BACHELOR OF ARTS EXAMINATION, 2023
(1ST YEAR, 2ND SEMESTER)
ECONOMICS (HONOURS)
Paper: Statistical Methods for Economics

Time: Two Hours   Full Marks: 30

*Answer **Question no. 1** and **any two** from the rest*

[**Note**: All notations carry their usual meaning]

1. Answer *any five* from the following $2 \times 5 = 10$

(a) $\bar{X}$ is the mean of X_1, X_2, and X_3. If x_1, x_2, and x_3 are the deviations of X_1, X_2, and X_3 from $\bar{X}$ respectively, prove that $x_1^2 + x_2^2 + x_3^2 = X_1^2 + X_2^2 + X_3^2 - 3\bar{X}^2$.

(b) If $4u = 2x + 7$ and $6v = 2y - 15$, and the regression coefficient of y on x is 3, then find the regression coefficient of v on u?

(c) For a frequency distribution of height (in cm.), a student estimated the cumulative relative frequency of the class-interval 160-170 as 1.27. Do you think she has made some mistake in her calculation? Give reasons for your answer.

(d) Show that if two variables y and x are linearly related in the form $y = c + dx$, then their modes are connected by the same relation.

(e) Suppose a variable x takes only two values x_1 and x_2 with equal frequencies. Find the standard deviation of x,

(f) Determine the trend by 4-yearly moving average method from the following data:

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Annual Sales (in lakhs of Rs)	464	515	518	467	502	540	557	571	586	600

(g) Two groups of 15 and 22 values have variances 9 and 16 respectively. If the group means differ by 8.2, then find the standard deviation of the combined group of values.

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2.(a) If a variable x takes the values $1, 2, \ldots \ldots, r$ with $F_1, F_2, \ldots \ldots, F_r \, (= n)$ as the corresponding less-than type cumulative frequencies, then prove that

$$\bar{x} = (r + 1) - \frac{1}{n}\sum_{i=1}^{r} F_i$$

(b) If z is a function of two variables x and y such that $z = xy$, then show that geometric mean of z is similarly related to the geometric means of x and y.

(c) With the help of the following data calculate price index number using Fisher's formula and show that it satisfies both 'time reversal' and 'factor reversal' test.

Commodity	1970		1972	
	Price	Quantity	Price	Quantity
A	6	50	10	56
B	2	100	2	120
C	4	60	6	60
D	10	30	12	24
E	8	40	12	36

4+2+4=10

3. (a) Show that standard deviation is the minimum root-mean-square deviation.

(b) Find the dispersion for the following data using a suitable measure

Values	Frequency
Less than 15	4
15-20	12
20-25	16
25-30	22
30-40	10
40-50	8
50-60	6
More than 60	4
Total	82

(c) The first four moments of a distribution about the value 3 are 2, 10, 40 and 218 respectively. Find the first four moments about origin.

3+4+3=10

4. (a) Out of the two regression lines given by $3x + 9y = 46$ and $3y + 12x = 19$ which one is the regression line of x on y? If the variance of x is 4, calculate the variance of y.

(b) Derive the formula for Spearman's rank correlation coefficient (r_R) when there are no ties. Then prove that r_R lies between -1 and 1.

(3+2)+(3+2)=10