2022

ECONOMICS — HONOURS

Paper : CC-7

(Statistical Methods for Economics)

Full Marks : 65

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group - A

1. Answer ***any ten*** questions : 2×10

(a) Are the following data consistent? Give reasons.

Group	Number of observations	Mean
I	40	85
II	50	90
Combined	90	69

(b) State whether the following statements are true or false :

(i) Standard deviation can never be less than Mean absolute deviation about mean.

(ii) The sum of frequency densities in a distribution must be one.

(c) What do you mean by simple random sampling?

(d) If for a distribution the first order raw moment about 4 is 10, then find the mean of the distribution.

(e) In a two-variable model show that the correlation coefficient and the regression coefficients must be of same sign.

(f) Show that for any two events A and B, $P(A \cup B) \leq P(A) + P(B)$.

(g) Show that if A and B are two independent events then A^c and B^c are also independent.

(h) What is the probability of getting at least one black ball when two balls are drawn at random from a box containing 2 white and 4 black balls?

(i) If a person throws a fair die and gains or loses an amount according as the number appeared is even or odd. What is the expected gain or loss of the person in the long run per game?

(j) Show that for a binomial distribution mean can never be less than variance.

(k) What are the conditions under which a binomial can be approximated by a Poisson distribution?

(l) Write down the conditions under which two random variables X and Y are independent. Consider the cases when (i) both X and Y are discrete and (ii) both are continuous.

(m) Using examples clarify what you mean by complete enumeration survey and sample survey.

(n) What is meant by a minimum variance unbiased estimator?

Group - B

Answer ***any three*** questions.

2. Suppose that AM, GM and HM of a set of observations are 35.5, 33.9 and 33.3 respectively. If all observations are multiplied by a constant 10 then can you find the AM, GM and HM of the new set of observations? If so, find them. 5

3. Find the value of k such that the following function is a probability density function : 5

$$f(x) = \begin{cases} kx, & \text{when } 0 < x \leq 1 \\ k, & \text{when } 1 < x \leq 2 \\ k(3-x), & \text{when } 2 < x \leq 3 \\ 0, & \text{elsewhere} \end{cases}$$

4. The width of a machine part, which is being manufactured by a certain factory, follows normal distribution with mean 0.44 cm and S.D. 0.03 cm. All parts with a width exceeding 0.5 cm or below 0.47 cm are rejected. What is the % of rejected parts? 5

5. In order to test whether a coin is perfect, the coin is tossed 5 times. The null hypothesis of 'perfectness' is rejected if and only if more than 4 heads are obtained. What is the probability of type I error? 5

6. What do you mean by Multi-stage Sampling? 5

Group - C

Answer ***any three*** questions.

7. (a) What do you mean by dispersion of a variable? Show that the mean absolute deviation about mean is independent of the origin but depends upon the scale of measurement.

(b) The mean and SD of a variable X are known to be 38 and 6 respectively. What are the means and SDs of (i) $100 - 2X$ and (ii) $60 - X/2$. (1+5)+(2+2)

8. (a) Show that

$$|r| \leq \frac{|b_{xy}| + |b_{yx}|}{2},$$

where notations have their usual meanings.

(b) Consider the following data :

$n = 10$ $\Sigma Y = 8$ $\Sigma X = 40$ $\Sigma Y^2 = 20$ $\Sigma X^2 = 200$ $\Sigma XY = 20$

(i) Find the regression equation of Y on X.

(ii) Estimate Y if $X = 2$. 5+(4+1)

9. (a) Find a recurrence relation among the central moments for the Poisson distribution. Hence find the γ_1 and γ_2 coefficients and interpret.

(b) A bag contains 1 red and 7 white marbles. A marble is drawn from the bag and its colour is observed. Then the marble is put back into the bag and the contents are thoroughly mixed. Find the probability that in 8 such drawings a red marble is selected exactly three times. What is the most likely number of red marbles drawn? (4+2+1)+(2+1)

10. (a) Show that normal distribution is a symmetric about its mean.

(b) Weights of 3 boys in a group have been recorded in lbs. are 30, 32 and 36. Drawing simple random samples of size 2 without replacement verify the results that

$E(\bar{x}) = \mu$ and $V(\bar{x}) = (\sigma^2 / n)\{(N - n)/(N-1)\}$

where notations have their usual meanings. 4+6

11. (a) What are point estimation and interval estimation? Do you think that interval estimation is better that point estimation? Why?

(b) A random sample of 10 students of a class who are engaged in WhatsApp was selected and the hours per day that each is engaged was determined. The data are as follows : 9, 8, 7, 4, 8, 6, 8, 8, 7, 10. Test the null hypothesis that students of the class are engaged in WhatsApp for more than seven hours or on an average per day at 5 per cent level of significance.

Given that

$Z_{.025} = 1.96$ $Z_{.05} = 1.645$ $t_{.025,\,9} = 2.262$ $t_{.05,\,9} = 1.833$ $t_{.025,\,10} = 2.228$ $t_{.05,\,10} = 1.812$

(2+1)+7
