



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 9615

Roll No.

M. C. A.

(SEM. II) EXAMINATION, 2008-09

COMPUTER BASED NUMERICAL & STATISTICAL TECHNIQUES

Time : 3 Hours]

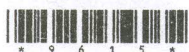
[Total Marks : 100

SECTION - A

All parts of this question are compulsory : 2x10=20

- 1 (a) The relative error if  $\frac{2}{3}$  is approximated to 0.667 is \_\_\_\_\_ . (fill the gap)
- (b) Rate of convergence of Newton-Raphson method is \_\_\_\_\_ . (fill the gap)
- (c) Write first step in eliminating  $x$  from the following system of equations by using Gauss-elimination method with pivoting  $2x + y + 4z = 12$ ,  $8x - 3y + 2z = 23$  and  $4x + 11y - z = 33$ .
- (d) With usual notations, match the items on right hand side with those on left hand side :

- |                       |                                    |
|-----------------------|------------------------------------|
| (i) $E \nabla$        | (a) $\frac{1}{2}(\Delta + \nabla)$ |
| (ii) $hD$             | (b) $\Delta - \nabla$              |
| (iii) $\nabla \Delta$ | (c) $\Delta$                       |
| (iv) $\mu \delta$     | (d) $-\log(1 - \nabla)$            |



- (e) The value of  $x^3$  in terms of Chebyshev polynomials  $T_1(x)$  and  $T_3(x)$  is \_\_\_\_\_. (fill the gap).
- (f) The Newton-Cote's quadrature formula is given by

$$\int_{x_0}^{x_0+nh} f(x)dx = nh \left[ y_0 + \frac{n}{2} \Delta y_0 + \frac{n(2n-3)}{12} \Delta^2 y_0 + \frac{n(n-2)^2}{24} \Delta^3 y_0 + \dots \right]$$

- (1) Simpson's one-third rule is obtain from above formula by taking  $n =$  \_\_\_\_\_. (fill the gap)
- (2) Weddle's rule is obtain from above formula by taking  $n =$  \_\_\_\_\_. (fill the gap).
- (g) The normal equations for fitting the data  $(x_i, y_i) i = 1, 2, \dots, n$  with parabolic equation

$y = a + bx + cx^2$  are given by

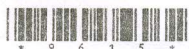
(i) \_\_\_\_\_ = 0

(ii) \_\_\_\_\_ = 0

(iii) \_\_\_\_\_ = 0

(Fill the above gaps)

- (h) The method of moving averages is useful for determining
- (i) Trend
  - (ii) Seasonal indices
  - (iii) Irregular variations
  - (iv) None of these
- (Choose the correct answer)



- (i) The test-statistic for testing  $H_0 : \mu = \mu_0$  when sample size  $n$  is small

(i)  $t = \frac{\bar{x} - \mu_0}{S / \sqrt{n}}$

(ii)  $z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$

(iii)  $t = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n-1}}$

- (iv) None of these  
(Choose the correct answer)

- (j) The test statistic  $F = \frac{S_1^2}{S_2^2}$  is used when

(i)  $S_2^2 > S_1^2$

(ii)  $S_1^2 > S_2^2$

(iii)  $S_1^2 = S_2^2$

- (iv) None of these  
(Choose the correct answer).

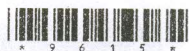
## SECTION - B

Attempt any three parts of the following question :  $10 \times 3 = 30$

- 2 (a) Write 'C' program for the evaluation of integration by

Simpson's  $\frac{3}{8}$ <sup>th</sup> rule. Find  $\int_0^b \frac{e^x}{1+x} dx$  approximately

using Simpson's  $\frac{3}{8}$ <sup>th</sup> the rule of integration.



- (b) Given  $\frac{dy}{dx} = y - x$ ,  $y(0) = 2$ . Find  $y(0.1)$  and

$y(0.2)$  correct to four decimal places by using Fourth order Runge-Kutta method.

