

2020**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	Median
I	40	85
II	50	90
Combined	90	69

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

(i) AM can never be less than HM .(ii) GM cannot be computed for a frequency distribution with open-end class.

(c) What do you mean by a relative measure of dispersion?

(d) A distribution has the standard deviation 2. What should be the value of the fourth order central moment such that the distribution is mesokurtic?

(e) Mention some cases where the correlation coefficient may give misleading idea about the relationship between two variables.

(f) State with reasons whether the following statement is True or False :
The regression coefficient of Y on X is 3.1 and that of X on Y is 0.9.(g) Show that if A and B are two independent events then A^c and B are also independent.(h) Two letters are drawn at random from the word HOME. Find the probability that one of the letters chosen is M .(i) For two events A and B , let $P(A) = 0.4$, $P(A \cup B) = 0.7$ and $P(B) = p$. For what value of p are A and B mutually exclusive?**Please Turn Over**

- (j) If a person gets Rs. $(2X + 5)$ where X denotes the number appearing when a balanced die is rolled once, how much money can he expect in the long run per game?
- (k) Show that for a random variable X following a binomial distribution with parameters n and p , maximum variance is $n/4$.
- (l) Define a standard normal variable. Write down its probability density function.
- (m) Show that for two independent random variables (discrete or continuous) $E(XY) = E(X) \cdot E(Y)$.
- (n) What do you mean by simple random sample with replacement?
- (o) What are sampling and non-sampling errors?

Group - B

Answer **any three** questions.

- 2. If the Standard Deviation of 1, 2,, n is $\sqrt{14}$, find n . 5
- 3. Given that $x = 4y + 5$ and $y = kx + 4$ are regression equations of X on Y and of Y on X respectively, show that $0 < k \leq 0.25$. If actually $k = 0.10$, find the means of the variables X and Y and also their coefficient of correlation. 5
- 4. There are two identical boxes containing respectively 4 white and 3 red balls, and 3 white and 7 red balls. A box is chosen at random and a ball is drawn from it. If the ball is white, what is the probability that it is from the first box? 5
- 5. The probability that an individual will suffer a bad reaction from a particular injection is 0.001. Determine the probability that out of 2000 individuals (i) exactly 3 and (ii) more than 2 will suffer a bad reaction. [Given $e^{-2} = 0.13534$] 5
- 6. What do you mean by Stratified Sampling? 5

Group - C

Answer **any three** questions.

- 7. (a) For two observations a and b ($a, b > 0$), show that $AM \geq GM \geq HM$.
- (b) Find a suitable measure of central tendency for the following distribution justifying your choice.

Class-limit	Frequency
51 – 55	4
56 – 60	10
61 – 65	14
66 and above	2

5+5

8. (a) If all observations on a variable are equal, then show that all measures of dispersion are zero. Are you surprised by this result? — Why?
- (b) The first of the two samples has 100 items with mean 15 and SD 3. If the whole group has 250 items with mean 15.6 and $SD \sqrt{13.44}$, find the SD of the second group. (4+1)+5
9. (a) Consider the sample space $S = \{e_1, e_2, e_3, e_4\}$. Define the events $A = \{e_1, e_3\}$, $B = \{e_2, e_3\}$, $C = \{e_3, e_4\}$.
Are A, B, C (i) pairwise independent? (ii) mutually independent? What conclusion can you draw from the answers to (i) and (ii)?
- (b) 3 lots contain respectively 10%, 20% and 25% defective articles. One article is drawn at random from each lot. What is the probability that among them there is exactly one defective? (2+1+1)+6
10. (a) If T_1 and T_2 be statistics with expectations
 $E(T_1) = 2\theta_1 + 3\theta_2$ and $E(T_2) = \theta_1 + \theta_2$
find unbiased estimators of parameters θ_1 and θ_2 .
- (b) The mean yield per plant for 11 tomato plants of a particular variety was found to be 1200 gm with a SD of 90 gm. Set up 99% confidence limits to the mean yield of all plants of this variety assuming that yield per plant follows normal distribution.
Given that $Z_{.005} = 2.58$ $t_{.005, 10} = 3.169$ $t_{.005, 11} = 3.106$. 4+6
11. (a) 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 $\alpha_1 < \alpha_2$.
- (b) Suppose that a random sample of size 9, drawn from a normal population with SD 6, has mean 52. Test $H_0: \mu = 55$ ag $H_1: \mu \neq 55$ at 1% level.
Given that $Z_{.005} = 2.58$, $t_{.005, 8} = 3.355$. $t_{.005, 9} = 3.250$. 5+5
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2021

ECONOMICS — HONOURS

Paper : CC-7

(Statistical Methods for Economics)

