

A-0682

Total Pages : 6

Roll No.

MAT-503

Mathematics (MSCMAT/MAMT)

(Advanced Statistics)

Examination, June 2025

Time : 2:00 Hrs.

Max. Marks : 70

Note :- This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. *Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.*

Section-A

(Long Answer Type Questions) 2×19=38

Note :- Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any two (02) questions only.

1. Suppose that a product is produced in three factories X, Y and Z. It is known that factory X produces thrice as many items as factory Y, and that factories Y and Z produce the same number of items. Assume that it is known that 3 per cent of the items produced by each of the factories X and Z are defective while 5 per cent of those manufactured by factory Y are defective. All the items produced in three factories are stoked, and an item of product is selected at random.
 - (i) What is the probability that this item is defective ?
 - (ii) If an item selected at random is found to be defective, what is the probability that it was produced by factory X, Y and Z respectively ?
2. Prove that, If F is the distribution function X and if $a < b$, then $P(a < X \leq b) = F(b) - F(a)$.
3. In a normal distribution, 31% of the items are under 45% and 8% are over 64. Find the mean and standard deviation of the distribution. It is given that if

$$f(t) = \frac{1}{\sqrt{2\pi}} \int_0^t e^{-\frac{x^2}{2}}$$

dx then $f(0.5) = 0.19$ and $f(1.4) = 0.42$.

4. Obtain the rank correlation coefficient for the following data :

X	Y
68	62
64	58
75	68
50	45
64	81
80	60
75	68
40	48
55	50
64	70

5. Find the most likely price in Bombay corresponding to the price of ₹ 70 at Calcutta from the following :

	Calcutta	Bombay
Average Price	65	67
Standard deviation	2.5	3.5

Correlation coefficient between the prices of commodities in the two cities is 0.8.

Section–B

(Short Answer Type Questions) $4 \times 8 = 32$

Note :– Section ‘B’ contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. What are the advantages of sampling ?
2. Use Chebyshev’s inequality to determine how many times a fair coin must be tossed in order that the probability will be at least 0.90 that the ratio of the observed number of heads to the number of tosses will lie between 0.4 and 0.6.
3. (a) Suppose that a book of 600 pages contains 40 printing mistakes. Assume that these errors are randomly distributed throughout the book and x , the number of errors per page has a Poisson distribution. What is the probability that 10 pages selected at random will be free from errors ?

- (b) Wireless sets are manufactured with 25 solders joints each, on the average 1 joint in 500 is defective. How many sets can be expected to be free from defective joints in a consignment of 1000 sets ?
4. Test the hypothesis that $\sigma = 10$, given that $s = 15$ for a random sample of size 50 from a normal population.
5. Prove that :
- $$P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$$
6. An integer is chosen at random from two hundred digits. What is the probability that the integer is divisible by 6 or 8.
7. Let X be a discrete random variable having probability mass function :

$$p_x(x) = \begin{cases} \frac{3}{4} & \text{if } x = 1 \\ \frac{1}{4} & \text{if } x = 2 \\ 0 & \text{otherwise} \end{cases}$$

Find the third central moment of X.

8. Let :

$$f(x, y) = c(x^2 - y^2) e^{-x}, 0 \leq x < \infty, -x \leq y < x$$

(a) Find c.

(b) Find the marginal densities
