X and Y are independent, the value of regression coefficient β_{YX} is equal to

(i) 1

(ii) ∞

(iii) 0

(iv) None of the above

(Choose the correct option)

- (g) The partial correlation coefficient lies between $-\infty$ and $+\infty$.

(State True or False)

2. Answer the following questions : $2 \times 4 = 8$

(a) State two limitations of statistics.

(b) For a distribution, mean is 10 and variance is 16. Find the first two moments about origin.

(c) Prove that Paasche's index number does not satisfy the time reversal test.

- (d) "The regression coefficient of X on Y is 3.2 and that of Y on X is 0.8." Is this statement correct? Give reasons in support of your answer.
3. Answer **any three** of the following questions : $5 \times 3 = 15$
- (a) Give a brief description of different components of a statistical table. 5
- (b) What is standard deviation? Find standard deviation of the first n natural numbers. $1 + 4 = 5$
- (c) Define multiple and partial correlation coefficient. If $r_{12} = 0.85$, $r_{13} = 0.65$ and $r_{23} = 0.72$; find $R_{1.23}$. (Notations having usual meaning.) $2 + 3 = 5$
- (d) Suppose P_{01}^{La} , P_{01}^{Pa} and P_{01}^{ME} denote Laspeyres, Paasche and Marshall-Edgeworth price index numbers respectively. If $P_{01}^{La} < P_{01}^{Pa}$, then prove that
- $$P_{01}^{La} < P_{01}^{ME} < P_{01}^{Pa}$$
- 5

- (e) Obtain the normal equations for fitting of the 2nd degree parabola

$$y = a + bx + cx^2 \text{ on the basis of } n \text{ pairs } (x_1, y_1), (x_2, y_2), \dots, (x_n, y_n) \text{ of values of } (X, Y).$$

5

4. Answer either (a) **or** (b) : 10

(a) (i) Distinguish between attributes and variables. 2

(ii) Discuss the construction of cost of living index number by family budget enquiry. 3

(iii) Prove that correlation coefficient lies between -1 and $+1$. Give the geometrical interpretation of the case when $r = +1$. $4 + 1 = 5$

(b) (i) Write a brief note on consistency of data with special reference to attributes. 2

(ii) Write a note on selection of base period in construction of index number. 3

(iii) Prove that regression coefficients are independent of change of origin but not of scale. 5

5. Answer either (a) or (b) : 10

(a) (i) Write briefly on control experiments. 2

(ii) Find the arithmetic mean of the AP series $a, a + d, a + 2d, \dots, a + 2nd$. 3

(iii) Elaborate on the uses of cost of living index number. 5

(b) (i) What does Karl Pearson correlation coefficient measure ? 1

(ii) Define mode and derive its formula. 1+5=6

(iii) State the properties of multiple correlation coefficient. 3

6. Answer either (a) or (b) : 10

(a) (i) State the values of β_1 and β_2 for a symmetric distribution. 1

(ii) Write a brief note on box plot. 3

(iii) Derive the formula for Spearman's rank correlation coefficient in case of non-repeated ranks. 6

(b) (i) Define chain-based index number. 2

(ii) What is skewness ? State various measures of skewness. 1+2=3

(iii) With usual notations, prove that

$$r_{12.3} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{(1-r_{13}^2)(1-r_{23}^2)}} \quad 5$$