Full Marks : 65

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as far as practicable.*

Group – A

1. Answer **any ten** questions :

2×10

- (a) Clarify what you mean by an attribute and a variable with the help of examples.
- (b) State whether the following statements are true or false :
 - (i) Expectation of a random variable cannot be negative.
 - (ii) For negative random variable X , $V(X)$ must be positive.
- (c) There are four small eateries and one hotel in a locality. The costs of lunch per person in the eateries are ₹ 60, ₹ 50, ₹ 70 and ₹ 80, and that for the hotel is ₹ 400. What is the average cost of lunch in that locality? Justify your choice of the measure of central tendency.
- (d) If the regression coefficient of X on Y is -1.6 and that of Y on X is -0.4 , then what is the correlation coefficient between X and Y ?
- (e) Give the axiomatic definition of probability.
- (f) Balls are drawn one-by-one with replacement from a box containing 4 red and 2 blue balls. Let R_i denote the event of getting a red ball in the i th drawing, $i = 1, 2$.
Examine whether (i) R_1 and R_2 are independent (ii) R_1 and R_2 are mutually exclusive.
- (g) Examine whether the following result is true or false : $P(A \cup B) \leq P(A)$.
- (h) Find the value of k such that the following function can be a probability function :

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

- (i) For a random variable X , show that $\left[E(X^2) \right]^{1/2} \geq E(X)$.
- (j) What is a moment generating function? Why is it so called?
- (k) What do you mean by standard error?

Please Turn Over

- (l) Define a statistic. Is it a random variable?
- (m) What is meant by multi-stage sampling?
- (n) When is an estimator called 'consistent'?
- (o) If the two regression lines coincide, show that the correlation coefficient $r = \pm 1$. If $r = 0$, show that the two regression lines are at right angles.

Group – B

2. Answer *any three* questions :

- (a) A variable takes only two distinct values a and b , each with equal frequency. Find the second and third central moments. 5
- (b) The second moments about the mean of two distributions are 9 and 16, while the third moments about the mean are -8.1 and -12.8 respectively. Which distribution is more skewed to the left? Give reason. 5
- (c) For the following data show that $r = 0$. Do you conclude that X and Y are uncorrelated? Why?

X	-3	-2	-1	0	1	2	3
Y	9	4	1	0	1	4	9

5

- (d) For each of the following probability functions, find $E(X)$ and the distribution function : $(1+1\frac{1}{2}) \times 2$

(i) $f(x) = \begin{cases} \frac{1}{3}, & \text{for } x = 0, 1, 3 \\ 0, & \text{otherwise} \end{cases}$

(ii) $f(x) = \begin{cases} \frac{1}{3} & \text{when } 0 < x < 3 \\ 0 & \text{elsewhere} \end{cases}$

- (e) Define Type I and Type II errors. 5

Group – C

Answer *any three* questions.

- 3. (a) Evaluate standard deviation as a measure of dispersion.
- (b) In a factory the average daily wage of 50 workers was ₹ 200 with a standard deviation ₹ 40. Each worker is given a hike of ₹ 20. What are the new average daily wage and standard deviation? If each worker is given a hike of 10% in wages, how are the mean and standard deviation affected? 5+5
- 4. (a) Can two events be mutually exclusive as well as mutually independent? Explain.
- (b) Three lots contain respectively 10%, 20% and 25% defective articles. One article is drawn at random from each lot. What is the probability that among them there is (i) exactly one defective (ii) at least one defective? 4+(3+3)

5. (a) Examine the validity of the following statements :
Sampling error is connected with sample survey only and non-sampling error is connected with complete enumeration survey only.
- (b) Consider the population $\{5, 10, 15\}$. Specify the sampling distribution of sample-mean drawing simple random samples of size 2 with replacement from this population. Verify the result that the expectation of sample-mean is equal to the population mean. Also find the standard error of sample-mean. 4+(2+2+2)
6. (a) Find the mode of a Poisson distribution.
- (b) A sample of 100 dry battery cells tested to find the length of life produced the following result : $\mu = 12$ hours, $\sigma = 3$ hours. Assuming that the data are normally distributed, what % of battery cells are expected to have life (i) more than 15 hours and (ii) less than 18 hours? 6+(2+2)
- Given :

Z	1	2
Area	0.3413	0.4772

7. (a) Suppose that (X_1, X_2, X_3) is a simple random sample drawn independently from a Normal population with mean μ and SD σ . Among the following two estimators, $T_1 = (X_1 + X_2 + X_3)/3$ and $T_2 = X_1 + X_2 - X_3$, which one is the minimum variance unbiased estimator?
- (b) 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? Find the probability of Type-II error when the corresponding probability of head is 0.2. 5+(3+2)
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