- (c) Obtain the cubic spline for the following data :

$x$	0	1	2	3
$y$	2	-6	-8	2

- (d) Assuming 5-yearly moving averages, calculate trend values from the data given below and draw approximately on answer sheet :

<i>Years</i>	1971	1972	1973	1974	1975	1976	1977
<i>Production ('000 tons')</i>	105	107	109	112	114	116	118

<i>Years</i>	1978	1979	1980	1981	1982	1983
<i>Production ('000 tons')</i>	121	123	124	125	127	129

- (e) Records taken of the number of male and female births in 800 families having four children are as follows :

<i>No. of male births</i>	0	1	2	3	4
<i>No. of female births</i>	4	3	2	1	0
<i>No. of families</i>	32	178	260	236	94

Test whether the data are consistent with hypothesis that the Binomial law holds and the chance of male birth

is equal to that of female birth, namely  $p = q = \frac{1}{2}$ .

(Tabulated value of  $\chi^2$  at 5% level of significance at 4 degree of freedom is 9.49)



## SECTION - C

Attempt any two parts from each question. All questions  $10 \times 5 = 50$  are compulsory :

- 3 (a) (i) Add the number  $0.1125 \times 10^{-3}$  and  $0.4798 \times 10^{-4}$  using normalized floating point concept.  
(ii) Subtract  $0.4688 \times 10^8$  from  $0.1544 \times 10^7$  using normalized floating point concept.  
(b) Find a real root of  $\cos x = 3x - 1$ , correct to four decimal places using iteration method.  
(c) Write 'C' program to find roots of an equation by Regula-False method.

- 4 (a) Evaluate  $\sqrt{21}$  corrected to four decimal places by Newton-Raphson method.  
(b) Find the root of the equation  $x e^x = \cos x$  corrected to four decimal places by using Secant method.  
(c) By Gauss-elimination method with pivoting, solve the system of equations :

$$2x + y + 4z = 12$$

$$8x - 3y + 2z = 23$$

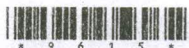
$$4x + 11y - z = 33$$

- 5 (a) Solve the following system of equations using Gauss-Seidal iteration method :

$$2x + 10y + z = 51$$

$$10x + y + 2z = 44$$

$$x + 2y + 10z = 61$$



(b) Derive the relation between operators

(i)  $E \equiv 1 + \Delta$

(ii)  $E \nabla \equiv \nabla E$

(iii)  $E \equiv \nabla e^{hD}$ .

(c) Using the table given below find the value of  $f(8)$  by Newton-Divided difference formula :

$x$	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

6 (a) The following table gives the population of a town during the last six censuses. Estimate the population in 1913 by Newton's forward difference formula

<i>Year</i>	1911	1921	1931	1941	1951	1961
<i>Population (in thousand)</i>	12	15	20	27	39	52

(b) Apply Bessel's formula to find the value of  $f(27.5)$  from the table :

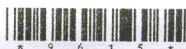
$x$	25	26	27	28	29	30
$f(x)$	4.000	3.846	3.704	3.571	3.448	3.333

(c) Apply Euler-Maclaurin's formula to evaluate

$$\frac{1}{51^2} + \frac{1}{53^3} + \frac{1}{55^2} + \dots + \frac{1}{99^2}$$

7 (a) Fit a second degree parabola to the following table :

$x$	1	2	3	4	5
$y$	1090	1220	1390	1625	1915



- (b) Find the two lines of regression and coefficient of correlation for the data given below :

$$n = 18, \sum x = 12, \sum y = 18, \sum x^2 = 60,$$

$$\sum y^2 = 96, \sum xy = 48$$

- (c) Two random samples drawn from two normal populations are as follows :

A	17	27	18	25	27	29	13	17
B	16	16	20	27	26	25	21	

Test whether the samples are drawn from the same normal populations.

(Tabulated value of  $f$  for 7 and 6 degrees of freedom at 5% level of significance is 4.21)

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