**BACHELOR OF ARTS EXAMINATION 2017**

**(1st Year, 1st Semester)**

**ECONOMICS (HONOURS)**

**Paper: Statistics 1 (OLD)**

**Time: Two Hours** **Total marks: 30**

***Answer any two questions***

1. (a) If $u = ax + by$, $v = ax - by$ and if u and v are uncorrelated, prove that

$$s_u s_v = 2ab(a^2 + b^2)s_x s_y\sqrt{1 - r_{xy}^2}\,.$$

(b) Two variables x and y take the values:

| | | | | | | |
|---|---|---|---|---|---|---|
| x | -5 | -3 | -2 | 2 | 3 | 5 |
| y | 25 | 9 | 4 | 4 | 9 | 25 |

Find out the correlation coefficient $r_{xy}$. Are the variables x and y dependent? Justify your answer.

(c) For certain X and Y, which are correlated, the two regression lines are:

$5X - 6Y + 90 = 0$ and $15X - 8Y - 130 = 0$

Find which is the regression of Y on X and which is that of X on Y. Find the means of the two series and the correlation coefficient between them.

(d) An yearly trend line is given as:

$y_t = 27728.83 + 2837.21t + 389.80t^2$ (origin at 1955)

Write down the expression for the quarterly trend line. 6+4+3+2

2. a) Given two sets, each of n positive values, $x_{11}, x_{12}, \ldots, x_{1n}$ and $x_{21}, x_{22}, \ldots, x_{2n}$, prove that the geometric mean of the ratios of corresponding values in the two sets is equal to ratio of the geometric means of the two sets.

b) Prove that arithmetic mean of squares of variable values is greater than equal to square of arithmetic mean of variable values.

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c) During a certain period, the cost of living index number goes up from 120 to 210 and the salary of a worker is also raised from Rs. 960 to Rs. 1575. Does the worker gain? By how much the worker gains or looses in real terms?

d) Find the values of $Q_1$, $Q_3$ and $P_{35}$ from the following observations:

| Height (cm) | 141-145 | 146-150 | 151-155 | 156-160 | 161-165 | 166-170 | 171-175 |
|---|---|---|---|---|---|---|---|
| Number of persons | 7 | 9 | 15 | 23 | 21 | 10 | 5 |

e) The prices of a commodity in the year 1975 and 1980 were Rs. 25 and Rs. 30 respectively. Find the price relatives (i) taking 1975 as base year; (ii) taking 1980 as base year. Verify the time reversal property. 5+2+4+2+2

3. a) For a set of 10 observations the arithmetic mean and standard deviation were calculated as 15 and 3 respectively. It was later found on scrutiny that the last observation of the data set should be 20 instead of 10. Calculate the correct arithmetic mean and standard deviation.

b) For a given set of data the arithmetic mean and standard deviation are 47.8 and 17.6918 respectively. Find root-mean-square deviation about 50.

c) A variable takes only two values a and b equal number of times. Calculate second, third and fourth order central moments. Calculate a and b if the arithmetic mean and standard deviation are 30 and 4 respectively.

d) The first three moments about the origin are given by:

$$\mu_1' = \frac{n+1}{2}, \mu_2' = \frac{(n+1)(2n+1)}{6}, \mu_3' = \frac{n(n+1)^2}{4}$$

Is it possible to find different values of the variable? Examine the skewness of the data.

6+2+4+3

4. a) Show that in a discrete series, deviations are small compared with mean, that is if the deviation $X_i = x_i - M$ is very small in comparison with mean M so that $\left(\frac{x}{M}\right)^2$ and higher

powers of $\frac{x}{M}$ are neglected, prove that $CV=\sqrt{\frac{2(M-G)}{M}}$, where G is the geometric mean of the variable values $x_i$, $i=1,2,\ldots,n$.

b) A group of 100 items have a mean of 55 and a standard deviation of 5. If the mean and the standard deviation of 40 of these items be 61 and 4.5 respectively, find the standard deviation of the other 60 items.

c) De-trend the following paddy production (in metric tons) series.

| year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| y | 137 | 142 | 161 | 159 | 185 | 197 | 209 | 210 | 231 | 235 | 248 |

Interpret the path of de-trended series.

d) Prove that in any frequency distribution table, "less-than cumulative frequency + more-than cumulative frequency – absolute frequency = total frequency". 6+4+3+2