

2016

STATISTICS

(Major)

Paper : 1.1

(Descriptive Statistics)

Full Marks : 60

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer the following questions as directed (reasoning is not necessary) : $1 \times 7 = 7$

(a) State the definition of mean deviation in words.

(b) If x_i / f_i ($i = 1, 2, \dots, n$) is a frequency distribution and $u_i = \frac{x_i - a}{h}$, then which

one of the following is true?

(i) $\bar{x} = h\bar{u}$

(ii) $\bar{x} = a + h\bar{u}$

(iii) $\bar{x} = a + \bar{u}$

(iv) $\bar{x} = a - h\bar{u}$

[Symbols have their usual meanings.]

(c) The standard deviations of the following two series

Series-1 : 1, 2, 3, 4

Series-2 : 3, 4, 5, 6

are

(i) same

(ii) not the same

(iii) sometimes same and sometimes not

(iv) None of the above

[You have to answer without doing any calculation.]

(d) The geometric mean of $3, 3^2, \dots, 3^n$ is

(i) $3^{n/2}$

(ii) $3^{\frac{n+1}{2}}$

(iii) 3^n

(iv) $3^{\frac{n(n+1)}{2}}$

(e) State whether the following statement is true :

“Coefficient of variation is invariant of unit of measurement.”

(f) Mention any one use of range.

(g) If $\hat{x} = 3$ and

$$A = \sum_{i=1}^n (x_i - 3)^2, B = \sum_{i=1}^n (x_i - 2)^2, C = \sum_{i=1}^n (x_i - 4)^2$$

then minimum of A, B, C is

- (i) B
- (ii) C
- (iii) A
- (iv) None of the above

2. Answer the following questions : 2×4=8

- (a) Write the expressions for second and fourth central moments in terms of raw moments. 1+1=2
- (b) Write any two measures of kurtosis.
- (c) Suppose you have the following :

x :	2	4	6	8
y :	4	6	8	10

Then which one of the following is correct?

- (i) $b_{yx} = 1$
- (ii) $b_{yx} = -1$
- (iii) $b_{yx} = 0$
- (iv) $b_{yx} = \infty$

[Give reason to support your answer.]

(d) Define the Karl-Pearson correlation coefficient. Also state what does it measure. 1+1=2

3. Answer any *three* of the following : 5×3=15

(a) Define mode and derive its formula.

(b) Define arithmetic mean (AM) and harmonic mean (HM). Show also that $AM \geq HM$. [You have to prove it for n values.] 2+3=5

(c) Show that the correlation coefficient lies between -1 and $+1$. Also give the geometrical interpretation of the case when $r = +1$. 4+1=5

(d) If a variable takes values $0, 1, 2, 3, \dots$ with frequencies proportional to $e^{-\lambda}, \lambda e^{-\lambda}, \frac{e^{-\lambda} \lambda^2}{2!}, \frac{e^{-\lambda} \lambda^3}{3!}$, then find the mean and variance of the distribution.

(e) For any discrete series, show that mean deviation about mean is less than standard deviation.

4.

EITHER

- (a) Compare and contrast amongst different measures of dispersion. 5
- (b) Establish the relationship between standard deviation and range. 5

OR

5. (a) For two variables X and Y , find the line of regression of Y on X . 5
- (b) Show that the mean deviation is least when measured about median. 5

6.

EITHER

Define cumulants. Establish its additive property. With usual notation show that $\mu_2 = \kappa_2$. 3+4+3=10

OR

7. (a) Suppose you want to fit a third degree polynomial of the type

$$y = a_0 + a_1x + a_2x^2 + a_3x^3$$

to the set of points (x_i, y_i) , $i = 1, 2, \dots, n$, where a_0, a_1, a_2 and a_3 are constants. Derive the normal equations to obtain the constants a_0, a_1, a_2 and a_3 . 5

(b) Explain how would you fit the polynomials of the following types : $2\frac{1}{2} \times 2 = 5$

(i) $y = ax^b$

(ii) $y = ab^x$

8.

EITHER

(a) Find the arithmetic mean and variance of the observations $1 \cdot 3 \cdot 5, 3 \cdot 5 \cdot 7, 5 \cdot 7 \cdot 9, \dots, (2n-1)(2n+1)(2n+3)$. $2+3=5$

(b) Write a note on skewness in detail. 5

OR

9. Write explanatory notes on any one of the following : 10

(a) Orthogonal polynomials

(b) Correlation ratio
