



Name :

Roll No. :

Invigilator's Signature :

CS/MCA/SEM-3/M(MCA)-301/2011-12

2011

STATISTICS AND 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 × 1 = 10

i) E^{-1} is equivalent to

a) $1 - \nabla$

b) $1 + \Delta$

c) $1 - \nabla$

d) none of these.

ii) if $Var (aX + bY) = a^2 Var (X) + b^2 Var (Y)$, the X and Y are

a) mutually exclusive

b) uncorrelated

c) impossible events

d) none of these.



- iii) If E^c is the complement of the event E then
- a) $P(E^c) = 1 - P(E)$
 - b) $P(E^c) = P(E)$
 - c) $P(E^c) = 1 + P(E)$
 - d) none of these.
- iv) For a binomial distribution
- a) Mean > Variance
 - b) Mean = Variance
 - c) Mean < Variance
 - d) none of these.
- v) If $f(x)$ is a polynomial of degree n , then $\Delta^n f(x)$ is
- a) 0
 - b) constant
 - c) 1
 - d) none of these.
- vi) Romberg's method is based on the error in
- a) Trapezoidal rule
 - b) Simpson's 1/3rd rule
 - c) Weddle's rule
 - d) none of these.
- vii) Order of convergence of Newton-Raphson method is
- a) 0
 - b) 2
 - c) 1
 - d) none of these.



- viii) Normal distribution is
- a) unimodal b) bimodal
c) trimodal d) none of these.
- ix) Order of error in Simpson's 1/3rd rule is
- a) h^2 b) h^4
c) 1 d) none of these.
- x) Condition for convergence of Fixed-point iteration method to solve the equation $f(x) = 0$ in $[a, b]$ is that
- a) $\phi'(x) < 1$ b) $\phi'(x) > 1$
c) $\phi'(x) = 1$ d) $\phi'(x) \leq 1$
- in $[a, b]$ where $f(x) = 0$ can be written as $\phi(x) = x$.
- xi) The formula of the area of a trapezium whose length of the parallel sides are a, b and the distance between them is h is
- a) $\frac{h}{2}(a + b)$ b) $\frac{h}{2} + a + b$
c) $h(a + b)$ d) $h + a + b$.
- xii) The method of bisection for solving equation $f(x) = 0$ in $[a, b]$ is based on
- a) Intermediate value theorem
b) MVT of integral calculus
c) MVT of differential calculus
d) Fundamental theorem of Algebra.



xiii) $\int_a^b f(x) dx$ describe the

- a) area
 - b) volume
 - c) surface area
 - d) volume and surface area both
- under the curve $y = f(x)$ in $[a, b]$.

xiv) In Newton's forward and backward interpolation formula the points are

- a) equally spaced
- b) unequally spaced
- c) both of the previous
- d) none of the previous.

GROUP – B

(Short Answer Type Questions)

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

2. Prove that $P(A \cup B) = P(A) + P(B)$, if A and B are disjoint events.
3. The probabilities of X , Y and Z being managers are in the ratio $4 : 2 : 3$ respectively. The probabilities that the bonus scheme will be introduced if X , Y , Z become managers are $\frac{3}{10}$, $\frac{1}{2}$, $\frac{4}{5}$ respectively.
 - i) What is the probability that bonus scheme will be introduced ?
 - ii) If the bonus scheme has been introduced, what is the probability that the manager appointed was Y ?



4. Evaluate $\int_0^1 x/(1+x) dx$ using Trapezoidal rule using 5 intervals.
5. Evaluate $\int_1^2 \log x dx$ using Simpson's 1/3rd rule using 5 intervals.
6. Distinguish between absolute error and relative error with example.

GROUP – C

(Long Answer Type Questions)

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

7. a) Use Newton-Raphson method to find a positive root of $e^x = 3x$ correct to four decimal places.
- b) What are the advantages and disadvantages of Newton-Raphson method ?
- c) State and prove Bayes' theorem. $6 + 4 + 5$
8. a) Find $\Delta^2 f(x)$ where $f(x) = 3x^4 + 8x^2 + 5x + 7$ by taking $h = 1$.
- b) Apply Simpson's 1/3rd rule to find $\int_0^{\pi/2} \cos x dx$ by dividing the range on integration into 6 subintervals.
- c) Prove that if E_1 and E_2 are statistically independent, then $P(E_1 \cap E_2) = P(E_1)P(E_2)$. $6 + 6 + 3$



9. a) Discuss the convergence of fixed point iteration.
- b) Prove that if ρ_{xy} is the Pearson correlation coefficient between the random variables X and Y , then $-1 \leq \rho_{xy} \leq 1$.
- c) Apply Newton's forward interpolation to find $f(x)$ at $x = 2.5$ from the following table :

x	2	3	4	5	6
$f(x)$	1.456	1.689	1.992	2.010	2.225

5 + 5 + 5

10. a) Find $\sqrt{45}$ usng Newton-Raphson method.

- b) Use Gauss-Jordan method to solve

$$p + 2q + r - s = -2$$

$$2p + 3q - r + 2s = 7$$

$$p + q + 3r - 2s = -6$$

$$p + q + r + x = 2.$$

- c) Prove that if $X \sim \text{Binomial}(n, p)$ then $E(X) = np$.

5 + 5 + 5

11. a) Derive the expression of error in the composite trapezoidal rule.

- b) Apply Runge-Kutta method of order 4 to solve $\frac{dy}{dx} = x +$

$$y, \text{ where } y(0) = 1 \text{ at } x = 0.1 \text{ and } 0.2.$$

7 + 8



12. a) Apply LU factorization to find the inverse of

$$\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$$

- b) Prove that for a normal distribution :

$$\text{Mean} = \text{Median} = \text{Mode}$$

- c) Fit an approximating polynomial to the following data :

x	0	3	4
$f(x)$	2.12	4.34	3.19

$$8 + 3 + 4$$

