

2023

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

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2×10

1. Answer *any ten* questions :

- (a) A discrete variable can take only integral values. — Is it a correct statement? Justify with the help of an example.
- (b) Show that HM can never be greater than AM.
- (c) For the following frequency distribution AM is 47.17. Find the missing frequency.

Class Interval	Frequency
31–40	2
41–50	?
51–60	4

- (d) A study on B.Sc. Economics (Hons.) Examination results of 1000 students in 2010 gave that average marks secured as 50% with a standard deviation of 3. A similar study in 2020 revealed average marks secured and standard deviation as 55% and 5 respectively. Have the results improved over the decade?
- (e) In a bivariate model if the two regression coefficients are (-1.6) and (-0.4) , then find the correlation coefficient between the variables.
- (f) Let A_1, A_2, \dots, A_n be n mutually exclusive events. Consider another event B dependent on A_i 's. Show that $A_1 \cap B, A_2 \cap B, \dots, A_n \cap B$ are also mutually exclusive.
- (g) Set up a numerical problem where the Bayes' theorem will be applicable for solving.
- (h) The letters of the word TRIANGLE are arranged at random. Find the probability that the word so formed (i) starts with T (ii) starts with T and ends with E.
- (i) For a binomial distribution mean is 3 and standard deviation is $\sqrt{2}$. Find the values of n and p .
- (j) The probability that a Poisson variate X takes a positive value is $1 - e^{-2}$. Find mean and mode of X .
- (k) If a random variable X follows a normal distribution with a mean of 30 and variance of 25, then find the point(s) of inflection of X .

Please Turn Over

- (l) If a simple random sample of size 4 is drawn without replacement from a population of size 40 where the variance of the population is 25, then find the standard error of sample mean.
- (m) What do you mean by a maximum likelihood estimator?
- (n) What is meant by power of a test?
- (o) What do you mean by multi-stage sampling?

Group - B

2. Answer *any three* questions :

- (a) Using an example clarify what you mean by a relative measure of dispersion. When is it used? 2+3
- (b) Evaluate simple correlation coefficient as a measure of association between two variables. 5
- (c) State and prove the theorem of total probability for three events. 5
- (d) Find out the moment generating function about origin for binomial distribution. Also find the mean and standard deviation of the distribution. 2+3
- (e) Argue whether the following statement is true or false :
If H_0 is accepted at $\alpha_1\%$ level of significance, then it will definitely be accepted at $\alpha_2\%$ level of significance, where $\alpha_1 < \alpha_2$. 5

Group - C

Answer *any three* questions.

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3. (a) Examine the validity of the following statement :

The standard deviation of a variable measured in inches is less than the standard deviation of the variable measured in feet.

(b) Heights (X, in inches) and weights (Y, in kg) of 5 persons are given below :

X : 64 60 67 59 69

Y : 57 60 73 62 68

Determine the nature of relationship between height and weight. If, by a defect in weighing machine, weights are recorded by 2 kg more than the true weight, then indicate the change in the result. 4+(5+1)

4. (a) A variable takes only two distinct values a and b , each with equal frequency. Find second, third and fourth central moments.
- (b) The SD of a symmetric distribution is 5. What must be the value of the fourth moment about the mean in order that the distribution to be leptokurtic, mesokurtic and platykurtic? 6+4

5. (a) Consider the sample space $S = \{e_1, e_2, e_3, e_4\}$. Define the events, $A = \{e_1, e_2\}$, $B = \{e_2, e_3\}$, $C = \{e_3, e_4\}$.
- Are A, B, C pairwise independent?
 - Are they mutually independent?
 - What conclusion can you draw from the answers to (i) and (ii)?
- (b) If the standard error of the sample mean for SRSWR is twice that for SRSWOR, show that $4n = 3N + 1$; where n and N denote the sample size and population size respectively. (2+2+1)+5

6. (a) Show that the following function is a probability density function.

$$f(x) = \left(5/\sqrt{\pi}\right)e^{-25x^2}, -\infty < x < \infty$$

- (b) The mean of a normal distribution is 60 and 6% of the values are greater than 70. Find the standard deviation of this distribution. [Given that the area under the standard normal curve between $Z = 0$ and $Z = 1.56$ is 0.44.] 5+5

7. (a) If $E(T_1) = \theta_1 + 3\theta_2$ and $E(T_2) = 3\theta_1 - \theta_2$, then find an unbiased estimator of θ_1 .
- (b) A random sample of 10 students of a college who are engaged in WhatsApp is selected and the hours per day that each of them is engaged is determined. The data are as follows :

9, 8, 7, 4, 8, 6, 8, 8, 7, 10.

Is it reasonable to accept that on average the students of the college are engaged in WhatsApp for more than 7 hours per day at 5 per cent level of significance? [Assume that the data follow normal distribution. Given that $t_{0.05,9} = 1.833$, $t_{0.025,9} = 2.262$, $t_{0.05,10} = 1.812$, $t_{0.025,10} = 2.228$] 4+6