B.A. (Honours) Examination, 2022

Semester–III (CBCS)

Economics

Course: CC-7 (Core)

(Statistical Methods for Economics)

Time: Three Hours **Full Marks: 60**

Questions are of value as indicated in the margin

Answer ***any four*** questions

1. (a) The following table shows the 'less than' type cumulative frequencies for a grouped frequency distribution of age of 700 people.

Age (years)	1-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89
No. of persons in the age group or below	20	50	110	220	340	490	590	660	700

(i) Calculate the number of persons belonging to each age group.
(ii) Estimate the number of persons aged 45 years or below.
(iii) Calculate the mean age of the people.

(b) Under what circumstances the median is preferred to the A.M. as a measure of central tendency? Find the median marks of the students from the following distribution

Marks	0 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80
No. of students	19	21	60	42	24	18	16

(2+4+3)+(2+4)=15

2. (a) Out of 400 observations, 100 observations have a value 1 and the rest are 0. Find the mean and standard deviation of all 400 observations taken together.

(b) The A.M. and S.D. of 25 observations are calculated as 30 and 2 respectively. After the calculations are done, it was noticed that two observations with values 29 and 31 are wrongly included in the calculation. What will be the correct values of A.M. and S.D. if these two observations are excluded?

(c) What is coefficient of variation? When it is used? Explain with an example. 5+6+4=15

3. (a) Let $x_1, x_2, \ldots, x_n$ be a set of n observations. Suppose $y_i = a + bx_i$ $(i = 1,2, \ldots, n)$ where a and b are constants. Express the standard deviation of y in terms of the standard deviation of x and comment on the relationship between the two.

(b) The first three moments about the value 3 for a frequency distribution are 2, 10 and 30 respectively. Obtain the first three moments about zero.

(c) Define skewness of a frequency distribution. What are its alternative measures? Suppose for a grouped frequency distribution the first and the last class are open-ended. What measure will you use to estimate its skewness? 5+5+5=15

4. (a) For a bivariate data (x_i, y_i) of size 10, the following information is provided:

$\sum x = 12;\quad \sum y = 4;\quad \sum x^2 = 16.2;\quad \sum y^2 = 1.96;\quad \sum xy = 5.2$

Calculate the covariance between x and y and variance of x. Also estimate the regression equation of y on x.

(b) Two regression equations are given as $6x + 5y = 105$ and $3x + 10y = 75$. Find the mean values of x and y and the value of the correlation coefficient between them.

(c) Ten students have the following scores out of 100 in their two subjects. Calculate the rank correlation coefficient.

Roll No.	1	2	3	4	5	6	7	8	9	10
Marks in Subject A	78	36	98	25	75	82	90	62	65	39
Marks in Subject B	84	51	91	60	68	62	86	58	53	47

5+5+5=15

5. (a) From the following information, estimate the probable crop yield per acre when rainfall is 30 cm. It is known that the correlation between rainfall and crop yield per acre is 0.65.

	Mean value	Standard Deviation
Rainfall (cm)	25	3
Crop yield per acre (quintal)	40	6

(b) A scatter diagram is produced from a dataset (x_i, y_i) $(i = 1,2, \ldots, n)$ and a regression equation $\hat{y}_i = a + bx_i$ is estimated by the method of least squares. Assuming the relationship between the two variables is linear and positive (i) draw a diagram showing the scatter and the regression line (ii) distinguish between y_i and $\hat{y}_i$ (iii) Define Explained Sum of Squares (ESS) and Total Sum of Squares (TSS).

(c) For two positively and linearly related variables x and y, a linear regression equation is estimated by the method of least squares. The TSS is calculated as 500 and the ESS is found to be 450. What can you say regarding the correlation coefficient between x and y?

5+6+4=15

6. (a) For two mutually exclusive events A and B (neither of them are impossible events) check whether the following statements are true or false. Justify your answers.

(i) $P(A \cup B) < P(A) + P(B)$

(ii) $P(A) + P(B) = 1$

(iii) $P(A \cap B) = P(A)P(B/A)$

(iv) $P(A \cap B^c) = P(A)$

(b) State and prove Bayes' Theorem. 8+7=15

7. (a) A bag contains 50 tickets numbered 1,2,3 .....50. Five tickets are drawn at random and then arranged in ascending order of their numbers. What is the probability that after the arrangement, the third ticket bears number 30?

(b) There are 3 Red and 4 Black balls in an urn. Two balls are drawn one after another without replacement. What is the probability of (a) getting 1 Red and 1 Black ball (b) the first ball is Red and second ball is Black?

(c) A number is chosen at random from the set of numbers 1,2,3, ...,100. Another number is chosen randomly from another set of numbers 1,2,3, ...,50. What is the expected value of their product? 5+5+5=15

8. (a) A student appeared in a test consisting of 10 multiple choice questions. Each question has 4 choices out of which only one is correct. The student was completely unprepared and randomly ticked one choice for each of the questions. What is the probability that he ticked none of the correct answers?

(b) If 5% of the electrical bulbs manufactured by a company are defective, use Poisson distribution to find the probability that in a sample of 100 bulbs (i) none is defective (ii) number of defective bulbs is 3 or less.

(c) An unbiased coin is tossed 400 times. What is the probability that the number of heads appeared will be between 180 and 220? [Given that the area under the standard normal curve between 0 and 2 is 0.4772]. 5+5+5=15