*Name* : ………………………………………………………

*Roll No.* : ………………………………………………………

*Invigilator's Signature* : …………………………………….

**CS/MCA/SEM-3/M(MCA)-301/2012-13**

# 2012

# 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 :

$$10 \times 1 = 10$$

   i) The truncation error in Composite Trapezoidal Rule is

   a) $h^2$ 　　　　　　　　b) $h^3$

   c) $h^4$ 　　　　　　　　d) none of these.

   ii) If $n$ values of $f(x)$ are given, then $f(x)$ can be approximated by a polynomial of degree

   a) $n$ 　　　　　　　　b) $n-1$

   c) $n+1$ 　　　　　　　　d) none of these.

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iii)  Lagrange's interpolation formula is used for

    a)  equally spaced arguments

    b)  unequally spaced arguments

    c)  unequally or equally spaced arguments

    d)  none of these.

iv)  The number of significant figures in $0.0128742$ is

    a)  five                b)  six

    c)  seven           d)  three.

v)  One of the iterative methods by which we can find the solution of simultaneous system of linear equations is

    a)  Gauss Elimination Method

    b)  Gauss-Jordan Method

    c)  LU-factorization Method

    d)  Gauss-Seidel Method.

vi)  The next iterative value of the root $x^2 - 4 = 0$ of using Newton-Raphson's method, if the initial guess is 3, is
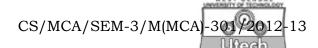
    a)  $1.500$            b)  $2.066$

    c)  $2.167$            d)  $3.000$.

vii)  If the random variable $X$ has p.d.f., $f(x) = \dfrac{1}{2}x, \ 0 \le x \le 2$ the mean value of $X$ is

    a)  $\dfrac{4}{3}$             b)  $\dfrac{7}{8}$

    c)  $\dfrac{5}{4}$            d)  $\dfrac{2}{3}$.

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viii) When the variance of a random variable is $\dfrac{2}{3}$, the $Var(3X+5)$ is

    a)    6             b)    2

    c)    11           d)    none of these.

ix) For two events $A, B, P(B/A)$

    a)    $\dfrac{P(AB)}{P(B)}$          b)    $\dfrac{P(AB)}{P(A)}$

    c)    $\dfrac{P(B)}{P(A)}$           d)    $P(A)*P(B)$.

x) The mean of Poisson distribution is $\mu$ then its standard deviation is

    a)    $\dfrac{1}{\sqrt{\mu}}$          b)    $\mu$

    c)    $\dfrac{1}{\mu}$           d)    $\sqrt{\mu}$.

xi) The equation of regression lines are $4x+9y+5=0$ and $x+4y+3=0$. The means $\overline{X}$ and $\overline{Y}$ of $X$ and $Y$ are

    a)    1, −1          b)    1, 0

    c)    0, 1           d)    −1, −1.

xii) The value of $k$ for which $\begin{aligned}f(x)&=kx(1-x),\ 0<x<1\\ &=0,\text{otherwise}\end{aligned}$ will be the probability density function of a random variable $X$ is

    a)    6             b)    2

    c)    1            d)    3.

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xiii) What is the probability that a leap year selected at random contains 53 Sundays ?

    a)    $\dfrac{1}{366}$          b)    $\dfrac{2}{366}$

    c)    $\dfrac{2}{7}$          d)    $\dfrac{3}{7}$ .

xiv) The A.M. of 2, 4, 6, ..., $2n$ is

    a)    $\dfrac{(n+1)}{2}$          b)    $n(n+1)$

    c)    $n+1$          d)    $\dfrac{n(n+1)}{2}$ .

