

2023

## STATISTICS — MDC

Paper : CC-1

Full Marks : 75

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer **question nos. 1 & 2** and **any three** questions from the rest.1. Answer **any five** questions :

2×5

- (a) Arithmetic mean of a set of observations is 20. If all the observations are increased by 5, what will be the mean of the new set of observations?
- (b) Compute a suitable measure of central tendency for the data {1, 2, 3, 4, 5, 100}.
- (c) Obtain the harmonic mean of  $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{n}$ .
- (d) Suppose for a symmetrical distribution,  $Q_1 = 20, Q_3 = 36$ . Find the median.
- (e) What is nominal data? Give an example.
- (f) What is  $b_2$ ? If  $b_2 = 2$ , identify the type of kurtosis.
- (g) If  $P(A) = \frac{1}{3}, P(B) = \frac{1}{2}, P(A|B) = \frac{1}{6}$ , find the values of  $P(B|A)$  and  $P(B|A^c)$ .
- (h) If  $A$  and  $B$  are independent events, show that  $A^c$  and  $B$  are also independent.

2. Answer **any four** questions :

5×4

- (a) If  $Y = a + bX$ , where  $X$  and  $Y$  are two variables,  $a$  and  $b$  are constants, find the mean and standard deviation of  $Y$  in terms of mean ( $\bar{x}$ ) and standard deviation of  $X$  ( $S_X^2$ ).
- (b) Prove that the standard deviation of two values  $x_1$  and  $x_2$  of a variable  $X$  is equal to half their difference. Also find the third order central moment ( $m_3$ ) of  $X$ .
- (c) Discuss the classical definition of probability. Mention its limitations.
- (d) What is conditional probability? When do we call two events to be independent?
- (e) If a variable assumes  $n$  values  $a, ar, ar^2, \dots, ar^{n-1}$  ( $r < 1$ ) with equal (constant) frequencies, then find the arithmetic mean and geometric mean of these values.
- (f) What is the use of relative measure of dispersion? Discuss the different relative measures.

Please Turn Over

3. (a) What is data? Distinguish between qualitative and quantitative data.  
 (b) Discuss different types of bar charts. What is histogram? Explain the differences between bar chart and histogram. (2+3)+(4+3+3)
4. (a) What do you mean by dispersion? Discuss the absolute measures of dispersion.  
 (b) Show that mean deviation is least when deviations are taken about median.  
 (c)  $A_1, A_2, \dots, A_n$  are independent events such that  $P(A_i) = 1 - q_i (i = 1, 2, \dots, n)$ . Prove that

$$P\left(\bigcup_{i=1}^n A_i\right) = 1 - q_1 q_2 \dots q_n.$$

6+5+4

5. (a) If  $\bar{x}_1$  and  $\bar{x}_2$  be the means of  $n_1$  and  $n_2$  observations respectively, find out the composite mean  $\bar{x}$  for the combined set of  $(n_1 + n_2)$  observations. Also show that this composite mean lies between the two group means.  
 (b) Show that for the set of first  $n$  ( $n \geq 2$ ) natural numbers,  $n! < \left(\frac{n+1}{2}\right)^n$ .  
 (c) Discuss the idea of Quartiles in detail. Mention their uses in measuring dispersion and skewness. (3+3)+3+(4+2)
6. (a) If  $2u + 5x = 17$  where  $\bar{x} = 3$  and  $S_X^2 = 4$ , find the coefficient of variation (c.v.) of  $u$ .  
 (b) Define  $r$ th order central moment and  $r$ th order raw moment. Express 2nd order central moment in terms of raw moments.  
 (c) What do you mean by skewness and kurtosis of a frequency distribution? Discuss their measures.  
 (d) If the letters of the word TOWEL are arranged at random with no repetition, what is the probability that there are exactly two letters between O and E? 3+3+(3+3)+3
7. (a) Define sample space and mutually exclusive events with examples.  
 (b) State and prove Bayes' Theorem.  
 (c) In a manufacturing plant, machines  $A, B$  and  $C$  produce respectively 60%, 30% and 10% of a product. It is seen that 40% of the products produced by machine  $A$  are defective, 50% of the products produced by machine  $B$  are defective and 70% of the products produced by machine  $C$  are defective. Find the probability that the sampled product was produced by machine  $B$ . 4+6+5