MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : M(MCA)-301

STATISTICS & NUMERICAL TECHNIQUES

Time Allotted : 3 Hours | *Full Marks* : 70

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

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) Lagrange's interpolation formula is applied in case of

      a) Equispaced arguments

      b) Unequispaced arguments

      c) Both (a) and (b)

      d) None of these.

   ii) The condition of convergence of Newton-Raphson method when applied to an equation $f(x) = 0$ is

      a) $f'(x) \neq 0$ b) $|f'(x)| < 1$

      c) $\{f'(x)\}^2 < |f(x) f''(x)|$ d) $\{f'(x)\}^2 > |f(x) f''(x)|$.

iii) The error in Trapezoidal rule is of order

a) h b) h^2

c) h^3 d) none of these.

iv) Which one of the following is not an iterative method ?

a) Gauss Elimination b) Gauss-Seidel

c) Newton-Raphson d) None of these.

v) If $f(a) \times f(b) < 0$ in Bisection method after n iteration, the root lies in the interval whose length is

a) $\frac{b-a}{n}$ b) $\frac{b-a}{2^n}$

c) $\frac{b-a}{2n}$ d) $\frac{(b-a)^{1/n}}{n}$.

vi) In Simpson's 1/3rd rule of integration, the number of sub-intervals can never be

a) odd b) even

c) 100 d) none of these.

vii) A random variable X has the following p.d.f :

$f(x) = k, -2 < x < 2$

$= 0$, otherwise.

Then the value of the constant k is

a) $\frac{1}{8}$ b) $\frac{1}{2}$.

c) $\frac{1}{4}$ d) $\frac{1}{12}$.

viii) The Poisson distribution is a limiting case of Binomial distribution when

a) n is very large and p is very small

b) n is very small and p is very large

c) n, p both are very small

d) n, p both are very large.

ix) A random variable has a Poisson distribution such that $P(1) = P(2)$. Then the SD of X is

a) 0 b) 2

c) $\sqrt{2}$ d) $\pm\sqrt{2}$.

x) The chance that a leap year selected at random will contain 53 Wednesdays is

a) $\frac{2}{7}$ b) $\frac{1}{7}$

c) $\frac{53}{366}$ d) none of these.

xi) For a pair of mutually exclusive events A and B

a) $P(A \cap B) = \Phi$

b) $P(A \cap B) = 1$

c) $P(A \cap B) = P(A \cup B)$

d) $P(A \cup B) = \Phi$.

xii) Var ($aX + b$) is

a) Var (X) b) Var (a)

c) a Var (X) d) a^2 Var (X).

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Find by suitable interpolation method, the value of $f(2.5)$ from the following table :

x	2	3	4	5
$f(x)$	14.5	16.3	17.5	18.0

3. Find a root of the equation $x^3 - 4x - 9 = 0$ using the method of Bisection.

4. A card is drawn at random from an ordinary deck of 52 playing cards. Find the probability that it is (i) an ace (ii) a heart (iii) a nine or a club (iv) neither a spade nor a ten.

5. Evaluate $\int_1^2 \log x \, dx$ taking 10 intervals by Simpson's one-third rule.

6. Find the mean and median/mode for the following values :

Value range	150 - 154	155 - 159	160 - 164	165 - 169	170 - 174	175 - 179	180 - 184	185 - 189
Frequency	5	2	6	8	9	11	6	3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Find the smallest positive root of the given equation $3x - \cos x - 1 = 0$, correct up to two decimal places by Regula Falsi method.

   b) Solve the given system of equations by Gauss Elimination method :

   $x + y + z = 9,\ 2x - 3y + 4z = 13,\ 3x + 4y + 5z = 40.$

   c) Find the mean and variance of Binomial distribution. 5 + 5 + 5

8. a) Verify whether the given systems of equations is deigonally dominant. Hence solve them by Gauss-Siedel method correct to 2 decimal places.

   $-2x + 3y + 10z = 22,\ x + 10y - z = -22,\ 10x + 2y + z = 9.$

   b) Using Runge-Kutta 4th order method solve the differential equation to find $y(0.2)$ $\frac{dy}{dx} = xy,\ y(0) = 1,$

   Take $h = 0{\cdot}1$. 7 + 8

9. a) Deduce the Trapezoidal rule for numerical integration. Also state the expression for the corresponding error term.

   b) There are three men aged 60, 65 and 70 years old. The probability to live 5 years more is 0.8 for a 60 years old, 0.6 for 65 years old and 0.3 for a 70 years old persons. Find the probability that at least two of the three persons will remain alive 5 years hence.

   c) Evaluate $3\sqrt{13}$ correct up to three places of decimal using Newton-Raphson method. 5 + 5 + 5

10. a) Evaluate $f(40)$ using Lagrange's Interpolation formula. Given values as follows :

x :	30	35	45	55
$f(x)$:	148	96	68	34

   b) The p.d.f. of a continuous distribution of a random variable X is given by

$$f(x) = \begin{cases} kx^2 & 0 < x < 1 \\ = 0, & \text{elsewhere} \end{cases}$$

   Find the value of k and distribution function $F(x)$.

   c) Using fuler's Modified Method find $y(0.2)$ correct up-to three decimal places from

$$\frac{dx}{dx} = x + y^2,\ y(0) = 1,\ h = 0{\cdot}1$$ 5 + 5 + 5

11. a) Using L-U factorization method solve the given system of equations :

$2x-3y+10z=3, -x+4y+2z=20, 5x+2y+z=-12$

b) The distribution of heights of men is normally distributed with mean 64.5 "and standard deviation 4.5".

Among 10,000 men find the number of men whose heights are

(i) less than 69 "but greater than 55.5"

(ii) less than 55.5 "and

(iii) more than 73.5"

[Given, $\int_0^1 \phi(t)\,dt = 0.3413$ $\int_0^2 \phi(z)\,dt = 0.4772$]

c) The number of persons X, in a Singapore family chosen at random has the following probability distribution :

X	1	2	3	4	5	6	7	8
$P(X)$	0.34	$4k$	k	0.06	0.02	0.01	0.01	0.01

i) Find the value of k.

ii) What is the probability that a family has at most 3 members ? 5 + 5 + 5