## GROUP – B

### ( Short Answer Type Questions )

Answer any *three* of the following      3 × 5 = 15

2. Using method of false position, find the real root of the equation $f(x) = x^3 - 3x - 5 = 0$ up to 4 decimal places.

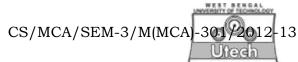3. The p.d.f. of a continuous distribution of a random variable $X$ is given by

$$f(x) = kx^2, \ 0 < x \leq 1$$
$$= 0 \ \ , \text{elsewhere}$$

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

4. Evaluate $\displaystyle\int_{0}^{1} (4x - 3x^2)\,dx$ taking 10 intervals by Simpson's one-third rule.

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5. Find the missing frequencies in the following frequency distribution, when it is known that A.M. = 11·09 and total frequency = 60.

| Class limits | 9·3-9·7 | 9·8-10·2 | 10·3-10·7 | 10·8-11·2 |
|---|---|---|---|---|
| Frequency | 2 | 5 | $f_3$ | $f_4$ |

| 11·3-11·7 | 11·8-12·2 | 12·3-12·7 | 12·8-13·2 |
|---|---|---|---|
| 14 | 6 | 3 | 1 |

6. Find the mean and standard deviation of the binomial distribution with parameters $n$ and $p$.

## GROUP – C

### ( Long Answer Type Questions )

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

7. a) Solve by Euler's modified method, the following differential equation for $x = 0·02$, by taking step length $h = 0·01, \dfrac{\mathrm{d}y}{\mathrm{d}x} = x^2 + y, \ y(0) = 1$.

   b) Check whether the following system of equations are diagonally dominant. If not, rearranges them and solve by Gauss-Seidal method.

   $$-2x + 3y + 10z = 22$$

   $$x + 10y - z = -22$$

   $$10x + 2y + z = 9 \qquad\qquad 7 + 8$$

8. a) Solve the following system of equations by LU-factorization method :

   $$3x + 4y + 2z = 15$$
   $$5x + 2y + z = 18$$
   $$2x + 3y + 2z = 10$$

   b) Establish second order Runge-Kutta method.     $8 + 7$

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9. a) State and prove Multiplication Theorem.

 b) There are two boxes, the first box containing 3 white and 7 black balls and the second containing 7 white and 3 black balls. One box is chosen at random and from it 2 balls are drawn without replacement. Find the probability that both the balls are white. Also, given that both the balls are white, find the conditional probability that the first ball was chosen.

 c) Prove that $P(A^C) = 1 - P(A)$, where $A^C$ implies complement of the event $A$. $\qquad$ 5 + 5 + 5

10. a) Apply Taylor series method to determine $y(0,1)$ by solving the equation $\dfrac{dy}{dx} = 3x + y^2;\ y(0) = 1$.

 b) Apply Bisection method to find the root of

 $f(x) = \sin x - 3x + 1 = 0$
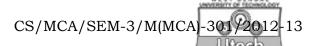
 c) Apply Romberg method to approximate the integral

 $$I = \int\limits_{0}^{1\cdot2} \frac{1}{1+x}\, dx \qquad\qquad 4 + 5 + 6$$

11. a) Apply secant method to find the root of the equation $f(x) = \cos x - xe^x = 0$ in between 0 and 1.

 b) Fit a straight line $y = a + bx$ to the following data by the method of least square :

| $X$ : | 0 | 1 | 3 | 6 |
|-------|---|---|---|---|
| $Y$ : | 1 | 3 | 2 | 5 |

$\qquad\qquad$ 8 + 7

12. a) Find the probability of getting exactly two even numbers when a balanced die is rolled thrice.

b) The mean and S.D. of 20 items are found to be 10 and 2 respectively. At the time of checking it was found that one item 8 was incorrect. Calculate the mean and S.D. if

   i) the wrong item is omitted

   ii) it is replaced by 2.

c) Find the median and median class of the following data given below :

| Class boundaries | 15-25 | 25-35 | 35-45 | 45-55 | 55-65 | 65-75 |
|---|---|---|---|---|---|---|
| Frequency | 4 | 11 | 19 | 14 | 0 | 2 |

5 + 5 + 5

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