UNIVERSITY OF CALCUTTA · Previous Year Question Paper

2026

MATHEMATICS — MDC

Paper: MN-6

(Statistics and Numerical Analysis)

Full Marks: 75

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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
[Statistics]
(Marks : 50)

Unit - 1
(Marks : 25)

Answer *any five* questions.

1. (a) Define conditional probability.

(b) Show that $P(AB) \geq P(A) + P(B) - 1$. **2+3**

2. Consider the events A and B such that $P(A) = \frac{1}{4}$, $P(B \mid A) = \frac{1}{2}$, $P(A \mid B) = \frac{1}{4}$, find $P(\bar{A} \mid B)$ and $P(A \mid \bar{B})$. **5**

3. There are three identical urns containing white and black balls. The first urn contains 2 white and 3 black balls, the second urn contains 3 white and 5 black balls and the third urn contains 5 white and 2 black balls. An urn is chosen at random and a ball is drawn from it. If the ball drawn is white, what is the probability that the second urn is chosen? **5**

4. A coin is tossed 8 times in succession. What is the probability of obtaining (a) 3 heads and 5 tails, (b) at least 2 heads? **2+3**

5. Determine the value of k such that $f(x)$ defined by,

$$f(x) = \begin{cases} kx(1-x), & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$$

is a probability density function. Also find $P\left(X > \frac{1}{2}\right)$. **3+2**

6. Define variance of a random variable X. Show that $\text{Var}(X) = E\{X(X-1)\} - E(X)\{E(X)-1\}$. **2+3**

7. Find the mean and variance of Binomial distribution with parameters n & p. $2\frac{1}{2} + 2\frac{1}{2}$

8. Show that the function $f(x, y)$ defined by,

$$f(x,y) = \begin{cases} \sin x \sin y, & 0 < x < \frac{\pi}{2},\ 0 < y < \frac{\pi}{2} \\ 0, & \text{elsewhere} \end{cases}$$

is a possible two-dimensional probability density function. Find the marginal density functions and prove that the random variables are independent. **2+2+1**

9. Calculate the Covariance between random variables X and Y if the joint probability density function is given by, $f(x,y) = \begin{cases} e^{-x-y}, & x>0,\ y>0 \\ 0, & \text{elsewhere} \end{cases}$ **5**

Unit - 2

(Marks : 25)

Answer *any five* questions.

10. The Arithmetic mean of the following distribution is 67.45 inches. Find the value of f. **5**

Height (inches)	60–62	63–65	66–68	69–71	72–74
Frequency	15	54	f	81	24

11. Calculate the standard deviation of the following distribution : **5**

Weight (kg)	45–50	50–55	55–60	60–65	65–70
No. of persons	10	16	32	28	14

12. Define A.M., G.M. and H.M. for two variables x_1 and x_2. Write the relation among them. Show that for two distinct observations $(\text{G.M.})^2 = (\text{A.M.}) \times (\text{H.M.})$. **3+1+1**

13. For a symmetrical distribution A.M. = Median = 8.5. The semi-interquartile range is 4. Find the first and third quartiles. **5**

14. Two regression lines of a sample are $x + 6y = 6$ and $3x + 2y = 10$. Find the correlation coefficient. **5**

15. Prove that, the sample mean is an unbiased estimate of the population mean. **5**

16. (a) Distinguish between point estimation and interval estimation.

(b) Define type I and type II errors in connection with testing of hypothesis. **2+3**

17. The variable X is normally distributed with the mean 68 cms. and standard deviation 2.5 cms. What should be the size of the sample whose mean shall not differ from the population mean by more than 1 cm. with probability 0.95?
[Given that the area under standard normal curve to the right of the ordinate at 1.96 is 0.025.] **5**

18. A sample 2.3, -0.2, -0.4, -0.9 is taken from a normal population with variance 9. Find 95% confidence interval for the population mean [Given $P(U > 1.960) = 0.025$, where U is a Normal $(0,1)$ variate]. **5**

Group - B

[Numerical Analysis]

(Marks : 25)

Answer *any five* questions.

19. (a) Prove that $\Delta \cdot \nabla = \Delta - \nabla$.

(b) Evaluate $\left(\frac{\Delta^2}{E}\right) x^3$. **3+2**

20. Calculate the absolute, relative and percentage errors by approximating $\frac{5}{3}$ correct up to three significant figures. **5**

21. Find $f(0.5)$ from the following table : **5**

x	0	1	2	3	4
$f(x)$	2	3	12	35	78

22. Using Lagrange's interpolation formula find value of $f(0)$ from the following table : **5**

x	-1	-2	2	4
$f(x)$	-1	-9	11	69

23. Evaluate approximately, by Trapezoidal rule, the integral $\int_0^1 (4x - 3x^2)\,dx$ correct up to three decimal places by taking $n = 4$. **5**

24. Find approximate value of $\int_0^1 \frac{x\,dx}{1+x}$ up to four decimal places by Simpson's $\frac{1}{3}$rd rule by dividing $[0, 1]$ into two equal subintervals. **5**

25. Obtain a root of $x^3 - 4x - 9 = 0$ by Bisection method correct up to two places of decimal. **5**

26. Find a positive real root of $x^2 + 2x - 2 = 0$ by Newton-Raphson method, correct to two significant figures. **5**

27. Solve the following system of equations by Gauss-elemination method : **5**

$$\begin{aligned} x + 2y + z &= 0 \\ 2x + 2y + 3z &= 0 \\ -x - 3y &= 2. \end{aligned}$$

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