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

PAPER ID : 9615 Roll No.

M.C.A.

(SEM II) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

COMPUTER BASED NUMERICAL & STATISTICAL TECHNIQUES

Time : 3 Hours *Total Marks : 100*

Note : *(i) This paper is in Three sections. **Section-A** carries 20 Marks, **Section-B** carries 30 Marks and **Section-C** carries 50 Marks.*

*(ii) Attempt **all** questions. Marks are indicated against each questions/parts.*

(iii) Make suitable assumptions, if required.

SECTION-A

1. You are required to answer **all** the parts of this question : **(10x2=20)**

Choose the correct answer for parts (a) to (d) :

(a) The condition, when the result of an arithmetic operation is smaller than the smallest number which could be stored in this (hypothetical) computer, is called an :

(i) Overflow (ii) Underflow

(iii) Normalization (iv) None of the above

(b) The order of convergence of False Position method to find a root of a equation is :

(i) 1.4 (ii) 2.1 (iii) 1.62 (iv) 1

(c) If at any time during pivotal consideration it is found that the values of $\{|a_{mk}|\}$ for $m = k + 1$ to n, are less than a pre-assigned small quantity 'e' then the equations are said to be :

(i) Well conditioned set of equations

(ii) Ill conditioned set of equations

(iii) None of the above

(d) One of the method to solve the system of linear equations is :

(i) Bisection Method.

(ii) Gaussian quadrature formula.

(iii) Simpson's Rule.

(iv) None of the above.

*State **True** or **False** for the parts (e) to (g)*

(e) Gauss elimination method is useful for solving ill conditioned set of linear equations.

(f) Simpson's rule with n points gives about as much accuracy as Trapezoidal rule with 2n points.

(g) The determination of value $f(y)$ at a point y inside the interval $[X_1, X_n]$ is called extrapolation.

*Fill in the **Blanks** for parts (h) to (j) :*

(h) The relative error involved in rounding and truncating 4.9997 to 5.000 are _____ and _____ .

(i) Gaussian quadrature formulae used for solving _____ .

(j) An unstable algorithms is _____ .

SECTION-B

2. Attempt **any three** parts of the following : **(3x10=30)**

(a) Discuss the various steps of Newton-Raphson method to find root of equation. For what starting values will Newton's method converge if the function is :

$$f(x) = x^2/(1+x^2)$$

(b) Solve the following set of equation by Gauss-Seidel iterative method :

$$3x_1 + 2x_2 - x_3 = 7$$
$$5x_1 - 3x_2 + 2x_3 = 4$$
$$-x_1 + x_2 - 3x_3 = -1$$

(c) Find the order of the polynomial which might be suitable for the following function :

x	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7
$f(x)$	0.577	0.568	0.556	0.540	0.520	0.497	0.471	0.442

Also find the value of f(2.15) using difference formulae.

(d) Describe Simpson's rule for integration. Also write a function in C to find the integration using Simpson's Rule.

(e) Write short notes on the following :

(i) Forecasting models and methods.

(ii) F-Test and t-test.

SECTION-C

3. Attempt any two parts of the following : (2x5=10)

(a) Show with suitable examples that associative and the distributive laws of arithmetic are not always valid when floating point representation of numbers is used.

(b) Write an algorithm and a program in C for finding the summation of the following series :

$$S = x - x^3/3! + x^5/5! - x^7/7! + \ldots + (-1)^{n-1} * x^{(2n-1)}/(2n-1)!$$

(c) Prove that the order of convergence of Secant method for finding the roots of equation is 1.62.

4. Attempt any two parts of the following : (2x5=10)

(a) Find the root of the following equation in the interval [0, 1] by Regula falsi method :

$$2x(1 - x^2 + x) \ln x = x^2 - 1.$$

(b) Solve the following equations by Gauss elimination method :

$$3x_1 + 2x_2 - 5x_3 = 0$$
$$2x_1 - 3x_2 + x_3 = 0$$
$$x_1 + 4x_2 - x_3 = 4$$

The answer should be correct to 3 significant digits.

(c) What do you mean by interpolation ? When a function is tabulated at equal intervals, obtain a more concise Lagrange interpolation formula.

5. Attempt any two parts of following : (2x5=10)

(a) Find an approximate value of $\int_1^2 x^{-1}\, dx$ using composite Simpson's Rule with $h = 0.25$. Give a bound on the error.

(b) Describe Eular's Method for solving the differential equations.

(c) What straight line best fits the following data :

x	1	2	3	4
y	0	1	1	2

in the least square sense.

6. Attempt **any two** parts of the following : (2x5=10)

(a) Give the application of cubic spline. Determine the natural cubic spline that interpolates the functions $f(x) = x^6$ over the interval [0, 2] using nodes 0, 1, and 2.

(b) The velocity V of a liquid is known to vary with temperature T, according to a quadratic law $V = a + bT + cT^2$. Find the best values of a, b, and c for the following table :

T	1	2	3	4	5	6	7
V	2.31	2.01	1.80	1.66	1.55	1.47	1.41

(c) Write short note on the fourth order Runge-Kutta method for solving the ordinary differential equation.

7. Write short notes on **any four of the** following : (4x2.5=10)

(a) Moving averages.

(b) Multiple regressions.

(c) Representation of floating point numbers.

(d) Frequency charts.

(e) Statistical quality control methods.

(f) Hermite's interpolation.

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